



ARC RESOURCES

**Dual Separator Packages
LSD: 03-18-080-14 W6M**

Manufacturer's Data Book

P.O. # 3462-01
BWO: 35528
CO: 26541

FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS
(Alternate Form for Single Chamber, Completely Shop or Field Fabricated Vessels Only)

As Required by the Provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1

1. Manufactured and certified by Bromley Mechanical Services, A Division of Argo Sales Inc. 925 23 St. SW, Medicine Hat AB T1A 8R1 CANADA
(Name and address of Manufacturer)
2. Manufactured for Arc Resources General Partnership, 1200, 308 - 4th Avenue SW, Calgary, Alberta T2P 0H7 ①671 942②
(Name and address of Purchaser)
3. Location of installation LSD: 03-18-080-14 W6M
(Name and address)
4. Type Vertical Test Separator 35528-02 V4393.231 33915-REG Rev.0 N/A 2018
(Horizontal or vertical, tank) (Manufacturer's serial number) (CRN) (Drawing number) (National Board number) (Year built)
5. ASME Code, Section VIII, Division 1 2015 Edition N/A N/A
[Edotopm amd Addemda. If applicabla (date)] (Code Case numbers) [Special service per UG-120(d)]
6. Shell SA516-70N 1.500" 0.125" 36" OD 10'-0" S/S
(Material spec. number, grade) (Nominal thickness) (Corr allow) (Inner diameter) [l ength (overall)]

Body Flanges on Shells

No.	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Location	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
N/A												

7. Seams Butt (Type 1) Full 100 1150°F 1.5 Butt (Type 1) Full 100 1
[Long. (welded, dbl., sngl., lap, butt)] [R. T. (spot or full)] (Eff., %) (H. T. temp.) (Time, hr) [Girth (welded, dbl., sngl., lap, butt)] [R. T. (spot or full)] (Eff., %) (No. of courses or full)]

8. Heads: (a) Material SA516-70N (b) Material SA516-70N
(Spec. no., grade) (Spec. no., grade)

	Location (Top, Bottom, Ends)	Minimum Thickness	Corrosion Allowance	Crown Radius	Knuckle Radius	Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side To Pressure (Convex or Concave)
(a)	TOP	1.4375"				2:1				Concave
(b)	BOTTOM	1.4375"				2:1				Concave

Body Flanges on Heads

	Location	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
(a)	N/A											
(b)	N/A											

9. MAWP 1440 Psig N/A at max. temp. 130°F N/A
(Internal) (External) (Internal) (External)
 Min. design metal temp. 20°F at 1440 Psig Hydro., pneu., or comb. test pressure 1872 Psig
 Proof test N/A

10. Nozzles, inspection, and safety valve openings:

Purpose (Inlet, Outlet, etc.)	No.	Diameter or Size	Type	Material		Nozzle Thickness		Reinforcement Material	Attachment Details		Location (Insp. Open.)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
Inlet	1	4"	CL600RFLWN	A350LF2Cl	A350LF2Cl	1.000"	0.125"		UW-16.1(c)		Shell
Outlet	1	4"	CL600RFLWN	A350LF2Cl	A350LF2Cl	1.000"	0.125"		UW-16.1(c)		Inspection
LSHH	1	3"	CL600RFLWN	A350LF2Cl	A350LF2Cl	0.810"	0.125"		UW-16.1(a)		Shell
TI	1	3"	CL600RFLWN	A350LF2Cl	A350LF2Cl	0.810"	0.125"		UW-16.1(a)		Inspection
Bridle Conn.	3	2"	CL600RFWN	SA106B	SA105N	0.344"	0.125"		UW-16.1(a)	Type 1	Shell
PSV, LG(4), PIT	6	2"	CL600RFWN	SA106B	SA105N	0.344"	0.125"		UW-16.1(a)	Type 1	Shell
Dump(2), Drain	3	2"	CL600RFWN	SA106B	SA105N	0.344"	0.125"		UW-16.1(a)	Type 1	atum head, sh

11. Supports: Skirt Yes Lugs 0 Legs 0 Other 0 Attached Datum head weld
(Yes or no) (Number) (Number) (Describe) (Where and how)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report: NA, CA: 0.125", PSV suppl by others per UG125, No Impact testing exempt per UCS-66(a)(b) & UG20(f)(1-5)
(Name of part, item number, Manufacturer's name and identifying stamp)

Volume: 64.5 cu ft or 1.84 cu m, Construction drawing cad.no.35528-Test Rev.0

FORM U-1A (Back)

Ⓐ 671942W

CERTIFICATE OF SHOP / FIELD COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. "U" Certificate of Authorization Number 30634

expires 10/26/2019
Date Jan 18, 2018 Co. name Bromley Mechanical Services, A Division of Signed [Signature]
Argo Sales Inc. (Manufacturer) (Representative)

CERTIFICATE OF SHOP / FIELD INSPECTION

Vessel constructed by Bromley Mechanical Services, A Division of Argo Sales Inc. at 925 23 St. SW, Medicine Hat, AB T1A 8R1 CANADA. I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and employed by Alberta Boiler's Safety Association (ABSA)

have inspected the component described in this Manufacturer's Data Report on Jan 18, 2018, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. By signing this certificate neither the Inspector nor his/her employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his/her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date Jan 18, 2018 Signed [Signature] Commissions NB10304, D0003103
(Authorized Inspector) [National Board (incl. endorsements)]

BROMLEY MECHANICAL SERVICES

Pressure Vessel Travel Sheet

Travel Sheet AI Review/Date : <i>D Dec 17/17</i>	Travel Sheet Initiation : Merle K	Travel Sheet Revision Number :
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Customer : Arc Resources Ltd.

DRAWING/CAD#: 35528-TEST	DRAWING/CAD REVISION #: 0	WO-35528	SERIAL # : 35528-02
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W/O DESIGNATION : 36" OD x 10'0" x 1440 Psi Test Separator

Seq.	Item	Comments	Q.C.I.	Date	A.I. Hold Points	A.I.	Date	Owner	Date
1.	Calculations in File		<i>le</i>	<i>12/11/17</i>	R	<i>D</i>	<i>Dec 17/17</i>	<i>D Hoge</i>	MAY 07 2018
2.	Release of App'd Dwg.		<i>le</i>	12/11/17	R	<i>D</i>	<i>Dec 17/17</i>	<i>D Hoge</i>	MAY 07 2018
3.	Heat Numbers Recorded		<i>os</i>	JAN 15 2018	W	<i>D</i>	<i>Jan 15/18</i>	<i>D Hoge</i>	MAY 07 2018
4.	Material Examination		<i>os</i>	JAN 15 2018				<i>D Hoge</i>	MAY 07 2018
5.	MTRs Checked		<i>os</i>	JAN 15 2018	W	<i>D</i>	<i>Jan 18/18</i>	<i>D Hoge</i>	MAY 07 2018
6.	WPS(s) Checked		<i>le</i>	12/11/17	R	<i>D</i>	<i>Dec 12/17</i>	<i>D Hoge</i>	MAY 07 2018
7.	Welder(s) Qualified		<i>os</i>	12/12/17	W	<i>D</i>	<i>Jan 12/18</i>	<i>D Hoge</i>	MAY 07 2018
8.	Thicknesses Verified & Recorded		<i>os</i>	JAN 15 2018				<i>D Hoge</i>	MAY 07 2018
9.	Shell(s) & Head(s) Fit-up Inspection		<i>os</i>	1/5/18	W	<i>D</i>	<i>Jan 17/18</i>	<i>D Hoge</i>	MAY 07 2018
10.	Nozzles & Fittings Fit-up Inspection		<i>os</i>	JAN 15 2018				<i>D Hoge</i>	MAY 07 2018
11.	Nozzle Orientation		<i>os</i>	JAN 15 2018				<i>D Hoge</i>	MAY 07 2018
	Nozzle & Flange Rating Checked		<i>os</i>	JAN 15 2018				<i>D Hoge</i>	MAY 07 2018
13.	Impact Tests	Exempt						<i>D Hoge</i>	MAY 07 2018
14.	Internals Checked	Per UG-76(C)	<i>os</i>	JAN 04 2018	W	<i>D</i>	<i>Jan 4/18</i>	<i>D Hoge</i>	MAY 07 2018
15.	Final Internal Inspection		<i>os</i>	JAN 15 2018	H	<i>D</i>	<i>Jan 15/18</i>	<i>D Hoge</i>	MAY 07 2018
16.	Weld Size Checked		<i>os</i>	JAN 15 2018				<i>D Hoge</i>	MAY 07 2018
17.	Welder I.D. Checked		<i>os</i>	12/12/17	R	<i>D</i>	<i>Jan 4/18</i>	<i>D Hoge</i>	MAY 07 2018
18.	Final External Inspection		<i>os</i>	JAN 15 2018	W	<i>D</i>	<i>Jan 15/18</i>	<i>D Hoge</i>	MAY 07 2018
19.	Radiography	RT - 1	<i>os</i>	JAN 15 2018	W	<i>D</i>	<i>Jan 10/18</i>	<i>D Hoge</i>	MAY 07 2018
20.	Other N.D.E. MPI	<i>MPI LIFT LUGS</i>	<i>os</i>	JAN 15 2018				<i>D Hoge</i>	MAY 07 2018
21.	Final Ext. Prior to P.W.H.T.	1150F for 135 minutes	<i>os</i>	JAN 15 2018	W	<i>D</i>	<i>Jan 17/18</i>	<i>D Hoge</i>	MAY 07 2018
22.	PWHT Details		<i>le</i>	1/18/18				<i>D Hoge</i>	MAY 07 2018
23.	PWHT Chart Checked		<i>le</i>	1/18/18	R	<i>D</i>	<i>Jan 18/18</i>	<i>D Hoge</i>	MAY 07 2018
24.	Hydrostatic Test 1872 Psig	Shell Side Gauge # <i>FLUOI, PLU 17</i>	<i>le</i>	1/18/18	H	<i>D</i>	<i>Jan 18/18</i>	<i>D Hoge</i>	MAY 07 2018
25.	CRN Drawing	V 4393.231	<i>le</i>	12/14/17	R	<i>D</i>	<i>Dec 17/17</i>	<i>D Hoge</i>	MAY 07 2018
26.	N.C.R. #							<i>D Hoge</i>	MAY 07 2018
27.	Nameplate Stamping		<i>le</i>	1/18/18	W	<i>D</i>	<i>Jan 18/18</i>	<i>D Hoge</i>	MAY 07 2018
28.	Manuf. Data Report Completed & Verified		<i>le</i>	1/18/18	R	<i>D</i>	<i>Jan 18/18</i>	<i>D Hoge</i>	MAY 07 2018
29.	Nameplate Installation							<i>D Hoge</i>	MAY 07 2018

Authorized Inspector shall be presented with the Travel Sheet prior to construction so that he can designate addition inspection points and/or Hold Points. Any revisions shall be marked with a delta symbol with revision number and described at the bottom of this page.

I/R Denotes Inspection/Review Point W/H Denotes Witness/Hold Point

VESSEL SERIAL NUMBER: 35528-02 MATERIAL THICKNESS VERIFICATION AND IDENTIFICATION				WPS / WELD I.D. / WELDER SYMBOLS / FIT-UP					
Designation	Thickness	Material Spec. & Grade	Heat & Slab Number or I.D. Number	WPS	Weld I.D.	Welder Symbol	Verify Fit Up & Type 1 Joint	Date	ABSA USE
Shell 1	1.500"	SA516-70N	C31891	BA-1	L-1	M6	08	Dec 19 2017	D Jan 11/18
					L-				
					L-				
Head 1	1.500"	SA516-70N	C32392	BA-1	L-				W Jan 11/18 D Jan 17/18
Head 2	1.500"	SA516-70N	C32392		C-1	S3	08	Jan 8 2018	
)					C-2	S3	08	Jan 8 2018	
Welding Consumable Heat Number			HI # 3897 8435T		C-				

ATTACHMENT AND / OR NOZZLE MATERIAL THICKNESS VERIFICATION AND IDENTIFICATION						WELDER ID / WPS & ABSA USE			
Mark	Mat. I.D.	Neck	Fitting	Flange	Repad or Attachment	Cat. B, C	Cat D	WPS	ABSA USE
N1 N2	Spec.-Grd.		Duel	SA350LF2	CL1		C-8		
	Thk./Rating			4"-CL 600	RFLWN (1.0") WT				
	Heat# or ID			G1017BN					
N3 N4	Spec.-Grd.		Duel	SA350LF2	CL1		DW W2		
	Thk./Rating			3" CL 600	RFLWN (0.81")				
	Heat# or ID			C.T.O					
N8 Thru N12	Spec.-Grd.	SA106B		SA105N		KH	CM K2 01		
	Thk./Rating	2"s160(0.343")		2"-600 s160	RFWN				
	Heat# or ID	VS35556		522176					
	Spec.-Grd.								
	Thk./Rating								
	Heat# or ID								
	Spec.-Grd.								
	Thk./Rating								
	Heat# or ID								
	Spec.-Grd.								
	Thk./Rating								
	Heat# or ID								
	Spec.-Grd.								
	Thk./Rating								
	Heat# or ID								

Used for recording miscellaneous information (Skirt/ Lift Lug Heat numbers, Another shell etc...)					
	Material	Heat Number		WPS	Remarks
Skirt 3/8" x 27 3/16"	SA516-70N	VS 35658	W2 D1		
Lift Lug 1"	SA516-70N	VS 33732	08		

Shells & Heads			Final		
Task	Name/Welder symbol	Date	Task	Name/Welder symbol	Date
Layout / Checked by			Weld ID/ Material code/ Vessel Serial number stamped	W2 201 K2 08 DW SFAEKHDI	JAN 15 2018
Shell cut by			Vessel completed by	DW W2	JAN 15 2018
Internals by	DW SFAEK3	1/3/18	Final Quality Control check	DS	JAN 15 2018

FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS
 (Alternate Form for Single Chamber, Completely Shop or Field Fabricated Vessels Only)
 As Required by the Provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1

1. Manufactured and certified by Bromley Mechanical Services, A Division of Argo Sales Inc. 925 23 St. SW, Medicine Hat AB T1A 8R1 CANADA
(Name and address of Manufacturer)

2. Manufactured for Arc Resources General Partnership, 1200, 308 - 4th Avenue SW, Calgary, Alberta T2P 0H7 **A671942**
(Name and address of Purchaser)

3. Location of installation LSD: 03-18-080-14 WEM
(Name and address)

4. Type Vertical Test Separator 35528-02 V4393.231 33915-REG Rev 0 N/A 2018
(Horizontal or vertical, tank) (Manufacturer's serial number) (CRN) (Drawing number) (National Board number) (Year built)

5. ASME Code, Section VIII, Division 1 2015 Edition N/A N/A
(Edition and Addenda, if applicable (date)) (Code Case numbers) (Special service per UG-120(d))

6. Shell SAS16-70N 1.500" 0.125" 36" OD SA516 S/S
(Material specification) (Thickness) (Corrosion allowance) (Outside diameter) (Material specification)

CERTIFIED BY:



Medicine Hat, Alberta
 (800) 215 - 9806
 (403) 526 - 3142

U
W
RT-1
HT

M.A.W.P. 1440 PSI AT 130 °F

M.D.M.T. -20 °F AT 1440 PSI

MFR'S SER. NO. 35528-02 YR. BUILT 2018

VESSEL TYPE VERTICAL SEPARATOR

TAG ARC RESOURCES LTD.

M.A.W.P. 9929 KPA AT 54 °C

SHELL NOM. 1.500" MATERIAL SA516-70N

HEAD MIN. 1.4375" MATERIAL SA516-70N

C.A. 0.125" CRN V4393.231

A671942

11. Supports: Skirt Yes No Lugs 0 (Number) Legs 0 (Number) Other 0 (Describe) Attached Datum head weld (Where and how)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report: NA, CA: 0.125", PSV suppl by others per UG125, No Impact testing exempt per UCS-66(a)(b) & UG203(1-5)
(Name of part, item number, Manufacturer's name and identifying stamp)

Volume: 64.5 cu ft or 1.84 cu m, Construction drawing cad no. 35528-Test Rev 0

CERTIFIED BY:



Medicine Hat, Alberta
(800) 215 - 9806
(403) 526 - 3142

U
W
RT-1
HT

M.A.W.P. PSI AT °F

M.D.M.T. °F AT PSI

MFR'S SER. NO. YR. BUILT

VESSEL TYPE

TAG

M.A.W.P. KPA AT °C

SHELL NOM. MATERIAL

HEAD MIN. MATERIAL

C.A. CRN

35528-01
↓
35528-02

W0# 35528
Jare
095A02013

Integrity Engineering Ltd

403-362-5757 1-800-442-8721


DATE: Dec 20 2017

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CLIENT ADDRESS	<u>Bromley Mechanical</u>	VIE JOB NO.	<u>BMS-110</u>	TOTAL HRS	<u>6.0</u>	KM'S	
		PO. NO.	<u>PO-28241</u>	IN	<u>17:00</u>	DAILY SUBS	
		AFE NO.		OUT	<u>20:00</u>	ROOMS	
JOB LOCATION	<u>Arc</u>	WORK ORDER #	<u>35528</u>	IN		DAILY MEALS	
CONTRACTOR	<u>Bms</u>	PROJECT NO.		OUT		LATE MEAL	

TECHNIQUE NO.	<u>RT001 tech 07</u>	WT	WALL THICKNESS	WELD DEFECTS 1. SLIGHT 2. MEDIUM 3. REJECT					
MAX SOURCE SIZE	<u>2.7 x 2.9 mm</u>	WS	WELDER SYMBOL	AB	ARC BURN	C	CRACK	S	SLAG
TYPE OF MATERIAL	<u>CS</u>	EX	NUMBER OF EXPOSURES	EP	EXCESSIVE PENETRATION		HL	HIGH LOW	
LEAD SCREENS FRONT	<u>01010</u>	SO	SOURCE TO OBJECT DISTANCE OR C FOR CONTACT	IP	INCOMPLETE PENETRATION		P	POROSITY	
LEAD SCREENS BACK	<u>01010</u>			IC	INTERNAL CONCAVITY		LC	LOW COVER	
FILM PER CASSETTE	<u>1</u>	SSF	MAX. DISTANCE FROM SOURCE SIDE OF OBJECT TO FILM	IUC	INTERNAL UNDERCUT		CR	CONCAVE ROOT	
FILM DENSITY	<u>2.9</u>			EUC	EXTERNAL UNDERCUT		LF	LACK OF FUSION	
FILM BRAND	<u>Agfa</u>	EW	ASTM ESSENTIAL WIRE #	BT	BURN THROUGH		HB	HOLLOW BEAD	

NO.	WELD			NO. EX	SO	SSF	EW #	FILM TYPE	CODE	LIST ACCEPTABLE DEFECTS	OK	SHOW LOCATION OF UNACCEPTABLE DEFECTS	REJECT
	SIZE	WT	WS										
1													
2													
3													
4	<u>L1 36"</u>	<u>1.5"</u>	<u>N2</u>	<u>8</u>	<u>26"</u>	<u>1.69</u>	<u>11</u>	<u>DS</u>	<u>4</u>				
5	<u>0-15</u>										✓		
6	<u>15-30</u>										✓		
7	<u>30-45</u>										✓		
8	<u>45-60</u>										✓		
9	<u>60-75</u>										✓		
10	<u>75-90</u>										✓		
11	<u>90-105</u>										✓		
12	<u>105-120</u>										✓		
13													
14													
15	<u>L1 36"</u>	<u>1.5"</u>	<u>N2</u>	<u>8</u>	<u>26"</u>	<u>1.69</u>	<u>11</u>	<u>DS</u>	<u>4</u>				
16	<u>0-15</u>									<u>P-1</u>	✓		
17	<u>15-30</u>										✓		
18	<u>30-45</u>										✓		
19	<u>45-60</u>										✓		
20	<u>60-75</u>										✓		
21	<u>75-90</u>										✓		
22	<u>90-105</u>										✓		
23	<u>105-120</u>										✓		
24													
25													
26													
27										<u>film used 16-4 1/2 x 17"</u>			
28										<u>SNT # 5335 w/ 2RT MT PT</u>			
29													
30													

AUTHORIZED BY (signature):	WELDING CODES:	TECHNICIANS SIGNATURE	 Kevin Hayward RT, MT, PT Level II CGSB/SNT-TC-1A # 5335
<u>[Signature]</u> 21 DEC 2017	<u>UWSI-15</u>	<u>[Signature]</u> 400 <u>Jessie M. Hill</u> ASSISTANT	

Integrity Engineering Ltd

DATE: Jan 10 2018

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403-362-5757 1-800-442-8721

CLIENT ADDRESS	<u>Bromley Mechanical</u>	VIE JOB NO.	<u>BMS-110</u>	TOTAL HRS	<u>4.0</u>	KM'S	
		P.O. NO.	<u>88241</u>	IN	<u>18:00</u>	DAILY SUBS	
		AFE NO.		OUT	<u>22:00</u>	ROOMS	
JOB LOCATION	<u>Arc</u>	WORK ORDER #	<u>35528</u>	IN		DAILY MEALS	
CONTRACTOR	<u>BMS</u>	PROJECT NO.		OUT		LATE MEAL	

TECHNIQUE NO.	<u>RTOCI tech c4</u>	WT	WALL THICKNESS	WELD DEFECTS 1. SLIGHT 2. MEDIUM 3. REJECT					
MAX SOURCE SIZE	<u>2.7 x 2.9 mm</u>	WS	WELDER SYMBOL	AB	ARC BURN	C	CRACK	S	SLAG
TYPE OF MATERIAL	<u>C.S</u>	EX	NUMBER OF EXPOSURES	EP	EXCESSIVE PENETRATION		HL	HIGH LOW	
LEAD SCREENS FRONT	<u>01010</u>	SO	SOURCE TO OBJECT DISTANCE OR C FOR CONTACT	IP	INCOMPLETE PENETRATION		P	POROSITY	
LEAD SCREENS BACK	<u>01010</u>			IC	INTERNAL CONCAVITY		LC	LOW COVER	
FILM PER CASSETTE	<u>1</u>	SSF	MAX. DISTANCE FROM SOURCE SIDE OF OBJECT TO FILM	IUC	INTERNAL UNDERCUT		CR	CONCAVE ROOT	
FILM DENSITY	<u>2.7 - 3.2</u>			EUC	EXTERNAL UNDERCUT		LF	LACK OF FUSION	
FILM BRAND	<u>Agfa</u>	EW	ASTM ESSENTIAL WIRE #	BT	BURN THROUGH		HB	HOLLOW BEAD	

NO.	WELD			NO. EX	SO	SSF	EW #	FILM TYPE	CODE	LIST ACCEPTABLE DEFECTS	OK	SHOW LOCATION OF UNACCEPTABLE DEFECTS	REJECT
	SIZE	WT	WS										
1													
2													
3													
4													
5													
6	<u>C1</u>	<u>36"</u>	<u>1.5"</u>	<u>S3</u>	<u>1</u>	<u>16.5</u>	<u>1.69</u>	<u>10</u>	<u>D5</u>	<u>4</u>			
7	<u>0-15</u>	↓									✓		
8	<u>15-30</u>	↓									✓		
9	<u>30-45</u>	↓									✓		
10	<u>45-60</u>	↓									✓		
11	<u>60-75</u>	↓									✓		
12	<u>75-90</u>	↓									✓		
13	<u>90-105</u>	↓									✓		
14	<u>105-0</u>	↓									✓		
15													
16	<u>C2</u>	<u>36"</u>	<u>1.5"</u>	<u>S3</u>	<u>1</u>	<u>16.5</u>	<u>1.69</u>	<u>10</u>	<u>D5</u>	<u>4</u>			
17	<u>0-15</u>	↓									✓		
18	<u>15-30</u>	↓									✓		
19	<u>30-45</u>	↓									✓		
20	<u>45-60</u>	↓									✓		
21	<u>60-75</u>	↓									✓		
22	<u>75-90</u>	↓									✓		
23	<u>90-105</u>	↓									✓		
24	<u>105-0</u>	↓									✓		
25													
26													
27													
28													
29													
30													

film used 16 - 4 1/2" x 17"
ONT # 5335 Lvl 2 AT NT PT

AUTHORIZED BY (signature):	WELDING CODES:	TECHNICIANS SIGNATURE	 Kevin Hayward RT, MT, PT Level II CGSB/SNT-TC-1A # 5835
<u>[Signature]</u>	<u>UWSI-15</u>	<u>[Signature]</u> Jessie M.H. ASSISTANT	
		INTERPRETED BY (stamp)	



Integrity Engineering Ltd

MAGNETIC PARTICLE EXAMINATION REPORT

DATE Jan 10 2018 Report No. 806015

CLIENT	Bromley Mechanical	VIE Job#	BMS-110	PAGE	2 of 2
Address:		W.O. #	35528	SUBSISTENCE	
Location:		P.O. #	88241	<input type="checkbox"/> Breakfast	<input type="checkbox"/> Lunch
Project:	Arc	AFE #		<input type="checkbox"/> Room	<input type="checkbox"/> Dinner
Contractor	BMS			<input type="checkbox"/> Late Meal	<input type="checkbox"/> 1 Day
			in out in out	hours	km's
				999.1	-

VISION PROCEDURE AND CODE REFERENCE	
PROCEDURE >	MT001
REVISION >	REV03
TECHNIQUE >	1
LIGHTING EQUIPMENT	
<input checked="" type="checkbox"/> Flash Light	<input type="checkbox"/> Trouble Light
<input checked="" type="checkbox"/> Output > 100fc@Surface	<input type="checkbox"/> Sun Light
	<input type="checkbox"/> Halogen Lamp
	<input type="checkbox"/> Output > 1000µW/cm²
BLACK LIGHT MODEL / SN# >	
LIGHT METER MODEL / SN# >	LX10108/S674492
CALIBRATION DUE DATE >	

MT EQUIPMENT EMPLOYED	
METHOD >	<input checked="" type="checkbox"/> Wet <input type="checkbox"/> Dry <input checked="" type="checkbox"/> AC <input type="checkbox"/> DC
SERIAL NUMBER >	9064
MAKE & MODEL >	ES-X
CALIBRATION DATE >	Jan 10 2018
LIFT TEST VERIFIED PRIOR TO USE >	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
TEST BAR WEIGHT >	<input checked="" type="checkbox"/> 10 lbs <input type="checkbox"/> 40 lbs
TEST BAR SERIAL NUMBER >	ATI-002
DEMAG REQUIRED >	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

CONSUMABLE MATERIALS			
PARTICLE BRAND >	Magnaflux	PRODUCT # >	7HF
SUSPENSION >	<input type="checkbox"/> Water <input type="checkbox"/> Oil <input checked="" type="checkbox"/> N/A	COLOUR >	<input type="checkbox"/> Grey <input type="checkbox"/> Red <input type="checkbox"/> Yellow <input checked="" type="checkbox"/> Black <input type="checkbox"/> Green
CONTRAST PAINT BRAND >	Magnaflux	PRODUCT # >	WCP-2
		BATCH # >	16F04K
		BATCH # >	14H12K

SURFACE CONDITIONS			
The Technique Has Been Demonstrated Over a Painted Surface >	<input type="checkbox"/> YES (In-Service Applications Only)	<input type="checkbox"/> NO	<input checked="" type="checkbox"/> Not Applicable
SURFACE CONDITION >	<input type="checkbox"/> As Ground <input checked="" type="checkbox"/> As Welded	<input type="checkbox"/> Machined	<input type="checkbox"/> Shot Blasted
SURFACE TEMPERATURE >	<input checked="" type="checkbox"/> 4°C/40°F To 50°C/120°F	<input type="checkbox"/> 50°C/120°F to 316°C/600°F	<input type="checkbox"/> Other

Arc w/o # 35528

Black on white MPI inspection was performed on 2 lifting lugs.

1) SN # 35528-02 2 lifting lugs MPI-OK

No relevant indications were present at the time of inspection.

SNT # 5335 w/ 2 RT MT PT

 Authorized by: (signature)	Acceptance Standards	Vision Technicians	 KEVIN HAYWARD CGSB #5335 LEVEL II RT MT PT
	Asme Sec 8 Div 1		
	Assistant		
	CEDO Jessie Marshall		

CLIENT	Bromley Mechanical	VIE Job#	BMS-110	PAGE		2	of	2
Address:		W.O. #	35528	SUBSISTENCE				
Location:		P.O. #	88141	<input type="checkbox"/> Breakfast	<input type="checkbox"/> Lunch	<input type="checkbox"/> Dinner		
Project:	ARC	AFE #		<input type="checkbox"/> Room	<input type="checkbox"/> Late Meal	<input type="checkbox"/> 1 Day		
Contractor	BMS			in	out	in	out	hours
								km's
							<i>page 1</i>	<i>-</i>

VISION PROCEDURE AND CODE REFERENCE	
PROCEDURE >	MT001
REVISION >	REV03
TECHNIQUE >	1
LIGHTING EQUIPMENT	
<input checked="" type="checkbox"/> Flash Light	<input type="checkbox"/> Trouble Light
<input checked="" type="checkbox"/> Sun Light	<input type="checkbox"/> Halogen Lamp
<input checked="" type="checkbox"/> Output > 100fc@Surface	<input type="checkbox"/> Output > 1000µW/cm²
BLACK LIGHT MODEL / S/N# >	
LIGHT METER MODEL / S/N# >	LX10108/S674492
CALIBRATION DUE DATE >	

MT EQUIPMENT EMPLOYED	
METHOD >	<input checked="" type="checkbox"/> Wet <input type="checkbox"/> Dry <input checked="" type="checkbox"/> AC <input type="checkbox"/> DC
	<input type="checkbox"/> Fluorescent <input checked="" type="checkbox"/> Visible <input checked="" type="checkbox"/> Yoke
SERIAL NUMBER >	9064
MAKE & MODEL >	ES-X
CALIBRATION DATE >	Jan 17 2018
LIFT TEST VERIFIED PRIOR TO USE >	<input type="checkbox"/> YES <input type="checkbox"/> NO
TEST BAR WEIGHT >	<input checked="" type="checkbox"/> 10 lbs <input type="checkbox"/> 40 lbs
TEST BAR SERIAL NUMBER >	ATI-002
DEMG REQUIRED >	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

CONSUMABLE MATERIALS			
PARTICLE BRAND >	Magnaflux	PRODUCT # >	7HF
SUSPENSION >	<input type="checkbox"/> Water <input type="checkbox"/> Oil <input checked="" type="checkbox"/> N/A	COLOUR >	<input type="checkbox"/> Grey <input type="checkbox"/> Red <input type="checkbox"/> Yellow <input checked="" type="checkbox"/> Black <input type="checkbox"/> Green
CONTRAST PAINT BRAND >	Magnaflux	PRODUCT # >	WCP-2
		BATCH # >	16F04K
		BATCH # >	14H12K

SURFACE CONDITIONS			
The Technique Has Been Demonstrated Over a Painted Surface >	<input type="checkbox"/> YES (In-Service Applications Only)	<input type="checkbox"/> NO	<input checked="" type="checkbox"/> Not Applicable
SURFACE CONDITION >	<input type="checkbox"/> As Ground <input checked="" type="checkbox"/> As Welded	<input type="checkbox"/> Machined	<input type="checkbox"/> Shot Blasted
SURFACE TEMPERATURE >	<input checked="" type="checkbox"/> 4°C/40°F To 50°C/120°F	<input type="checkbox"/> 50°C/120°F to 316°C/600°F	<input type="checkbox"/> Other

ARC WO#35528



Black on white mpi inspection was performed on two lifting lugs

1.) SN# 35528-02 2-Lifting lugs MPI-OK

No relevant indications were present at the time of inspection



SNT# 5335 Level 2 RT, MT, PT

Authorized by: (signature)	Acceptance Standards ASME SEC 8 DIV 1	Vision Technicians 	 KEVIN HAYWARD CGSB #5335 LEVEL II RT MT PT
	Assistant CEDO Jessie Marshall	Inspected by	

Heat Treatment Instructions

Customer:	Arc Resources / Seven Generations	Date:	1/16/2018
WO No.(s):	WO-35528, 35549, 35550		

COMPONENT DESCRIPTION:

Dwg No. / Line No. / Serial No.	Diameter	Thk. (in.)	Material	Length	Weight (lbs)
SN:35528-01, 02, 35549-05	36"	1.500	P1	120"	21650
SN:35528-F07, F08	4"	0.531	P1	96-1/2"	570
SN:35550-02	60"	0.500	P1	60"	4200

TYPE OF HEAT TREATMENT: **PRESSURE VESSEL STRESS RELIEF P-No. 1**

HEATING

Temperature to be raised from 800°F (427°C) to 1150°F (621°C) at a maximum rate of

266 °F/hr, (**130** °C /hr)

NOTE: THIS VALUE MUST NEVER EXCEED 400°F (222°C) PER HOUR.

[Calculated rate = 400 degrees F /hr. (222 degrees C/hr) divided by the maximum metal thickness of the shell or head plate in inches.]

HOLDING

Temperature to be held at a minimum of 1150°F (621°C) for: **90** minutes

[Holding time to be determined by Table UCS-56 for Nominal Thickness as specified in UW-40(f)]

COOLING

Temperature to be lowered from 1150°F (621°C) to 800°F (427°C) at a maximum rate of

333 °F/hr, (**167** °C /hr)

NOTE: THIS VALUE MUST NEVER EXCEED 500°F (278°C) PER HOUR.

[Calculated rate = 500 degrees F /hr. (278 degrees C/hr) divided by the maximum metal thickness of the shell or head plate in inches.]

From 800°F (427°C) items may be cooled in still air

ADDITIONAL REQUIREMENTS

1. Job Number and description required on heat treatment charts along with the operator's signature and date.
2. Reporting of thermocouple attachment method and location and verification of furnace thermocouple calibration is required.
3. A sufficient number of thermocouples shall be located to control and maintain uniform distribution of temperature on all vessels and parts. Thermocouples shall be directly attached to the item or provision shall be made for thermocouple placement at bottom, centre and top of the furnace charge in accordance with the ASME Code
4. During the heating period, there shall not be a greater variation in temperature throughout the portion of the vessel being heated than 250°F (139°C) within any 15 ft. (4.6m) interval of length. An adequate number of thermocouples must be used to ensure this Code requirement is met. This limitation is also applicable to the temperature variations between the different thicknesses of various vessel components
5. During the holding period, there shall not be a greater difference than 150°F (83°C) between the highest and lowest temperature throughout the portion of the vessel being heat treated, except where the range is further limited by these instructions.
6. If Capacitor Discharge welding is used to attach thermocouples an ASME Code Section IX Welding Procedure Specification is required (WPS qualification is not required), and the energy output must be limited to 125 W-Seconds.
7. The method of thermocouple removal shall not damage the heat treated item.

APPROVALS

Quality Control Inspector Signature _____ Date Jan 17, 2018
 Thermocouple Attachment Method/Locations Capacitor Discharge/per UW 40
 Furnace Heat Number: #1-16-JAN-2018
 Furnace Operator Signature: _____ Date: 1/16/18



925 23 Street S.W. Medicine Hat, AB T1A 8R1
HEAT TREATMENT SERVICES

Date Started:	16-Jan-18	Date Finished:	16-Jan-18
Customer/WO Ref:	Seven Generations WO-35528, 35549, 35550		
Furnace S/N	23600		
Furnace Cal Date:	9/1/2017		
Procedure:	Internal PWHT Instructions/Cust Supplied		
Heat Treating Per:	A.S.M.E		

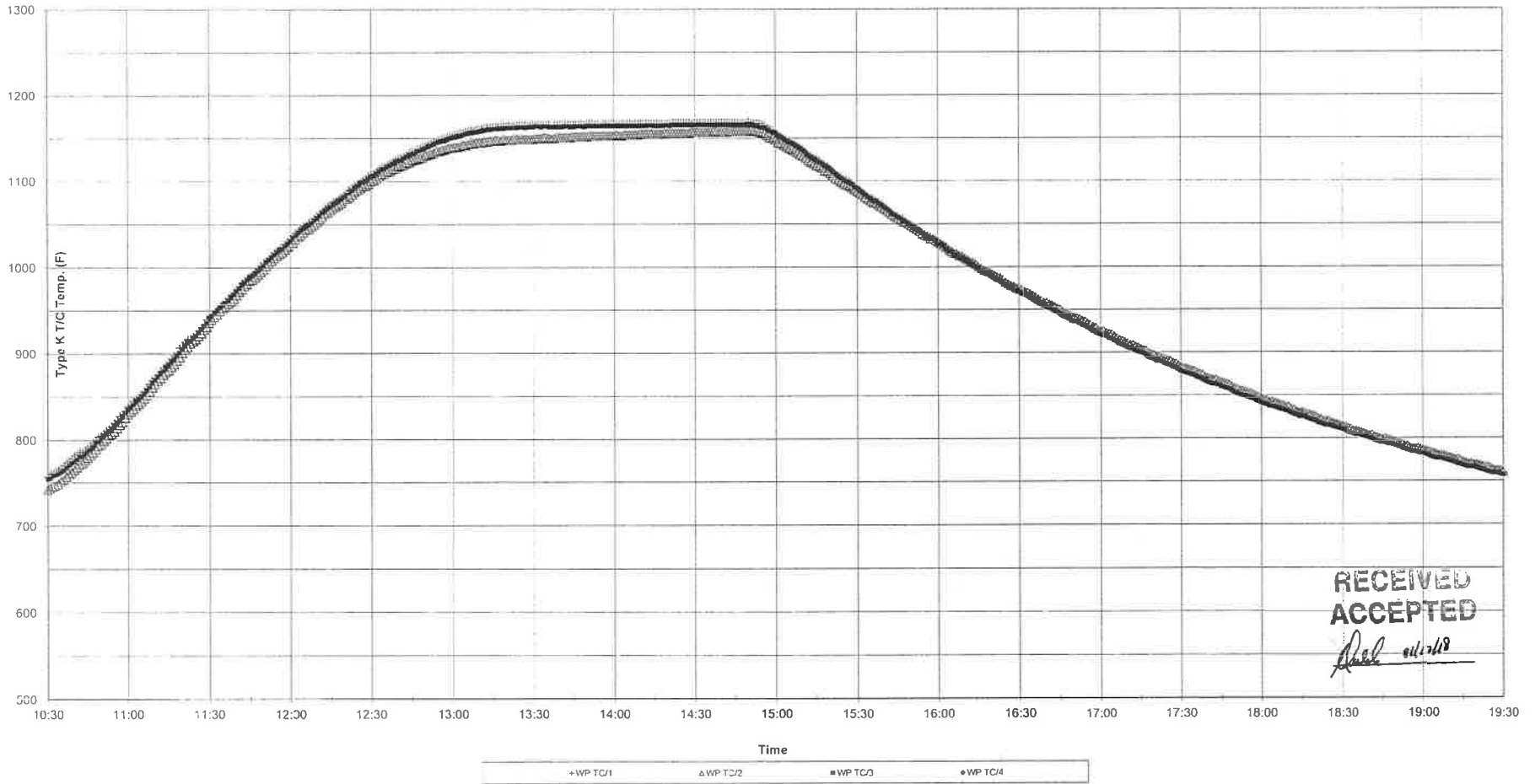
Rate of Rise:	800°F to 1150°F at 266°F per hour.
Holding Temp:	1150°F
Holding Time:	90 min. Minimum
Cooling Rate:	1150°F to 800°F at 333°F per hour.
Material(s):	P1
Operator:	Barry Gufriend

Notes:	(2) 36"X 10'-0"X 1440 psi SN:35528-01, 02
	(1) 36"X 9'-4"X 1440 psi SN:35549-05
	(1) 60"X 5'-0"X 170 psi SN:35550-02
	(2) 4"X 96-1/2" bridles SN:35528-F07, F08

Signature: *[Signature]* Date: Jan 17/18

Heat Number: #1-16-JAN-2018

HEAT TREATMENT RECORD



RECEIVED
ACCEPTED

[Signature] 01/17/18

SUPERHEAT FGH CONTROL UNIT CERTIFICATE OF CALIBRATION

Asset Number _____ Supercontroller Number 23600

Range 0 - 2000°F Sensor Type K

Calibration Procedure Number C1-TP-02-CMTE (Rev. ?)

Date September 2, 2017 Calibration Due February 28, 2018

This instrument has been calibrated within the manufacturer's specifications.

These specifications state that the maximum allowable error is $\pm 6^\circ\text{F}$

During calibration, if the "°F As Found/°F As Left" numbers (values) are the same and no adjustments have been made, only one number (value) will be noted.

Zone 1A	Input Signal	200	600	1000	1400	1800
	°F As Found	203	603	1003	1403	1803
	°F As Left					
Zone 7A	Input Signal	200	600	1000	1400	1800
	°F As Found					
	°F As Left					
Zone 1B	Input Signal	200	600	1000	1400	1800
	°F As Found					
	°F As Left					
Zone 7B	Input Signal	200	600	1000	1400	1800
	°F As Found					
	°F As Left					

Environmental Conditions: Temperature (°F): 50.0

The above unit has been calibrated and tested. It is directly traceable to the National Institute of Standards & Technology (N.I.S.T) or the National Research Council (N.R.C).

Max Kohut

Calibrated By


Signature

MEASURING & TEST EQUIPMENT USED

Make: FGH Type: Ezecal Model: MK3

Serial No.	Cert. Date	Due Date
3450	April 28, 2017	October 27, 2017



C000000053189



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CERTIFICATE OF CONFORMANCE

INVOICED TO: AIRCOM INSTRUMENTATION

DELIVERED TO: AIRCOM INSTRUMENTATION

ATTN. ACCTS PAYABLE
9328-37 AVENUE
EDMONTON, AB, CANADA

9378-37 AVENUE
EDMONTON, AB, CANADA

T6E5K3

T6E5K3

CERTIFICATE NO:	DATE:	CUSTOMER PO:	SALES ORDER:	PAGE:
C000000053189	8-Jan-14	20321	P105099	1 of 1

DATE OF MFG:

1/8/2014

ITEM	PRODUCT	LOT #	# of Spools	Shipping QTY	Total
2	FW6381 GEFIR2200 ULTRA-20-KK Your Part N215-241	15014-115	2	1000ft	1000ft
<p>CALIBRATION RESULTS ARE TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) AND MEET DEVIATION TOLERANCES AS DEFINED IN ISA MC96.1 (FORMERLY ANSI) AND ASTM-E-230.</p> <p>ALL PRODUCTS MANUFACTURED IN THE USA.</p>					

This is to certify that the materials furnished on this shipment are in conformance with the requirements, specifications, and drawings of the above referenced customer purchase order. Inspection and test records are on file and available for customer review. This product contains no metallic Mercury or Mercury compounds and is free from Mercury contamination.

Signed by:

Date:

1/8/2014

PRESSURE-TEST REPORT

DATE OF TEST: Jan 18 2018 HYDRO-TEST NO.: 1-18-18 AVZ

CUSTOMER: Arc Resources Ltd LOCATION: Bromley Mechanical
(LSD OR ADDRESS)

WORK ORDER NO.: 35528 SIZE: DIAMETER: 36"
LENGTH: 10'-0"

SERIAL NO.: 35528-01,02

NUMBER OF ITEMS TESTED: Two

HYDRO-TEST PRESSURE: 1872 PSI OR 12907 KPA

MEDIUM: WATER MEDIUM TEMPERATURE: See Chart

TIME: HYDRO-TEST ON 0800 A M AMBIENT TEMP: SEE CHART PRESSURE: 1872 Psi INIT: [Signature]

HYDRO-TEST OFF 1043 A M AMBIENT TEMP: SEE CHART PRESSURE: 1872 Psi INIT: [Signature]

LENGTH OF TEST: 163 MINUTES

TEST GAUGE No.: FLU 1 RANGE: 0-10⁰⁰⁰ PSI

TEST GAUGE No.: FLU 17 RANGE: 0-10⁰⁰⁰ PSI

CHART RECORDER NO.: _____ RANGE: _____

QCI WITNESSED BY: [Signature]

OWNER WITNESSED BY: [Signature]

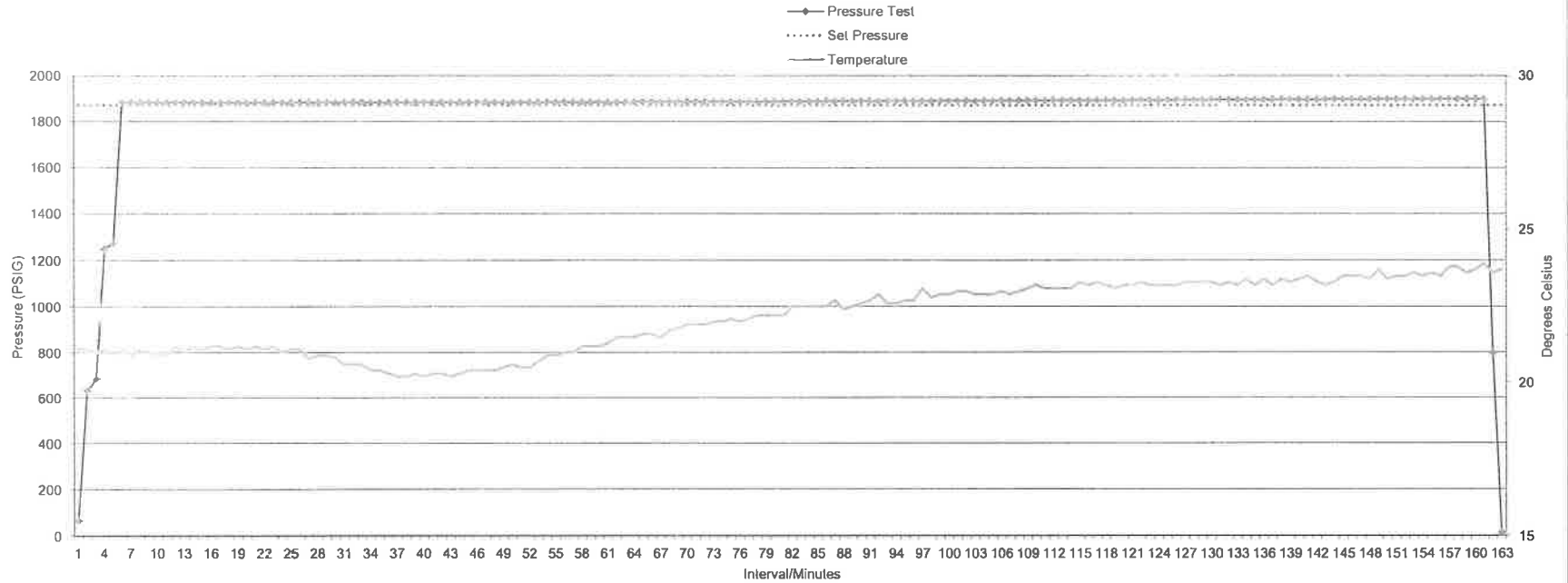
QCM APPROVED BY: [Signature]



Date Started	1/18/2018	Date Finished	1/18/2018
Customer / WC Ref:	ARC Resources/WO: 35528		
Notes:	Vessel SN 35528-01 & 02		
	FLU01		
Gauge Details	FLUKE, 700G, 2822048, 4.04		
Interval	1 minutes		

Witnessed by:	DEREK HOPE <i>[Signature]</i>
Approved by:	M. KANEWISCHER <i>[Signature]</i>

PRESSURE TEST RECORD



MATERIAL REPORT

DATE: Jan 15 2018

CUST: ARC RESOURCES LTD.

CHECKED: *Dull*

SERIAL NO: 35528-02

SIZE: 36' OD X 10' - 0"

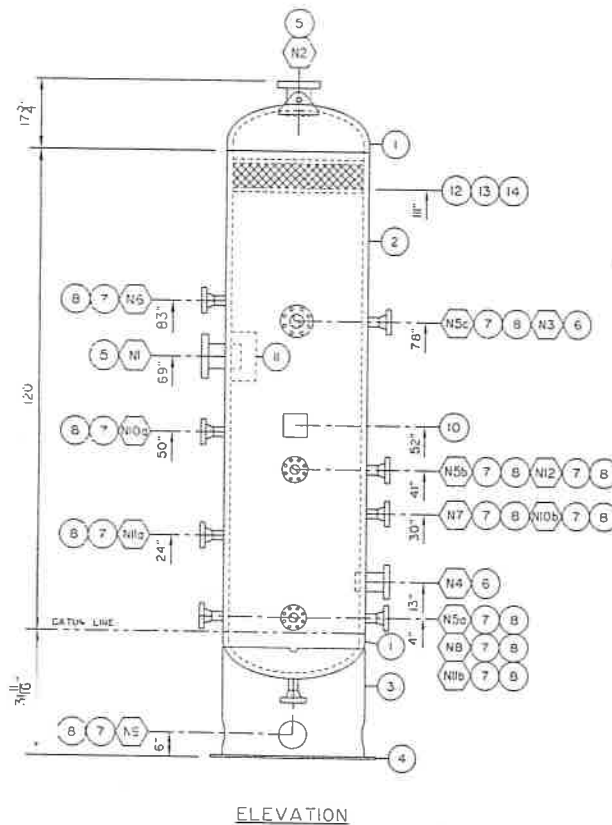
PRESSURE: 1440 PSI

W.O 35528

CRN V4393.231

DRAWING NO.: 33915 - REG Rev .0

CAD NC; 35528 - TEST



ITEM	DESCRIPTION	HEAT NUMBER	HEAT NUMBER	MATERIAL	MIN. THK.
1a	S.E.HEAD,36"OD X 1.500" NOM (1.4375"MIN) HOT FORMED	C32392		SA516 - 70N	1.452"
1b	S.E.HEAD,36"OD X 1.500" NOM (1.4375"MIN) HOT FORMED	C32392		SA516 - 70N	1.452"
2	SHELL, 36' OD X 1.500" X 10' - 0" LONG	C31891		SA516 - 70N	1.500"
3	ROLLED PLATE,36" CD X 0.375" X 27 3/16" LONG	V535658		SA516 - 70N	0.375"
4	BASE PLATE - PLATE, 1/2" (SEE DETAIL)			SA36 / 44W	0.500"
5	RFLWN, 4" 600 ANSI X 10" OAL	C10178N		SA350 LF2 -CL1	1.000"
6	RFLWN , 3" 600 ANSI X 9" OAL	CTD		SA350 LF2 -CL1	0.810"
7	RFWN, 2" 600 ANSI SCH. 160	522176		SA105N	0.344"
8	PIPE, 2" SCH. 160 (0 344") X 2 7/8" LONG	V535556		SA106B	0.344"
9	LIFT LUG - PLATE, 1", (SEE DETAIL)	V533732		SA516 - 70N	1.000"
10	TAG PLATE HOLDER & VESSEL ID PLATE			SA36 / ALUM	
11	INLET DIVERTER - PLATE, 3/8" (SEE DETAIL)			SA36 / 44W	0.375"
12	DEM 9LB, 33" OD X 6" TK. 3 PC NO GRD			316LSS	

BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT

DIA SIZE OR WITH: 36"
 NPS OD ID

INSPECTED BY: MICHAEL QUINN
 DATE: OCTOBER 30/2017
 P.O.#: PO-87519
 SUPPLIER: CESSCO FABRICATION
 PART ID#: VES 36015
 REQ. MIN TK: 1.4520"

GRADE: SA 516-70MT

HEADS 2:1
 HEMI
 WELD CAP
 OTHER
 SHELL
 PIPE → NDE BY MANUFACTURER
 PLATE HYDRO YES NDE NO
 REPAD NO YES
 STRUCT. NO NO
 OTHER SKIRT YES YES

LENGTH _____
 THICKNESS _____
 PIPE PUBLISHED NOM _____
 PLATE NOM 1.5000"

Weight per foot for pipe over 4"

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35825 <i>HHH</i>	8	C32392 HT-415883 366089-01	1.452"					ok	ok	ok	mq

W/O# WO-35528	RECEIVED & ACCEPTED BY: <i>OS</i>	REQUIRED CODE MARKINGS:
CUSTOMER: ARC RESOURCES GENERAL PARTNERSHP	DATE: DEC 12 2017	ALL MARKINGS STAMPED ONTO PLATE BY MANUFACTURE



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A09 Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 1
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257	A07.2 No.	A01 Product HEAVY PLATES CESSCO FABRICATION & ENGINEERING LTD LOG No. PREFIX C
E02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
E03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

E01-E99 Description of the product

E04 Item No.	E08 Number of pieces	E09 Thickness	E10 Width	E11 Length	E12 Theoretical mass	E04 Product delivery condition	E07.2 Heat No.	E07.1 Rolled plate No./ Test No.	A03 Purchaser article number
			INCH		KG				
01	1	0,5000 x	96,50000 x	384,00000	2383	N /	415618	363416-01	- 32330
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363416-02	- 32331
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363416-03	- 32332
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363417-01	- 32327
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363417-02	- 32328
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363420-01	- 32329
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363420-02	- 32333
**	7				16681				
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	363426-01	- 32338
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	363426-02	- 32336
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	367440-01	- 32335
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	367440-02	- 32337
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	377166-01	- 32334
**	5				18600				
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	363425-01	- 32344
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	363425-02	- 32342
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	364016-01	- 32343
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	364016-02	- 32340
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	364016-03	- 32341
**	5				14895				
04	1	0,6250 x	72,50000 x	384,00000	2238	N	415618	363418-01	- 32347
04	1	0,6250 x	72,50000 x	384,00000	2238	N	415618	363418-02	- 32348
04	1	0,6250 x	72,50000 x	384,00000	2238	N	415618	363421-01	- 32346

CHEMICAL & PHYSICALS
CHECKED
ASME Ed. 2015
CESSCO By Lindt Industrie
09/21/2015

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.		Dillinger Franco Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 3 - FRANCE Service Qualité-Essais Date 11.02.15	AD1 ED 1
	Manufacturer's mark	POISSONNET Test House Manager		





Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 5492887-06.02.15	A08 Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 2/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

B91-B99 Description of the product

B14 Item No.	B08 Number of pieces	B09 Thickness	B10 Width	B11 Length	B12 Theoretical mass	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No./ Test No.	A09 Purchaser article number
			INCH		KG				
04	1	0,6250 x	72,50000 x	384,00000	2238	N	415618	363421-02 -	32345
**	4				8952				
05	1	0,6250 x	120,50000 x	480,00000	4650	N	415618	363419-01 -	32351
05	1	0,6250 x	120,50000 x	480,00000	4650	N	415618	363419-02 -	32350
05	1	0,6250 x	120,50000 x	480,00000	4650	N	415618	363422-01 -	32352
05	1	0,6250 x	120,50000 x	480,00000	4650	N	415618	363422-02 -	32349
**	4				18600				
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	367447-01 -	32360
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	367447-02 -	32354
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368176-01 -	32357
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368176-02 -	32355
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368176-03 -	32358
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368177-01 -	32359
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368177-02 -	32353
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368177-03 -	32356
**	8				28600				
07	1	0,7500 x	146,00000 x	504,00000	7099	N	415618	368188-01 -	32362
07	1	0,7500 x	146,00000 x	504,00000	7099	N	415618	368189-01 -	32361
07	1	0,7500 x	146,00000 x	504,00000	7099	N	415618	368190-01 -	32363
**	3				21297				
08	1	0,8750 x	120,50000 x	480,00000	6510	N	415879	364012-01 -	32369
08	1	0,8750 x	120,50000 x	480,00000	6510	N	415879	364012-02 -	32366
08	1	0,8750 x	120,50000 x	480,00000	6510	N	415879	364013-01 -	32368

A04	 Manufacturer's mark	2011/202/203 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3532 rue du Comte Jean - CS 50317 F-58379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01
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Erklärungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)


A02	INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)	A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A01 Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 3/...
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A05 Established inspecting body DF	A06 Purchaser Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257	A07.2 No.	E01 Product HEAVY PLATES
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B02/ Steel design.	SAS16-70/SAS16M-485/A516-70/A516M-485
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014

B01-B99 Description of the product

B14 Item No.	B08 Number of pieces	B09 Thickness	B10 Width	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No./ Test No.	A09 Purchaser article number
			INCH						
08	1	0,8750 x	120,50000 x	480,00000	6510	N ✓	415879	364013-02	- 32367
08	1	0,8750 x	120,50000 x	480,00000	6510	N	415881	368026-01	- 32365
08	1	0,8750 x	120,50000 x	480,00000	6510	N	415881	368026-02	- 32364
**	6				39060				
09	1	1,0000 x	96,50000 x	384,00000	4767	N	415881	368001-01	- 32373
09	1	1,0000 x	96,50000 x	384,00000	4767	N	415881	368001-02	- 32370
09	1	1,0000 x	96,50000 x	384,00000	4767	N	415881	368001-03	- 32371
09	1	1,0000 x	96,50000 x	384,00000	4767	N	415881	368002-01	- 32372
09	1	1,0000 x	96,50000 x	384,00000	4767	N	415881	368002-02	- 32374
**	5				23835				
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	366017-01	- 32381
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	366017-02	- 32378
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	366125-01	- 32376
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	366125-02	- 32380
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	366126-01	- 32377
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	366126-02	- 32375
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	368027-01	- 32379
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	368027-02	- 32382
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	368028-01	- 32385
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	368028-02	- 32383
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	369010-01	- 32384
**	11				81840				
11	1	1,0000 x	145,00000 x	504,00000	9401	N	415881	366121-01	- 32387

A04	D11/D02/D03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 88317 F-59379 Dunkerque Cedex 4 - FRANCE Service Qualité-Essais Date 11.02.15	AC1
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Manufacturer's mark




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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A09/ Manufacturer's order/ A03 Certificate No. 399194-001	Sheet 4/...
A05 Established inspecting body DF	A08 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257	A07.2 No.	B01 Product HEAVY PLATES
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

B01-B99 Description of the product

B14 Item No.	B08 Number of pieces	B09 Thickness	B10 Width	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Muzt No.	B07.1 Rolled plate No./ Test No.	A09 Purchaser article number
11	1	1,0000 x	145,00000 x	504,00000	9401	N ✓	415881	366121-02 - 32386	
11	1	1,0000 x	145,00000 x	504,00000	9401	N	415883	366122-01 - 32388	
11	1	1,0000 x	145,00000 x	504,00000	9401	N	415883	366122-02 - 32391	
11	1	1,0000 x	145,00000 x	504,00000	9401	N	415883	366123-01 - 32389	
11	1	1,0000 x	145,00000 x	504,00000	9401	N	415883	366123-02 - 32390	
..	6				56406				
12	1	1,5000 x	96,50000 x	384,00000	7150	N	415883	366089-01 - 32392	*
12	1	1,5000 x	96,50000 x	384,00000	7150	N	415883	366089-02 - 32397	
12	1	1,5000 x	96,50000 x	384,00000	7150	N	415883	366089-03 - 32393	
12	1	1,5000 x	96,50000 x	384,00000	7150	N	415883	379171-01 - 32395	
12	1	1,5000 x	96,50000 x	384,00000	7150	N	415883	379171-02 - 32396	
12	1	1,5000 x	96,50000 x	384,00000	7150	N	415883	379171-03 - 32394	
..	6				42900				
13	1	1,5000 x	120,50000 x	480,00000	11161	N	415111	375109-01 - 32398	
13	1	1,5000 x	120,50000 x	480,00000	11161	N	415879	371380-02 - 32401	
13	1	1,5000 x	120,50000 x	480,00000	11161	N	415879	371380-02 - 32399	
13	1	1,5000 x	120,50000 x	480,00000	11161	N	415879	371381-01 - 32402	
13	1	1,5000 x	120,50000 x	480,00000	11161	N	415879	371381-02 - 32400	
..	5				55805				
14	1	1,5000 x	145,00000 x	504,00000	14101	N	415879	364025-01 - 32406	
14	1	1,5000 x	145,00000 x	504,00000	14101	N	415879	364026-01 - 32405	
14	1	1,5000 x	145,00000 x	504,00000	14101	N	415879	364027-01 - 32404	
14	1	1,5000 x	145,00000 x	504,00000	14101	N	415879	366124-01 - 32403	

A04	201/202/203 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Monnaie	Dillinger France Port 5032 3832 rue du Comte Jean - CS 36317 F-53379 Dunkerque Cedex 3 - FRANCE Service Qualité-Essais Date 11.02.15	A01
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QMS-System: Certification as per ISO 9001



DILLINGER HÜTTE

Erklärungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No / Date of dispatch 6492887-06.02.15	A09 Manufacturer's order / A03 Certificate No. 395394-001	Sheet 5/
A05 Established inspecting body DF	A06 Purchaser Final receiver CESSCO FAB., EDMONTON CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

B01-B99 Description of the product

B14 Item No.	B05 Number of pieces	B09 Thickness	B10 Width INCH	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No./ Test No.	A09 Purchaser order number
**	4				56404				
***	79				483875				

B04 Product delivery condition

ITEM NO.: 01-14
 N: HT: 1670 GR.F +27 -27 GR.F
 SOAKING TIME TO ATTAIN THE TARGET TEMPERATURE OVER THE WHOLE SECTION: 1-1,75 MIN/MM (25-45 MIN/INCH)
 COOLING IN STILL AIR

B05 Marking of the product

ITEM NO.: 01-14
 STEEL DESIGNATION SA516 70 MTLTV SA516M 485 MTLTV
 HEAT NO. / TRADEMARK / ROLLED PLATE NO.-TEST NO.

B07-B99 Further information about the product

ITEM NO.: 01-14
 THICKNESS REDUCTION RATIO >= 3,0 IS FULFILLED (CF. A/SA20 PAR. 5.3)

C10-C29 Tensile test

B14 Item No.	B07.2 Heat No.	B07.1 Rol. plate/ Test No.	B05 Reference (heat) treatment	C01	C02/ C01	C03 Temp. GRF	C10 MPA RP02	C11	C12 RM	C13	A % L0=200	A % L0=500	C14-C15
01	415618	363416		K1	Q0	RT	427		559			25	
01	415618	363417		K1	Q0	RT	401		553			24	
01	415618	363420		K1	Q0	RT	419		555			24	

 Manufacturer's mark	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais
			Date 11.02.15

QMS-System: Certification as per ISO 9001



DILLINGER HÜTTE

Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A01 Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 6/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-III:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C10-C29 Tensile test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/ C01	C03 Temp. GR.F	C10 MPA RP02	C11 ✓	C12 RM	C13	A % LO=2R	A % LO=8W	C14-C15
02	415618	363426		K1	Q0	RT	412		554			25	
02	415618	367440		K1	Q0	RT	413		561			23	
02	415618	377166		K1	Q0	RT	405		558			23	
03	415618	363425		K1	Q0	RT	416		559			25	
03	415618	364016		K1	Q0	RT	421		566			24	
04	415618	363418		K1	Q0	RT	401		550			24	
04	415618	363421		K1	Q0	RT	403		552			22	
05	415618	363419		K1	Q0	RT	417		558			24	
05	415618	363422		K1	Q0	RT	420		560			25	
06	415618	367447		K1	Q0	RT	402		553			25	
06	415618	368176		K1	Q0	RT	403		554			25	
06	415618	368177		K1	Q0	RT	405		553			26	
07	415618	368188		K1	Q0	RT	402		552			25	
07	415618	368189		K1	Q0	RT	403		551			26	
07	415618	368190		K1	Q0	RT	401		555			25	
08	415879	364012		K1	Q0	RT	406		557			26	
08	415879	364013		K1	Q0	RT	412		553			26	
08	415881	368026		K1	Q0	RT	404		545			24	
09	415881	368001		K1	Q0	RT	389		532			28	
09	415881	368002		K1	Q0	RT	397		530			27	
10	415881	366017		K1	Q0	RT	391		532			27	
10	415881	366125		K1	Q0	RT	409		550			25	
10	415881	366126		K1	Q0	RT	391		530			26	

<p>Manufacturer's mark</p>	<p>A04 Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.</p>	<p>POISSONNET Test House Manager</p>	<p>Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais</p>	<p>A04</p>
			<p>Date 11.02.15</p>	<p>ED 1</p>



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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 7/
A05 Established inspecting body DF	A08 Purchaser Final receiver CESSCO FAB., EDMONTON CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME- IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C10-C29 Tensile test

B14 Item No.	B07.2 Heat No.	B07.1 Rot.plate/ Test No.	B05 Reference (heat) treatment	C01 C01	C02 C02	C03 C03	C10 C10	C11 C11	C12 C12	C13 C13	A A	A A	C14-C15 C14-C15
				GR.F	Temp. GR.F	MPA RP02			RM		% LO=21N	% LU=01N	
10	415881	368027		K1 Q0	RT	390			530			26	
10	415881	368028		K1 Q0	RT	394			533			26	
10	415881	369010		K1 Q0	RT	393			534			27	
11	415881	366121		K1 Q0	RT	393			535			27	
11	415883	366122		K1 Q0	RT	396			542			28	
11	415883	366123		K1 Q0	RT	398			542			27	
12	415883	366089		K1 QV	RT	384			535	38			
12	415883	379171		K1 QV	RT	375			531	38			
13	415111	375109		K1 QV	RT	403			549	37			
13	415879	371380		K1 QV	RT	382			542	34			
13	415879	371381		K1 QV	RT	382			543	37			
14	415879	364025		K1 QV	RT	410			548	37			
14	415879	364026		K1 QV	RT	398			547	35			
14	415879	364027		K1 QV	RT	387			544	36			
14	415879	366124		K1 QV	RT	400			544	37			

C30-C39 Hardness test

B14 Item No.	B07.2 Heat No.	B07.1 Rot.plate/ Test No.	B05 Reference (heat) treatment	C01 C01	C02/C01 C02/C01	C03 C03	C30 C30	C35 C35	C34 C34	C32 C32
						Temp. GR.F	Method of test	Individual values	Individual values	Mean value
01	415618	363416		K1 Q0	Q0	RT HBW	5/750	HB 158		
01	415618	363417		K1 Q0	Q0	RT HBW	5/750	HB 156		
01	415618	363420		K1 Q0	Q0	RT HBW	5/750	HB 162		
02	415618	363426		K1 Q0	Q0	RT HBW	5/750	HB 159		
02	415618	367440		K1 Q0	Q0	RT HBW	5/750	HB 161		

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 <p>Manufacturer's mark</p>	<p>BROMLEY MECHANICAL SERVICES Checked to ASME</p> <p>POISSONNET Test House Manager</p>	<p>Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais</p> <p>Date 11.02.15</p>	A05
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Sect. IIA 2015 Edd. Min 1.452"
SA 20 08 12/12/17
Date





Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No / Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 8/...
A05 Established inspecting body DF	A06 Purchaser Final receiver CESSCO FAB., EDMONTON CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C30-C39 Hardness test

B14 Item No.	B07.2 Heat No.	B07.1 Rot. plates Test No.	B05 Reference (heat) treatment	C01	C02/C01	C03 Temp. GR.F	C30 Method of test	C35 C31 Individual values	C32 Mean value
02	415618	377166		K1	Q0	RT	HBW 5/750	HB 163	
03	415618	363425		K1	Q0	RT	HBW 5/750	HB 157	
03	415618	364016		K1	Q0	RT	HBW 5/750	HB 163	
04	415618	363418		K1	Q0	RT	HBW 5/750	HB 156	
04	415618	363421		K1	Q0	RT	HBW 5/750	HB 155	
05	415618	363419		K1	Q0	RT	HBW 5/750	HB 153	
05	415618	363422		K1	Q0	RT	HBW 5/750	HB 158	
06	415618	367447		K1	Q0	RT	HBW 5/750	HB 158	
06	415618	368176		K1	Q0	RT	HBW 5/750	HB 159	
06	415618	368177		K1	Q0	RT	HBW 5/750	HB 159	
07	415618	368188		K1	Q0	RT	HBW 5/750	HB 162	
07	415618	368189		K1	Q0	RT	HBW 5/750	HB 158	
07	415618	368190		K1	Q0	RT	HBW 5/750	HB 153	
08	415879	364012		K1	Q0	RT	HBW 5/750	HB 162	
08	415879	364013		K1	Q0	RT	HBW 5/750	HB 164	
08	415881	368026		K1	Q0	RT	HBW 5/750	HB 155	
09	415881	368001		K1	Q0	RT	HBW 5/750	HB 150	
09	415881	368002		K1	Q0	RT	HBW 5/750	HB 149	
10	415881	366017		K1	Q0	RT	HBW 5/750	HB 155	
10	415881	366125		K1	Q0	RT	HBW 5/750	HB 160	
10	415881	366126		K1	Q0	RT	HBW 5/750	HB 155	
10	415881	368027		K1	Q0	RT	HBW 5/750	HB 149	
10	415881	368028		K1	Q0	RT	HBW 5/750	HB 150	
10	415881	369010		K1	Q0	RT	HBW 5/750	HB 152	

 Manufacturer's mark	2017/202/203 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A04

Qli-System: Certification as per ISO 9001



DILLINGER HÜTTE

Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certifica)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No / Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order A03 Certificate No. 399394-001	Sheet 9/
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-11A:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C30-C39 Hardness test

B14 Item No.	B07.2 Heat No.	B07.1 Ref. plate/ Test No.	B05 Reference (heat) treatment	C01	C02/C01	C03 Temp. GR.F	C30 Method of test	C35 C34 Individual values	C32 min. value
11	415881	366121		K1	Q0		RT HBW 5/750	HB 147	
11	415883	366122		K1	Q0		RT HBW 5/750	HB 156	
11	415883	366123		K1	Q0		RT HBW 5/750	HB 147	
12	415883	366089		K1	Q0		RT HBW 5/750	HB 153	
12	415883	379171		K1	Q0		RT HBW 5/750	HB 149	
13	415111	375109		K1	Q0		RT HBW 5/750	HB 165	
13	415879	371380		K1	Q0		RT HBW 5/750	HB 153	
13	415879	371381		K1	Q0		RT HBW 5/750	HB 158	
14	415879	364025		K1	Q0		RT HBW 5/750	HB 157	
14	415879	364026		K1	Q0		RT HBW 5/750	HB 153	
14	415879	364027		K1	Q0		RT HBW 5/750	HB 193	
14	415879	366124		K1	Q0		RT HBW 5/750	HB 156	

C40-C49 Impact test

B14 Item No.	B07.2 Heat No.	B07.1 Ref. plate/ Test No.	B05 Reference (heat) treatment	C01	C02/ C01	C03 Temp. GR.F	C41 Width of test piece	C40 Type of test piece	C44 Testing method	C46 Energy	C49	C42 Individual values AV-RT, L3P	C45 min. value
01	415618	363416		K1	LO	-51		CHP-V		AV 8	190	195 170	185
01	415618	363417		K1	LO	-51		CHP-V		AV 8	192	147 159	166
01	415618	363420		K1	LO	-51		CHP-V		AV 8	170	147 200	172
02	415618	363426		K1	LO	-51		CHP-V		AV 8	185	130 192	169
02	415618	367440		K1	LO	-51		CHP-V		AV 8	136	117 129	129
02	415618	377166		K1	LO	-51		CHP-V		AV 8	143	147 199	161
03	415618	363425		K1	LO	-51		CHP-V		AV 8	142	132 134	136
03	415618	364016		K1	LO	-51		CHP-V		AV 8	113	118 135	121

<p>Manufacturer's mark</p>	<p>Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.</p>	<p>POISSONNET Test House Manager</p>	<p>Dillinger France Port 5632 3032 rue du Comte Jean - CS 56337 F-59378 Dunkerque Cedex 4 - FRANCE Service Qualité-Essais</p>	<p>Date 11.02.15</p>




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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 10/...
A05 Established inspecting body DF	A06 Purchaser: CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C40-C49 Impact test

B14 Item No.	B07.2 Heat No.	B07.1 Rot.plate/ Test No.	B06 Reference (heat) treatment	C01	C02/ C01	C03 Temp. GR.F	C41 Width of test piece	C40 Type of test piece	C44 Testing method	C46 Energy	C45	C42 Individual values AV=FT.LBF	C43 Mean value
04	415618	363418		K1	LO	-51		CHP-V			AV 8	125 108 125	119
04	415618	363421		K1	LO	-51		CHP-V			AV 8	142 197 151	163
05	415618	363419		K1	LO	-51		CHP-V			AV 8	151 139 135	142
05	415618	363422		K1	LO	-51		CHP-V			AV 8	137 119 149	135
06	415618	367447		K1	LO	-51		CHP-V			AV 8	136 119 148	134
06	415618	368176		K1	LO	-51		CHP-V			AV 8	138 120 141	133
06	415618	368177		K1	LO	-51		CHP-V			AV 8	141 134 189	155
07	415618	368188		K1	LO	-51		CHP-V			AV 8	131 120 136	129
07	415618	368189		K1	LO	-51		CHP-V			AV 8	186 129 109	141
07	415618	368190		K1	LO	-51		CHP-V			AV 8	119 116 129	121
08	415879	364012		K1	LO	-51		CHP-V			AV 8	162 156 205	174
08	415879	364013		K1	LO	-51		CHP-V			AV 8	192 191 189	191
08	415881	368026		K1	LO	-51		CHP-V			AV 8	201 201 180	194
09	415881	368001		K1	LV	-51		CHP-V			AV 8	212 188 197	199
09	415881	368002		K1	LV	-51		CHP-V			AV 8	197 184 193	191
10	415881	366017		K1	LV	-51		CHP-V			AV 8	198 193 195	195
10	415881	366125		K1	LV	-51		CHP-V			AV 8	192 187 187	188
10	415881	366126		K1	LV	-51		CHP-V			AV 8	198 197 193	196
10	415881	368027		K1	LV	-51		CHP-V			AV 8	152 197 213	187
10	415881	368028		K1	LV	-51		CHP-V			AV 8	195 207 187	196
10	415881	369010		K1	LV	-51		CHP-V			AV 8	191 145 161	166
11	415881	366121		K1	LV	-51		CHP-V			AV 8	188 165 139	164
11	415883	366122		K1	LV	-51		CHP-V			AV 8	197 198 195	197
11	415883	366123		K1	LV	-51		CHP-V			AV 8	161 149 208	173

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A05
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Manufacturer's mark

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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Spec 11/15
A05 Established inspecting body DF	A06 Purchaser Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IYA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C40-C49 Impact test

B14 Item No.	B37.2 Heat No.	B37.1 Ref. plate/ Test No.	B05 Reference (heat) treatment	C01	C02 C01	C03 / Temp. GR.F	C41 Width of test piece	C40 Type of test piece	C44 Testing method	C46 Energy	C45	C42 Individual values AV=FY,LD?	C43 AV=FY,LD?		
12	415883	366089		K1	LV	-51		CHP-V			AV 8	142	168	202	171
12	415883	379171		K1	LV	-51		CHP-V			AV 8	137	128	125	137
23	415111	375109		K1	LV	-51		CHP-V			AV 8	131	156	134	140
13	415879	371380		K1	LV	-51		CHP-V			AV 8	131	134	135	133
13	415879	371381		K1	LV	-51		CHP-V			AV 6	131	89	125	115
14	415879	364025		K1	LV	-51		CHP-V			AV 8	132	143	195	157
14	415879	364026		K1	LV	-51		CHP-V			AV 8	119	135	131	126
14	415879	364027		K1	LV	-51		CHP-V			AV 8	122	201	116	146
14	415879	366124		K1	LV	-51		CHP-V			AV 8	127	133	157	135

C66-C68 Supplementary tests on test samples

ITEM NO.: 12-13

FERRITE GRAIN SIZE ASTM E112 (SEE APPENDIX)

B07.2	B07.1	RESULT
415618	363422	9,0
415879	364013	9,0
415883	366089	8,5
415881	366125	9,0
415111	375109	9,0

A04



Manufacturer's mark

Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.



POISSONNET
Test House Manager

Dillinger France
Port 3032
3032 rue du Comte Jean - CS 56347
F-59379 Dunkerque Cedex 4 - FRANCE
Service Qualité-Essais

Date 11.02.15

BD

QM-System: Certification as per ISO 9001



DILLINGER HÜTTE

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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 12/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-III:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C70-C99 Chemical composition % - Heat analysis

B07.2 Heat	C70	C	SI	MN	P	S	CU	MO	NI	CR	V	NB	Ti	B	CA
415111	Y	0,168	0,379	1,17	0,009	0,0007	0,170	0,011	0,371	0,026	0,001	0,016	0,002	0,0001	0,0013
415618	Y	0,180	0,372	1,16	0,007	0,0008	0,098	0,013	0,057	0,040	0,001	0,017	0,002	0,0003	0,0027
415879	Y	0,177	0,369	1,17	0,007	0,0008	0,170	0,028	0,360	0,062	0,001	0,018	0,004	0,0003	0,0023
415881	Y	0,158	0,318	1,18	0,007	0,0009	0,177	0,019	0,362	0,033	0,001	0,016	0,003	0,0003	0,0015
415883	Y	0,163	0,343	1,18	0,007	0,0008	0,168	0,026	0,363	0,043	0,001	0,017	0,003	0,0002	0,0010

B07.2 Heat	C70	AL-T
415111	Y	0,031
415618	Y	0,032
415879	Y	0,042
415881	Y	0,046
415883	Y	0,039

C94 Heat analysis Carbon equivalent / Alloying restrictions

B07.2 Heat	FO-02=	FO-51=	FO-55=	FO-70=	FO-78=
415111	0,41	0,017	0,58	0,2	0,04
415618	0,39	0,018	0,21	0,2	0,05
415879	0,43	0,019	0,62	0,3	0,09
415881	0,40	0,017	0,59	0,2	0,05
415883	0,41	0,018	0,60	0,3	0,07

C95 Ladle treatment

ITEM NO.: 01-14
HEAT OF THE INDICATED ITEM: VACUUM DEGASSED / SULPHIDE SHAPE CONTROL

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.		Dillinger France Port 3032 3432 rue du Comte Jean - CS 50317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais
	BROMLEY MECHANICAL SERVICES Checked to ASME	POISSONNET Test House Manager	Date 11.02.15

V535825 Sect. IIA 2015 Edd. min 1.452"
SA 20 08. 12/12/17

QMI-System: Certification as per ISO 9001



DILLINGER HÜTTE

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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No / Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order A03 Certificate No 399394-001	SIGMA 13/...
A06 Established inspecting body DF	A08 Purchaser Final receiver CESSCO FAB., EDMONTON CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-III:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C95 Further information about ladle treatment

ITEM NO.: 01-14
MELTED IN GERMANY BY -AG DER DILLINGER HUETTENWERKE, DILLINGEN/SAAR-

ITEM NO.: 01-14
FULLY KILLED AND MADE TO FINE GRAIN PRACTICE

C78-C99 Further information about heat analysis

ITEM NO.: 01-14
OXYGEN MAX. 0,005% ON LADLE AND ON PRODUCT

C70-C99 Chemical composition % - Product analysis

B07.2 Heat	B07.1 Test No.	CM	C /	SI /	MN /	P /	S /	CU /	MO /	NI /	CR /	V	NB	W	B	CO
415111	375109	K10	0,165	0,364	1,13	0,009	0,0007	0,168	0,011	0,379	0,028	0,001	0,015	0,002	0,0002	0,0013
415618	363416	K10	0,185	0,375	1,14	0,007	0,0006	0,092	0,012	0,055	0,038	0,001	0,018	0,002	0,0001	0,0022
415618	363417	K10	0,182	0,368	1,12	0,007	0,0006	0,091	0,012	0,054	0,038	0,001	0,016	0,002	0,0002	0,0022
415618	363418	K10	0,181	0,354	1,13	0,007	0,0004	0,093	0,012	0,058	0,041	0,001	0,017	0,003	0,0002	0,0024
415618	363419	K10	0,178	0,362	1,14	0,007	0,0003	0,093	0,012	0,058	0,041	0,001	0,017	0,002	0,0002	0,0022
415618	363420	K10	0,176	0,352	1,13	0,007	0,0003	0,092	0,012	0,058	0,041	0,001	0,017	0,002	0,0001	0,0024
415618	363421	K10	0,166	0,367	1,16	0,008	0,0003	0,095	0,013	0,058	0,041	0,001	0,018	0,003	0,0002	0,0022
415618	363422	K10	0,173	0,359	1,13	0,007	0,0004	0,092	0,012	0,057	0,040	0,001	0,015	0,002	0,0002	0,0027
415618	363425	K10	0,175	0,356	1,13	0,007	0,0004	0,094	0,012	0,058	0,041	0,001	0,016	0,002	0,0002	0,0026
415618	363426	K10	0,180	0,347	1,15	0,007	0,0004	0,097	0,012	0,058	0,041	0,001	0,016	0,002	0,0002	0,0018
415618	364016	K10	0,169	0,342	1,13	0,007	0,0003	0,095	0,012	0,057	0,041	0,001	0,016	0,002	0,0002	0,0026
415618	367440	K10	0,173	0,352	1,14	0,007	0,0005	0,093	0,012	0,058	0,041	0,001	0,016	0,002	0,0002	0,0026
415618	367447	K10	0,181	0,362	1,16	0,008	0,0003	0,094	0,013	0,059	0,041	0,001	0,019	0,003	0,0002	0,0024
415618	368176	K10	0,180	0,349	1,11	0,007	0,0003	0,092	0,012	0,057	0,041	0,001	0,016	0,002	0,0002	0,0024
415618	368177	K10	0,179	0,349	1,12	0,007	0,0003	0,094	0,012	0,058	0,041	0,001	0,016	0,002	0,0002	0,0027

A04 Manufacturer's mark	201/202/203 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Yacht House Manager	Dillinger Franco Port 3932 3632 rue du Comte Jean - CS 66311 F-59579 Dunkerque Cedex 9 - FRANCE Service Qualité-Desach	Date: 11.02.15

QMS-System: Certification as per ISO 9001



DILLINGER HÜTTE

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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A00 Manufacturer's order/ A03 Certificate No 399394-001	Sheet 14/
A05 Established Inspecting body DF	A08 Purchaser CESSCO FAB., EDMONTON	A07.1 No. K-04257	B01 Product HEAVY PLATES	
A06 Final receiver CESSCO FAB., EDMONTON		A07.2 No.		
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-III:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C70-C99 Chemical composition % - Product analysis

E07.2 Heat	E07.1 Test No.	C01	C	SI	MN	P	S	CU	AlO	NI	CR	V	MO	Ti	B	CA
415618	368188	K10	0,187	0,352	1,13	0,007	0,0004	0,094	0,012	0,058	0,041	0,001	0,016	0,002	0,0002	0,0028
415618	368189	K10	0,164	0,349	1,11	0,006	0,0002	0,089	0,012	0,056	0,040	0,001	0,014	0,002	0,0002	0,0027
415618	368190	K10	0,186	0,353	1,13	0,007	0,0003	0,094	0,012	0,058	0,041	0,001	0,017	0,003	0,0002	0,0027
415618	377166	K10	0,181	0,360	1,16	0,008	0,0005	0,097	0,013	0,058	0,041	0,001	0,017	0,002	0,0002	0,0021
415879	364012	K10	0,171	0,360	1,14	0,006	0,0004	0,162	0,027	0,365	0,063	0,001	0,017	0,003	0,0003	0,0022
415879	364013	K10	0,164	0,341	1,15	0,007	0,0006	0,169	0,024	0,368	0,054	0,001	0,017	0,003	0,0002	0,0017
415879	364025	K10	0,170	0,360	1,14	0,006	0,0006	0,169	0,028	0,363	0,061	0,001	0,018	0,002	0,0002	0,0019
415879	364026	K10	0,169	0,364	1,15	0,006	0,0004	0,161	0,027	0,369	0,063	0,001	0,017	0,003	0,0003	0,0022
415879	364027	K10	0,167	0,356	1,14	0,006	0,0004	0,161	0,026	0,364	0,062	0,001	0,017	0,003	0,0002	0,0021
415879	366124	K10	0,166	0,350	1,14	0,006	0,0008	0,169	0,026	0,361	0,056	0,001	0,017	0,003	0,0003	0,0019
415879	371380	K10	0,168	0,346	1,11	0,007	0,0006	0,162	0,027	0,371	0,064	0,001	0,017	0,003	0,0003	0,0023
415879	371381	K10	0,170	0,348	1,11	0,006	0,0004	0,160	0,027	0,369	0,064	0,001	0,017	0,003	0,0003	0,0023
415881	366017	K10	0,153	0,313	1,14	0,007	0,0008	0,172	0,019	0,367	0,035	0,001	0,015	0,002	0,0002	0,0015
415881	366121	K10	0,160	0,322	1,15	0,007	0,0005	0,162	0,025	0,370	0,042	0,001	0,017	0,003	0,0002	0,0017
415881	366125	K10	0,161	0,335	1,14	0,007	0,0005	0,168	0,024	0,368	0,051	0,001	0,016	0,003	0,0002	0,0018
415881	366126	K10	0,151	0,307	1,14	0,007	0,0007	0,175	0,019	0,365	0,033	0,001	0,015	0,002	0,0002	0,0014
415881	368001	K10	0,149	0,304	1,13	0,007	0,0006	0,167	0,019	0,365	0,035	0,001	0,015	0,002	0,0002	0,0014
415881	368002	K10	0,150	0,303	1,15	0,007	0,0005	0,176	0,019	0,367	0,034	0,001	0,015	0,002	0,0002	0,0012
415881	368026	K10	0,155	0,316	1,15	0,007	0,0005	0,173	0,021	0,366	0,044	0,001	0,016	0,002	0,0002	0,0014
415881	368027	K10	0,148	0,308	1,11	0,007	0,0009	0,174	0,018	0,352	0,029	0,001	0,015	0,002	0,0002	0,0013
415881	368028	K10	0,149	0,299	1,11	0,006	0,0005	0,167	0,020	0,362	0,035	0,001	0,014	0,002	0,0002	0,0009
415881	369010	K10	0,160	0,321	1,14	0,007	0,0003	0,169	0,022	0,371	0,046	0,001	0,016	0,003	0,0002	0,0014
415883	366089	K10	0,157	0,334	1,15	0,007	0,0005	0,164	0,026	0,369	0,044	0,001	0,017	0,003	0,0002	0,0011
415883	366122	K10	0,158	0,325	1,14	0,007	0,0001	0,160	0,027	0,367	0,045	0,001	0,018	0,003	0,0002	0,0009
415883	366123	K10	0,154	0,327	1,13	0,007	0,0006	0,158	0,025	0,362	0,043	0,001	0,015	0,002	0,0002	0,0013

A03 201/202/203 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.



[Signature]

POISSONNET
Test House Manager

Dillinger France
Port 3032
3832 rue du Comte Jean - CS 58317
F-59379 Dunkerque Cedex 7 - FRANCE
Service Qual 3-Essais
Date: 11.02.15

RD

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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A09 Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 15/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B32 Steel design. SA516-70/BA516M-485/A516-70/A516M-485	B33 Any suppl. requirements ASME- IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C70-C99 Chemical composition % - Product analysis

B07.2 Heat	B07.1 Test No.	C01	C	SI	MN	P	S	CU	MO	NI	CR	N	MB	TI	B	CA
415883	379171	K10	0,163	0,330	1,14	0,007	0,0005	0,162	0,027	0,365	0,045	0,002	0,016	0,033	0,0002	0,0010

C94 Product analysis Carbon equivalent / Alloying restrictions

B07.2 Heat	B07.1 Test No.	C01	FO-02=	FO-51=	FO-55=	FO-70=	FO-78=
415111	375109	K10	0,40	0,016	0,59	0,2	0,04
415618	363416	K10	0,40	0,019	0,20	0,2	0,05
415618	363417	K10	0,39	0,017	0,20	0,2	0,05
415618	363418	K10	0,39	0,018	0,20	0,2	0,05
415618	363419	K10	0,39	0,018	0,20	0,2	0,05
415618	363420	K10	0,39	0,018	0,20	0,2	0,05
415618	363421	K10	0,38	0,019	0,21	0,2	0,05
415618	363422	K10	0,38	0,016	0,20	0,2	0,05
415618	363425	K10	0,38	0,017	0,21	0,2	0,05
415618	363426	K10	0,39	0,015	0,21	0,2	0,05
415618	364016	K10	0,38	0,017	0,21	0,2	0,05
415618	367440	K10	0,38	0,017	0,20	0,2	0,05
415618	367447	K10	0,40	0,020	0,21	0,2	0,05
415618	368176	K10	0,39	0,017	0,20	0,2	0,05
415618	368177	K10	0,39	0,017	0,21	0,2	0,05
415618	368188	K10	0,40	0,017	0,21	0,2	0,05
415618	368189	K10	0,37	0,015	0,20	0,2	0,05
415618	368190	K10	0,40	0,018	0,21	0,2	0,05
415618	377166	K10	0,40	0,018	0,21	0,2	0,05
415879	364012	K10	0,41	0,018	0,62	0,3	0,09
415879	364013	K10	0,41	0,018	0,62	0,3	0,08

A08 201/202/203 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.



[Signature]

POISSONNET
Test House Manager

Dillinger France
Part 3032
3032 rue du Comte Jean - CS 80317
F-50379 Quakerus Cedex 1 - FRANCE
Service Qualité-Essais

Date 11.02.15



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No 399394-001	Sheet 16/...
A05 Established inspecting body DF	A06 Purchaser Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257	A07 Product HEAVY PLATES	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-III:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C94 Product analysis Carbon equivalent / Alloying restrictions

E07.2 Heat	B07.1 Test No.	C01									
415879	364025	K10 FO-02=	0,41	FO-51=	0,019	FO-55=	0,62	FO-70=	0,3	FO-78=	0,09
415879	364026	K10 FO-02=	0,41	FO-51=	0,018	FO-55=	0,62	FO-70=	0,3	FO-78=	0,09
415879	364027	K10 FO-02=	0,41	FO-51=	0,018	FO-55=	0,61	FO-70=	0,3	FO-78=	0,09
415879	366124	K10 FO-02=	0,41	FO-51=	0,018	FO-55=	0,61	FO-70=	0,3	FO-78=	0,08
415879	371380	K10 FO-02=	0,41	FO-51=	0,018	FO-55=	0,62	FO-70=	0,3	FO-78=	0,09
415879	371381	K10 FO-02=	0,41	FO-51=	0,018	FO-55=	0,62	FO-70=	0,3	FO-78=	0,09
415881	366017	K10 FO-02=	0,39	FO-51=	0,016	FO-55=	0,59	FO-70=	0,2	FO-78=	0,05
415881	366121	K10 FO-02=	0,40	FO-51=	0,018	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07
415881	366125	K10 FO-02=	0,40	FO-51=	0,017	FO-55=	0,61	FO-70=	0,3	FO-78=	0,08
415881	366126	K10 FO-02=	0,39	FO-51=	0,016	FO-55=	0,59	FO-70=	0,2	FO-78=	0,05
415881	368001	K10 FO-02=	0,38	FO-51=	0,016	FO-55=	0,59	FO-70=	0,2	FO-78=	0,05
415881	368002	K10 FO-02=	0,39	FO-51=	0,016	FO-55=	0,60	FO-70=	0,2	FO-78=	0,05
415881	368026	K10 FO-02=	0,40	FO-51=	0,017	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07
415881	368027	K10 FO-02=	0,38	FO-51=	0,016	FO-55=	0,57	FO-70=	0,2	FO-78=	0,05
415881	368028	K10 FO-02=	0,38	FO-51=	0,015	FO-55=	0,58	FO-70=	0,2	FO-78=	0,06
415881	369010	K10 FO-02=	0,40	FO-51=	0,017	FO-55=	0,61	FO-70=	0,3	FO-78=	0,07
415883	366089	K10 FO-02=	0,40	FO-51=	0,018	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07
415883	366122	K10 FO-02=	0,40	FO-51=	0,019	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07
415883	366123	K10 FO-02=	0,39	FO-51=	0,016	FO-55=	0,59	FO-70=	0,2	FO-78=	0,07
415883	379171	K10 FO-02=	0,40	FO-51=	0,017	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07

A04	201/202/203 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3632 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	Sheet 16/...
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Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02	INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)	A10 Advice of dispatch No / Date of dispatch 6492887-06.C2.15	A08/ Manufacturer's order/ A03 Certificate No 399394-001	Sheet 17
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A05 Established inspecting body DF	A06 Purchaser Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257	A07.2 No.	B01 Product HEAVY PLATES
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B02 Steel design.	SA516-70/SA516M-485/AS16-70/AS16M-485
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:RC5-27.02.2014

C94 Carbon equivalent formula / Alloying restrictions

FO-02 = $C + (Mn/6) + (Cr+Mo+V)/5 + (Ni+Cu)/15$
 FO-51 = $V + Nb$
 FO-55 = $CU+MO+NI+CR$
 FO-70 = $CU+MO+CR+NB+V + TI$
 FO-78 = $CR+MO$

D01 Marking and identification, surface appearance, shape and dimensional properties

ITEM NO.: 01-14
 EXAMINATION OF MARKING, SURFACE, SHAPE AND DIMENSIONS: THE RESULTS MEET THE REQUIREMENTS.
 SURFACE AS PER ASME-SA20 (M)
 THICKNESS AS PER ASTM/ASME-20 (M+US)
 LENGTH AND WIDTH AS PER ASME-SA20
 FLATNESS AS PER ASME-SA20

D01 Further information about marking and identification, surface appearance, shape and dimensional properties

ITEM NO.: 01-14
 NO WELDING OR WELD REPAIRS HAVE BEEN PERFORMED.

D02 Non-destructive tests - Ultrasonic testing

ITEM NO.: 01-14
 UT-SPECIFICATION : ASME-SAS78 (M) LEVEL C SUPPLEMENTARY REQUIREMENTS S1 ✓
 SCANNING PLAN BODY : 100% OF PLATE SURFACE
 PERSONNEL QUALIFICATION : LEVEL 2 IN ACC. TO EN 473 / ISO 9712 AND SNT-TC-1A
 THE TEST RESULTS MEET THE REQUIREMENTS OF THE ORDER.

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jaan - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01
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DILLINGER HÜTTE

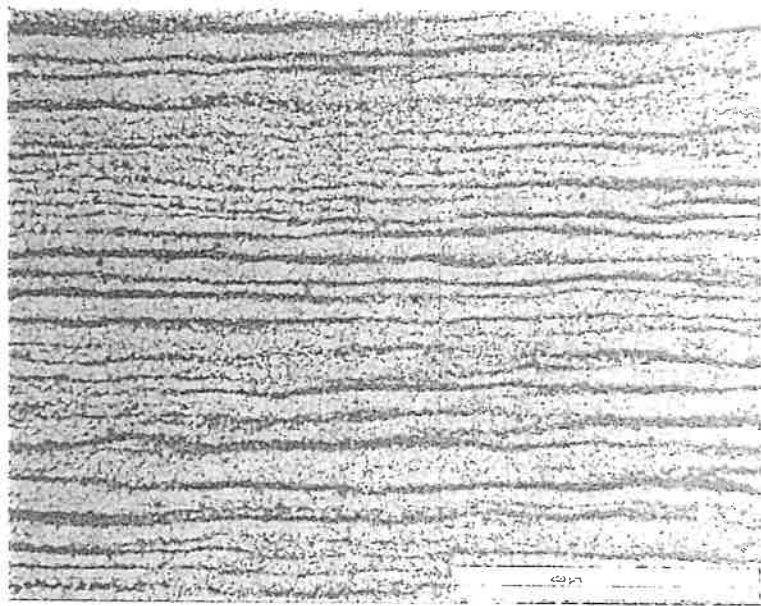
Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations



A02						Appendix		A08/ Manufacture's order/ A03/ Certificat No	Sheet
DETERMINING AVERAGE GRAIN SIZE						1		399394	1/1
A05 Established	Inspecting body	B02 Steel designation	B07.2 Heat No.	B07.1 Rolled plate/ Test No.	B11 Thickness	C01	C02/ C01		
DILLINGER FRANCE		SA/A516X-485/SA/A516-70	415111	375109	38.1 mm	K1	L		

----- C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES -----

DOCUMENTATION OF THE MICROSTRUCTURE

IMAGE No.	375109
MAGNIFICATION	100:1
GRAIN SIZE	9



Metallography Tester: MOREL Date: 27/01/2015  		Z01/Z02/Z03 We certify, that the results are in accordance with the agreement. Inspector	DILLINGER FRANCE-Groupe Dillinger Hütte A01 Point 3032 3032 rue du Comte Jean - CS 66317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité Essais
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Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations

A02

DETERMINING AVERAGE GRAIN SIZE

Appendix

A08/ A03 Manufacture's order/
Certificat No

Sheet

1

399394

1/1

A05 Established	Inspecting body	B02 Steel designation	B07.2 Heat No.	B07.1 Rolled plate/ Test No	B11 Thickness	C01	C02/ C01
DILLINGER FRANCE		SA/A516M-485/SA/A516-70	415618	363422	15.87 mm	K1	L

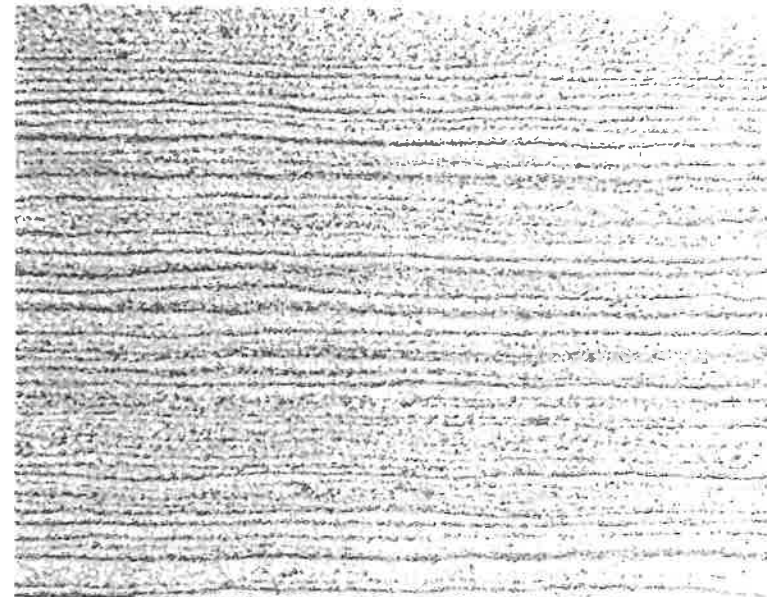
----- C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES -----

DOCUMENTATION OF THE MICROSTRUCTURE

IMAGE No. 363422

MAGNIFICATION 100:1

GRAIN SIZE 9



Metallography

Tester: MOREL

Date: 13/01/2015



Z01/Z02/Z03 We certify, that the results are in accordance with the agreement.

Inspector

DILLINGER FRANCE - Groupe Dillinger Hütte A01
 Port 3032
 3032 rue du Comte Jean - CS 56317
 F-59379 Dunkerque Cedex 1 - FRANCE
 Service Qualité Essais



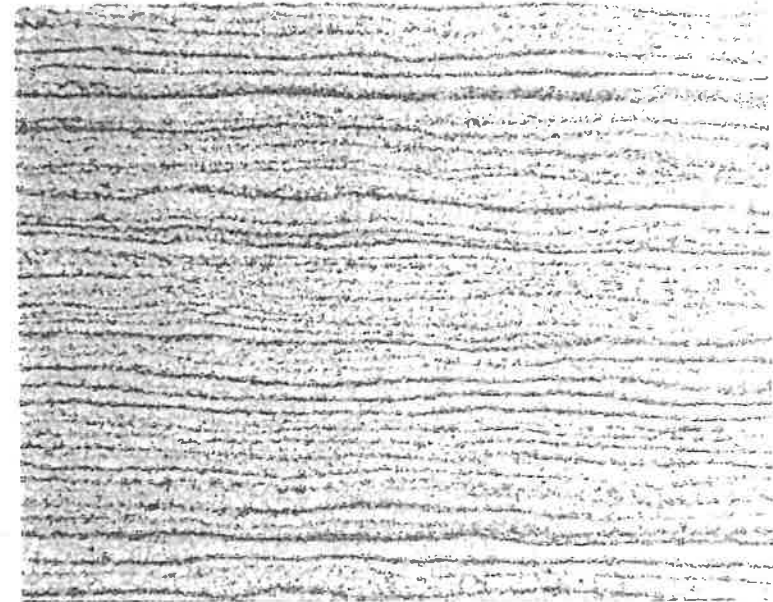
Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations

A02 DETERMINING AVERAGE GRAIN SIZE						Appendix 1	A08 Manufacture's order/ A09 Certificat No. 399394	Sheet 1/1
A05 Established DILLINGER FRANCE	Inspecting body	B02 Steel designation SA/A516M-485/SA/A516-70	B07.2 Heat No. 415881	B07.1 Rolled plate/ Test No. 366125	B11 Thickness 25.40 mm	C01 K1	C02/ C01 L	

C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES

DOCUMENTATION OF THE MICROSTRUCTURE

IMAGE No. 366125
MAGNIFICATION 100:1
GRAIN SIZE 5



Metallography

Z01/Z02/Z03 We certify, that the results are in accordance with the agreement.

Tester: MOREL

Date: 08/01/2015



Inspector

DILLINGER FRANCE-Gruppe Dillinger HÜTTE A01
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité Essais



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations

A02						Appendix		A09 Manufacture's order/	Sheet
DETERMINING AVERAGE GRAIN SIZE						1		A03 Certical No	1/1
A05 Established	Inspecting body	B02 Steel designation	B07.2 Heat No.	B07.1 Rolled plate/ Test No.	B11 Thickness	C01	C02/ C01	399394	
DILLINGER FRANCE		SA/A516M-485/SA/A516-70	415883	366089	38.10 mm	X1	L		

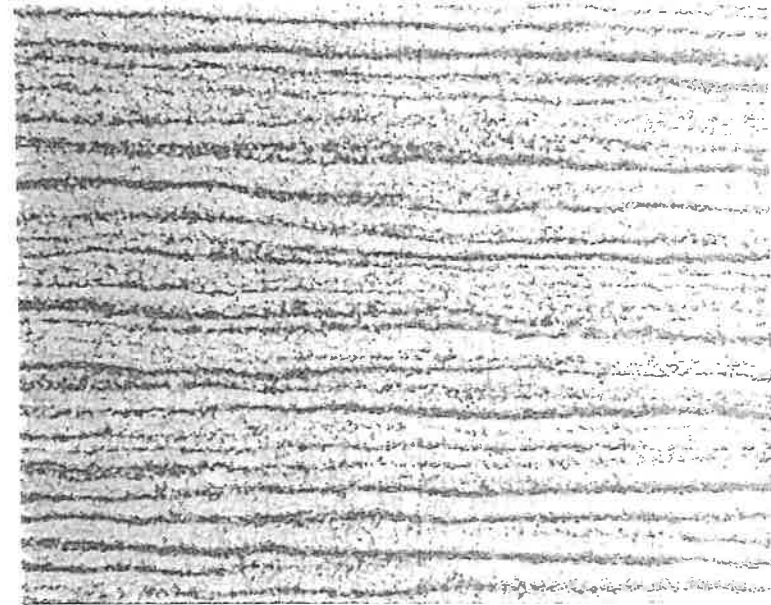
C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES

DOCUMENTATION OF THE MICROSTRUCTURE

IMAGE No. 366089

MAGNIFICATION 100:1

GRAIN SIZE 8.5



Metallography

Z01/Z02/Z03 We certify, that the results are in accordance with the agreement.

Tester: MOREL

Date: 08/01/2015



Inspector

DILLINGER FRANCE-Groupe Dillinger Hütte A01
 Port 3032
 3032 rue du Comte Jean - CS 58317
 F-59379 Dunkerque Cedex 1 - FRANCE
 Service Qualité Essais



DILLINGER HÜTTE

Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations

A02		Appendix				A11 Manufacture's order		Sheet	
DETERMINING AVERAGE GRAIN SIZE		1				A03 Certificat No		399394	
A05 Established Inspecting body		B02 Steel designation		B07.2 Heat No.	B07.1 Rolled plate/ Test No	B11 Thickness	C01	C02/ C01	
DILLINGER FRANCE		SA/A516X-485/SA/A516-70		415879	364013	22.22 mm	K1	L	

----- C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES -----

DOCUMENTATION OF THE
MICROSTRUCTURE

IMAGE No. 364013

MAGNIFICATION 100:1

GRAIN SIZE 9



Metallography

Z01/Z02/Z03 We certify, that the results are in accordance with the agreement.

Tester: MOREL

Date: 08/01/2015



Inspector

DILLINGER FRANCE - Groupe Dillinger Hütte A01
 Port 3032
 3032 rue du Comte Jean - CS 56317
 F-59379 Dunkerque Cedex 1 - FRANCE
 Service Qualite Essais

BROMLEY MECHANICAL SERVICES

MATERIAL INSPECTION REPORT

DIA SIZE OR WITH: 36"
 NPS OD ID

INSPECTED BY: MICHAEL QUINN

GRADE: SA 516-70MT

DATE: OCTOBER 30/2017

- HEADS 2:1
 HEMI
 WELD CAP
 OTHER

LENGTH 120"

P.O.# PO-87519

THICKNESS

PIPE PUBLISHED NOM

PLATE NOM 1.5000"

SUPPLIER: CESSCO FABRICATION

- SHELL
 PIPE → NDE BY MANUFACTURER

PART ID#: VES 25674

- PLATE HYDRO YES NDE NO
 REPAD NO YES
 STRUCT. NO NO
 OTHER YES YES

Weight per foot for pipe over 4"

REQ. MIN TK: 1.5000"

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35817	4	C32399 HT 415879 371380-02	1.501"	1.507"	1.509"	1.511"	1.503"	OK	OK	OK	ML
				1.501"	1.501"	1.504"	1.508"	OK	OK	OK	ML
				1.507"	1.513"	1.508"	1.518"	OK	OK	OK	ML
				1.506"	1.507"	1.504"	1.505"	OK	OK	OK	ML
6" X 24 COUPON	1	C32399 HT 415879 371380-02	1.504"	1.504"	1.515"						

W/O# WO-35528
 CUSTOMER: ARC RESOURCES GENERAL PARTNERSHP

RECEIVED & ACCEPTED BY: DS
 DATE: DEC 12 2017

REQUIRED CODE MARKINGS:
ALL MARKINGS STAMPED ONTO PLATE BY MANUFACTURE



7310 99 Street
 Edmonton, AB T6E 3R8
 Ph: 780-433-9531
 Fax: 780-432-7899

CERTIFICATE OF COMPLIANCE - SHELLS

Cessco Job No.: 170530 Tag No.: WO 35527/35528
 Customer: Dromley Mechanical, a div. of Argo Sales PO No.: 87519
 Material: SA-516-70N Shell Completion: Tacked

Item	Description	Log Number	Quantity	Form Procedure	Recorded Nom. Thk.	Required Nom. Thk.
A-10	1-1/2" PIt x 36" OD x 10'-0" LG	4- C32399 4- C31891	8	Cessco FP-1	1-1/2 inches	1-1/2 inches
A-20	3/8" PIt x 36" OD x 10'-0" LG	1- C32509 1- C32510	2	Cessco FP-1	3/8 inches	3/8 inches

This is to certify that the pressure equipment listed above was manufactured in compliance with the following as applicable:
 ASME Section VIII DIV I UG-79; UG80 & UCS-79

Meets the requirements of ASME Section II Part A Latest Edition and applicable project specific requirements.

ASME Section VIII DIV I UG-11(b)
 ASME Section VIII DIV I UCS-79(f)

Cold Formed

Other Heat Treatment:

Other Additional NDE:

Additional Information:

Carey Gaasbeek
 Signature

Carey Gaasbeek
 Cessco QC
 Oct 24 / 2017
 Date




Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 1/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES CESSCO FABRICATION & ENGINEERING LTD LOG No. PREFIX C	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

B01-B99 Description of the product

B14 Item No.	B08 Number of pieces	B09 Thickness	B10 Width	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No./ Test No.	A09 Purchaser article number
			INCH						
01	1	0,5000 x	96,50000 x	384,00000	2383	N ✓	415618	363416-01 - 32330	
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363416-02 - 32331	
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363416-03 - 32332	
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363417-01 - 32327	
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363417-02 - 32328	
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363420-01 - 32329	
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363420-02 - 32333	
**	7				16681				
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	363426-01 - 32338	
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	363426-02 - 32336	
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	367440-01 - 32335	
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	367440-02 - 32337	
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	377166-01 - 32334	
**	5				18600				
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	363425-01 - 32344	
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	363425-02 - 32342	
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	364016-01 - 32343	
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	364016-02 - 32340	
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	364016-03 - 32341	
**	5				14895				
04	1	0,6250 x	72,50000 x	384,00000	2238	N	415618	363418-01 - 32347	
04	1	0,6250 x	72,50000 x	384,00000	2238	N	415618	363418-02 - 32348	
04	1	0,6250 x	72,50000 x	384,00000	2238	N	415618	363421-01 - 32346	

CHEMICAL & PHYSICALS
CHECKED
A.S.M.E. Ed. 2015
@Cessco By Linda Prichard
09/21/2015

A04	Z01/Z02/Z03 We hereby certify that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01
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Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 2/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design, B03 Any suppl. requirements	SA516-70/SA516M-485/A516-70/A516M-485 ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

B01-B99 Description of the product

B14 Item No.	B08 Number of places	B09 Thickness	B10 Width	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No/ Test No.	A09 Purchaser article number
04	1	0,6250 x	72,50000 x	384,00000	2238	N ✓	415618	363421-02 - 32345	
**	4				8952				
05	1	0,6250 x	120,50000 x	480,00000	4650	N	415618	363419-01 - 32351	
05	1	0,6250 x	120,50000 x	480,00000	4650	N	415618	363419-02 - 32350	
05	1	0,6250 x	120,50000 x	480,00000	4650	N	415618	363422-01 - 32352	
05	1	0,6250 x	120,50000 x	480,00000	4650	N	415618	363422-02 - 32349	
**	4				18600				
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	367447-01 - 32360	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	367447-02 - 32354	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368176-01 - 32357	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368176-02 - 32355	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368176-03 - 32358	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368177-01 - 32359	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368177-02 - 32353	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368177-03 - 32356	
**	3				28600				
07	1	0,7500 x	146,00000 x	504,00000	7099	N	415618	368188-01 - 32362	
07	1	0,7500 x	146,00000 x	504,00000	7099	N	415618	368189-01 - 32361	
07	1	0,7500 x	146,00000 x	504,00000	7099	N	415618	368190-01 - 32363	
**	3				21297				
08	1	0,8750 x	120,50000 x	480,00000	6510	N	415879	364012-01 - 32369	
08	1	0,8750 x	120,50000 x	480,00000	6510	N	415879	364012-02 - 32366	
08	1	0,8750 x	120,50000 x	480,00000	6510	N	415879	364013-01 - 32368	

A04	Dillinger Hütte logo	Manufacturer's mark	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	Signature of POISSONNET Test House Manager	Dillinger France Part 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A05	ED 1
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QM-System: Certification as per ISO 9001



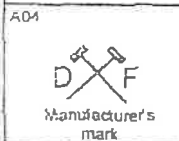
DILLINGER HÜTTE

Erläuterungen siehe Rückseite/Explications voir à verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 3/...
A05 Established Inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257	A07.2 No.	
B02/ Steel design. SA516-70/SA516M-485/A516-70/A516M-485 B03 Any suppl. ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 requirements STKCHEM1001:R05-27.02.2014			B01 Product HEAVY PLATES	

B01-B99 Description of the product

B14 Item No.	B08 Number of pieces	B09 Thickness	B10 Width	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No./ Test No.	A09 Purchaser article number
08	1	0,8750 x	120,50000	x 480,00000	6510	N ✓	415879	364013-02	- 32367
08	1	0,8750 x	120,50000	x 480,00000	6510	N	415881	368026-01	- 32365
08	1	0,8750 x	120,50000	x 480,00000	6510	N	415881	368026-02	- 32364
**	6				39060				
09	1	1,0000 x	96,50000	x 384,00000	4767	N	415881	368001-01	- 32373
09	1	1,0000 x	96,50000	x 384,00000	4767	N	415881	368001-02	- 32370
09	1	1,0000 x	96,50000	x 384,00000	4767	N	415881	368001-03	- 32371
09	1	1,0000 x	96,50000	x 384,00000	4767	N	415881	368002-01	- 32372
09	1	1,0000 x	96,50000	x 384,00000	4767	N	415881	368002-02	- 32374
**	5				23835				
10	1	1,0000 x	120,50000	x 480,00000	7440	N	415881	366017-01	- 32381
10	1	1,0000 x	120,50000	x 480,00000	7440	N	415881	366017-02	- 32378
10	1	1,0000 x	120,50000	x 480,00000	7440	N	415881	366125-01	- 32376
10	1	1,0000 x	120,50000	x 480,00000	7440	N	415881	366125-02	- 32380
10	1	1,0000 x	120,50000	x 480,00000	7440	N	415881	366126-01	- 32377
10	1	1,0000 x	120,50000	x 480,00000	7440	N	415881	366126-02	- 32375
10	1	1,0000 x	120,50000	x 480,00000	7440	N	415881	368027-01	- 32379
10	1	1,0000 x	120,50000	x 480,00000	7440	N	415881	368027-02	- 32382
10	1	1,0000 x	120,50000	x 480,00000	7440	N	415881	368028-01	- 32385
10	1	1,0000 x	120,50000	x 480,00000	7440	N	415881	368028-02	- 32383
10	1	1,0000 x	120,50000	x 480,00000	7440	N	415881	369010-01	- 32384
**	11				81840				
11	1	1,0000 x	145,00000	x 504,00000	9401	N	415881	366121-01	- 32387



Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.

POISSONNET
Test House Manager

Dillinger France
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais

Date 11.02.15

ED 1




Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 4/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.C2.2014			

B01-B99 Description of the product

B14 Item No.	B08 Number of places	B09 Thickness	B10 Width	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No./ Test No.	A09 Purchaser article number
			INCH						
11	1	1,0000 x	145,00000 x	504,00000	9401	N	415881	366121-02 - 32386	
11	1	1,0000 x	145,00000 x	504,00000	9401	N	415883	366122-01 - 32388	
11	1	1,0000 x	145,00000 x	504,00000	9401	N	415883	366122-02 - 32391	
11	1	1,0000 x	145,00000 x	504,00000	9401	N	415883	366123-01 - 32389	
11	1	1,0000 x	145,00000 x	504,00000	9401	N	415883	366123-02 - 32390	
**	6				56406				
12	1	1,5000 x	96,50000 x	384,00000	7150	N	415883	366089-01 - 32392	
12	1	1,5000 x	96,50000 x	384,00000	7150	N	415883	366089-02 - 32397	
12	1	1,5000 x	96,50000 x	384,00000	7150	N	415883	366089-03 - 32393	
12	1	1,5000 x	96,50000 x	384,00000	7150	N	415883	379171-01 - 32395	
12	1	1,5000 x	96,50000 x	384,00000	7150	N	415883	379171-02 - 32396	
12	1	1,5000 x	96,50000 x	384,00000	7150	N	415883	379171-03 - 32394	
**	6				42900				
13	1	1,5000 x	120,50000 x	480,00000	11161	N	415111	375109-01 - 32398	
13	1	1,5000 x	120,50000 x	480,00000	11161	N	415879	371380-01 - 32401	
13	1	1,5000 x	120,50000 x	480,00000	11161	N	415879	371380-02 - 32399	
13	1	1,5000 x	120,50000 x	480,00000	11161	N	415879	371381-01 - 32402	
13	1	1,5000 x	120,50000 x	480,00000	11161	N	415879	371381-02 - 32400	
**	5				55805				
14	1	1,5000 x	145,00000 x	504,00000	14101	N	415879	364025-01 - 32406	
14	1	1,5000 x	145,00000 x	504,00000	14101	N	415879	364026-01 - 32405	
14	1	1,5000 x	145,00000 x	504,00000	14101	N	415879	364027-01 - 32404	
14	1	1,5000 x	145,00000 x	504,00000	14101	N	415879	366124-01 - 32403	

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01
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Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 5/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME- IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

B01-B99 Description of the product

B14 Item No.	B08 Number of pieces	B09 Thickness	B10 Width INCH	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No/ Test No.	A09 Purchaser article number
**	4				56404				
***	79				483875				

B04 Product delivery condition

ITEM NO.: 01-14
 N: HT: 1670 GR.F +27 -27 GR.F
 SOAKING TIME TO ATTAIN THE TARGET TEMPERATURE OVER THE WHOLE SECTION: 1-1,75 MIN/MM (25-45 MIN/INCH)
 COOLING IN STILL AIR

B06 Marking of the product

ITEM NO.: 01-14
 STEEL DESIGNATION SA516 70 MTLTV SA516M 485 MTLTV
 HEAT NO. / TRADEMARK / ROLLED PLATE NO.-TEST NO.

B07-B99 Further information about the product

ITEM NO.: 01-14
 THICKNESS REDUCTION RATIO >= 3,0 IS FULFILLED (CF. A/SA20 PAR. 5.3)

C10-C29 Tensile test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.platz/ Test No.	B05 Reference (heat) treatment	C01	C02/ C01	C03 Temp. GR.F	C10 MPA RP02	C11	C12 RM	C13	A % L0=2IN	A % L0=8IN	C14-C15
01	415618	363416		K1	Q0	RT	427		559			25	
01	415618	363417		K1	Q0	RT	401		553			24	
01	415618	363420		K1	Q0	RT	419		555			24	



Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.

POISSONNET
 Test House Manager

Dillinger France
 Port 3032
 3032 rue du Cmte Jean - CS 56317
 F-59379 Dunkerque Cedex 1 - FRANCE
 Service Qualité-Essais
 Date 11.02.15

QM-System: Certification as per ISO 9001



DILLINGER HÜTTE

Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08 Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 6/...
A05 Established Inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C10-C29 Tensile test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/ C01	C03 Temp. GR.F	C10 C11 MPA RP02	C12 RM	C13 A % L0=2IN	A % L0=8IN	C14-C15
02	415618	363426		K1	Q0	RT	412	554		25	
02	415618	367440		K1	Q0	RT	413	561		23	
02	415618	377166		K1	Q0	RT	405	558		23	
03	415618	363425		K1	Q0	RT	416	559		25	
03	415618	364016		K1	Q0	RT	421	566		24	
04	415618	363418		K1	Q0	RT	401	550		24	
04	415618	363421		K1	Q0	RT	403	552		22	
05	415618	363419		K1	Q0	RT	417	558		24	
05	415618	363422		K1	Q0	RT	420	560		25	
06	415618	367447		K1	Q0	RT	402	553		25	
06	415618	368176		K1	Q0	RT	403	554		25	
06	415618	368177		K1	Q0	RT	405	553		26	
07	415618	368188		K1	Q0	RT	402	552		25	
07	415618	368189		K1	Q0	RT	403	551		26	
07	415618	368190		K1	Q0	RT	401	555		25	
08	415879	364012		K1	Q0	RT	406	557		26	
08	415879	364013		K1	Q0	RT	412	553		26	
08	415881	368026		K1	Q0	RT	404	545		24	
09	415881	368001		K1	Q0	RT	389	532		28	
09	415881	368002		K1	Q0	RT	397	530		27	
10	415881	366017		K1	Q0	RT	391	532		27	
10	415881	366125		K1	Q0	RT	409	550		25	
10	415881	366126		K1	Q0	RT	391	530		26	

A04	<p>Manufacturer's mark</p>	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	<p>POISSONNET Test House Manager</p>	<p>Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais</p> <p>Date 11.02.15</p>	A01
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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 7/...
A05 Established Inspecting body DF	A05 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C10-C29 Tensile test

B14 item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/ C01	C03 Temp. GR.F	C10	C11 MPA RP02	C12 RM	C13	A % LD=2IN	A % LD=8IN	C14-C15
10	415881	368027		K1	Q0	RT		390	530			26	
10	415881	368028		K1	Q0	RT		394	533			26	
10	415881	369010		K1	Q0	RT		393	534			27	
11	415881	366121		K1	Q0	RT		393	535			27	
11	415883	366122		K1	Q0	RT		396	542			28	
11	415883	366123		K1	Q0	RT		398	542			27	
12	415883	366089		K1	QV	RT		384	535	38			
12	415883	379171		K1	QV	RT		375	531	38			
13	415111	375109		K1	QV	RT		403	549	37			
13	415879	371380		K1	QV	RT		382	542	34			
13	415879	371381		K1	QV	RT		382	543	37			
14	415879	364025		K1	QV	RT		410	548	37			
14	415879	364026		K1	QV	RT		398	547	35			
14	415879	364027		K1	QV	RT		387	544	36			
14	415879	366124		K1	QV	RT		400	544	37			

C30-C39 Hardness test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/C01	C03 Temp. GR.F	C30 Method of test	C35	C31 Individual values	C32 Mean value
01	415618	363416		K1	Q0	RT	HBW 5/750	HB	158	
01	415618	363417		K1	Q0	RT	HBW 5/750	HB	156	
01	415618	363420		K1	Q0	RT	HBW 5/750	HB	162	
02	415618	363426		K1	Q0	RT	HBW 5/750	HB	159	
02	415618	367440		K1	Q0	RT	HBW 5/750	HB	161	

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	A01
	BROMLEY MECHANICAL SERVICES Checked to ASME	 POISSONNET Test House Manager
Manufacturer's mark		Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15

Secl IIA 2015 Edd. min 10501
SA 20 p.8 12/12/17
Date




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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 8/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C30-C39 Hardness test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/C01	C03 Temp. GR.F	C30 Method of test	C35 C31 Individual values	C32 Mean value
02	415618	377166		K1	Q0	RT	HBW 5/750	HB 163	
03	415618	363425		K1	Q0	RT	HBW 5/750	HB 157	
03	415618	364016		K1	Q0	RT	HBW 5/750	HB 163	
04	415618	363418		K1	Q0	RT	HBW 5/750	HB 156	
04	415618	363421		K1	Q0	RT	HBW 5/750	HB 155	
05	415618	363419		K1	Q0	RT	HBW 5/750	HB 153	
05	415618	363422		K1	Q0	RT	HBW 5/750	HB 158	
06	415618	367447		K1	Q0	RT	HBW 5/750	HB 158	
06	415618	368176		K1	Q0	RT	HBW 5/750	HB 159	
06	415618	368177		K1	Q0	RT	HBW 5/750	HB 159	
07	415618	368188		K1	Q0	RT	HBW 5/750	HB 162	
07	415618	368189		K1	Q0	RT	HBW 5/750	HB 158	
07	415618	368190		K1	Q0	RT	HBW 5/750	HB 153	
08	415879	364012		K1	Q0	RT	HBW 5/750	HB 162	
08	415879	364013		K1	Q0	RT	HBW 5/750	HB 164	
08	415881	368026		K1	Q0	RT	HBW 5/750	HB 155	
09	415881	368001		K1	Q0	RT	HBW 5/750	HB 150	
09	415881	368002		K1	Q0	RT	HBW 5/750	HB 149	
10	415881	366017		K1	Q0	RT	HBW 5/750	HB 155	
10	415881	366125		K1	Q0	RT	HBW 5/750	HB 160	
10	415881	366126		K1	Q0	RT	HBW 5/750	HB 155	
10	415881	368027		K1	Q0	RT	HBW 5/750	HB 149	
10	415881	368028		K1	Q0	RT	HBW 5/750	HB 150	
10	415881	369010		K1	Q0	RT	HBW 5/750	HB 152	

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01
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Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)			A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 9/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON	A07.1 No. K-04257	Final receiver CESSCO FAB., EDMONTON	A07.2 No.	B01 Product HEAVY PLATES
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485				
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014				

C30-C39 Hardness test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/C01	C03 Temp. GRF	C30 Method of test	C35	C31 Individual values	C32 Mean value
11	415881	366121		K1	Q0		RT HBW 5/750		HB 147	
11	415883	366122		K1	Q0		RT HBW 5/750		HB 156	
11	415883	366123		K1	Q0		RT HBW 5/750		HB 147	
12	415883	366089		K1	Q0		RT HBW 5/750		HB 153	
12	415883	379171		K1	Q0		RT HBW 5/750		HB 149	
13	415111	375109		K1	Q0		RT HBW 5/750		HB 165	
13	415879	371380		K1	Q0		RT HBW 5/750		HB 153	
13	415879	371381		K1	Q0		RT HBW 5/750		HB 158	
14	415879	364025		K1	Q0		RT HBW 5/750		HB 157	
14	415879	364026		K1	Q0		RT HBW 5/750		HB 153	
14	415879	364027		K1	Q0		RT HBW 5/750		HB 153	
14	415879	366124		K1	Q0		RT HBW 5/750		HB 156	

C40-C49 Impact test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/C01	C03 Temp. GRF	C41 Width of test piece	C40 Type of test piece	C44 Testing method	C46 Energy	C45	C42 Individual values AV=FT.LBF	C43 Mean value
01	415618	363416		K1	LO	-51		CHP-V		AV 8	190	195 170	185
01	415618	363417		K1	LO	-51		CHP-V		AV 8	192	147 159	166
01	415618	363420		K1	LO	-51		CHP-V		AV 8	170	147 200	172
02	415618	363426		K1	LO	-51		CHP-V		AV 8	185	130 192	169
02	415618	367440		K1	LO	-51		CHP-V		AV 8	136	117 129	127
02	415618	377166		K1	LO	-51		CHP-V		AV 8	143	147 194	161
03	415618	363425		K1	LO	-51		CHP-V		AV 8	142	132 134	136
03	415618	364016		K1	LO	-51		CHP-V		AV 8	113	118 135	122

A04



Manufacturer's mark

201/202/203 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.

POISSONNET
Test House Manager

Dillinger France
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais

Date 11.02.15

ED 1

A04




Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 10/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C40-C49 Impact test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/ C01	C03 Temp. GR.F	C41 Width of test piece	C40 Type of test place	C44 Testing method	C46 Energy	C45	C42 Individual values AV=FT.LBF	C43 Mean value
04	415618	363418		K1	LO	-51		CHP-V			AV 8	125 108 125	119
04	415618	363421		K1	LO	-51		CHP-V			AV 8	142 197 151	163
05	415618	363419		K1	LO	-51		CHP-V			AV 8	151 139 135	142
05	415618	363422		K1	LO	-51		CHP-V			AV 8	137 119 149	135
06	415618	367447		K1	LO	-51		CHP-V			AV 8	136 119 148	134
06	415618	368176		K1	LO	-51		CHP-V			AV 8	138 120 141	133
06	415618	368177		K1	LO	-51		CHP-V			AV 8	141 134 189	155
07	415618	368188		K1	LO	-51		CHP-V			AV 8	131 120 136	129
07	415618	368189		K1	LO	-51		CHP-V			AV 8	186 129 109	141
07	415618	368190		K1	LO	-51		CHP-V			AV 8	119 116 129	121
08	415879	364012		K1	LO	-51		CHP-V			AV 8	162 156 205	174
08	415879	364013		K1	LO	-51		CHP-V			AV 8	192 191 189	191
08	415881	368026		K1	LO	-51		CHP-V			AV 8	201 201 180	194
09	415881	368001		K1	LV	-51		CHP-V			AV 8	212 188 197	199
09	415881	368002		K1	LV	-51		CHP-V			AV 8	197 184 193	191
10	415881	366017		K1	LV	-51		CHP-V			AV 8	198 193 195	195
10	415881	366125		K1	LV	-51		CHP-V			AV 8	191 187 187	188
10	415881	366126		K1	LV	-51		CHP-V			AV 8	198 197 193	196
10	415881	368027		K1	LV	-51		CHP-V			AV 8	152 197 213	187
10	415881	368028		K1	LV	-51		CHP-V			AV 8	195 207 187	196
10	415881	369010		K1	LV	-51		CHP-V			AV 8	191 145 161	166
11	415881	366121		K1	LV	-51		CHP-V			AV 8	188 165 139	164
11	415883	366122		K1	LV	-51		CHP-V			AV 8	197 198 195	197
11	415883	366123		K1	LV	-51		CHP-V			AV 8	161 149 208	173

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A07	ED 1
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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 11/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

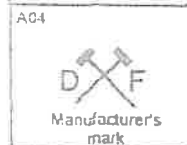
C40-C49 Impact test

B14 Item No.	B07.2 Heat No.	B07.1 Rol. plate/ Test No.	B05 Reference (heat) treatment	C01	C02 C01	C03 Temp. GRF	C41 Width of test piece	C40 Type of test piece	C44 Testing method	C46 Energy	C45	C42 Individual values AV=FT.LBF	C43 Mean value	
12	415883	366089		K1	LV	-51		CHP-V		AV 8	142	168	202	171
12	415883	379171		K1	LV	-51		CHP-V		AV 8	157	128	125	137
13	415111	375109		K1	LV	-51		CHP-V		AV 8	131	156	134	140
13	415879	371380		K1	LV	-51		CHP-V		AV 8	131	134	135	133
13	415879	371381		K1	LV	-51		CHP-V		AV 8	131	89	125	115
14	415879	364025		K1	LV	-51		CHP-V		AV 8	132	143	195	157
14	415879	364026		K1	LV	-51		CHP-V		AV 8	119	135	131	128
14	415879	364027		K1	LV	-51		CHP-V		AV 8	122	201	116	146
14	415879	366124		K1	LV	-51		CHP-V		AV 8	127	133	157	139

C66-C68 Supplementary tests on test samples

ITEM NO.: 12-13
FERRITE GRAIN SIZE ASTM B112 (SEE APPENDIX)

B07.2	B07.1	RESULT
415618	363422	9,0
415879	364013	9,0
415883	366089	8,5
415881	366125	9,0
415111	375109	9,0



Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.

POISSONNET
Test House Manager

Dillinger France
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais
Date 11.02.15

A01



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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 12/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA: 2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C70-C99 Chemical composition % - Heat analysis

B07.2 Heat	C70	C	SI	MN	P	S	CU	MO	NI	CR	V	NB	TI	B	CA
415111	Y	0,168	0,379	1,17	0,009	0,0007	0,170	0,011	0,371	0,026	0,001	0,016	0,002	0,0001	0,0013
415618	Y	0,180	0,372	1,16	0,007	0,0008	0,098	0,013	0,057	0,040	0,001	0,017	0,002	0,0003	0,0027
415879	Y	0,177	0,369	1,17	0,007	0,0008	0,170	0,028	0,360	0,062	0,001	0,018	0,004	0,0003	0,0023
415881	Y	0,158	0,318	1,18	0,007	0,0009	0,177	0,019	0,362	0,033	0,001	0,016	0,003	0,0003	0,0015
415883	Y	0,163	0,343	1,18	0,007	0,0008	0,168	0,026	0,363	0,043	0,001	0,017	0,003	0,0002	0,0010

B07.2 Heat	C70	AL-T
415111	Y	0,031
415618	Y	0,032
415879	Y	0,042
415881	Y	0,046
415883	Y	0,039

C94 Heat analysis Carbon equivalent / Alloying restrictions

B07.2 Heat	FO-02=	0,41	FO-51=	0,017	FO-55=	0,58	FO-70=	0,2	FO-78=	0,04
415111	FO-02=	0,41	FO-51=	0,017	FO-55=	0,58	FO-70=	0,2	FO-78=	0,04
415618	FO-02=	0,39	FO-51=	0,018	FO-55=	0,21	FO-70=	0,2	FO-78=	0,05
415879	FO-02=	0,43	FO-51=	0,019	FO-55=	0,62	FO-70=	0,3	FO-78=	0,09
415881	FO-02=	0,40	FO-51=	0,017	FO-55=	0,59	FO-70=	0,2	FO-78=	0,05
415883	FO-02=	0,41	FO-51=	0,018	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07

C95 Ladle treatment

ITEM NO.: 01-14
HEAT OF THE INDICATED ITEM: VACUUM DEGASSED / SULPHIDE SHAPE CONTROL

A04 Manufacturer's mark	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order. BROMLEY MECHANICAL SERVICES Checked to ASME Gest. HA <u>2015</u> Edd. <u>Min 1.501"</u>	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01 ED 1
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SA 20 68 12/12/17
Date



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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 13/...
A05 Established inspecting body DF	A06 Purchaser Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C95 Further information about ladle treatment

ITEM NO.: 01-14
MELTED IN GERMANY BY -AG DER DILLINGER HUETTENWERKE, DILLINGEN/SAAR-

ITEM NO.: 01-14
FULLY KILLED AND MADE TO FINE GRAIN PRACTICE ✓

C70-C99 Further information about heat analysis

ITEM NO.: 01-14
OXYGEN MAX. 0,005% ON LADLE AND ON PRODUCT

C70-C99 Chemical composition % - Product analysis

B07.2 Heat	B07.1 Test No.	COM	C ✓	SI ✓	MN ✓	P ✓	S ✓	CU ✓	MO ✓	NI ✓	CR ✓	V ✓	NB ✓	TI ✓	B ✓	CA ✓
415111	375109	K10	0,166	0,364	1,13	0,009	0,0007	0,168	0,011	0,379	0,028	0,001	0,015	0,002	0,0002	0,0013
415618	363416	K10	0,185	0,375	1,14	0,007	0,0006	0,092	0,012	0,055	0,038	0,001	0,018	0,002	0,0001	0,0022
415618	363417	K10	0,182	0,368	1,12	0,007	0,0006	0,091	0,012	0,054	0,038	0,001	0,016	0,002	0,0002	0,0022
415618	363418	K10	0,181	0,354	1,13	0,007	0,0004	0,093	0,012	0,058	0,041	0,001	0,017	0,003	0,0002	0,0024
415618	363419	K10	0,178	0,362	1,14	0,007	0,0003	0,093	0,012	0,058	0,041	0,001	0,017	0,002	0,0002	0,0022
415618	363420	K10	0,176	0,352	1,13	0,007	0,0003	0,092	0,012	0,058	0,041	0,001	0,017	0,002	0,0001	0,0026
415618	363421	K10	0,166	0,367	1,16	0,008	0,0003	0,095	0,013	0,058	0,041	0,001	0,018	0,003	0,0002	0,0022
415618	363422	K10	0,173	0,359	1,13	0,007	0,0004	0,092	0,012	0,057	0,040	0,001	0,015	0,002	0,0002	0,0027
415618	363425	K10	0,175	0,356	1,13	0,007	0,0004	0,094	0,012	0,058	0,041	0,001	0,016	0,002	0,0002	0,0026
415618	363426	K10	0,180	0,347	1,15	0,007	0,0004	0,097	0,012	0,058	0,041	0,000	0,015	0,002	0,0002	0,0018
415618	364016	K10	0,169	0,342	1,13	0,007	0,0003	0,095	0,012	0,057	0,041	0,001	0,016	0,002	0,0002	0,0026
415618	367440	K10	0,173	0,352	1,14	0,007	0,0005	0,093	0,012	0,058	0,041	0,001	0,016	0,002	0,0002	0,0027
415618	367447	K10	0,181	0,362	1,16	0,008	0,0003	0,094	0,013	0,059	0,041	0,001	0,019	0,003	0,0002	0,0024
415618	368176	K10	0,180	0,349	1,11	0,007	0,0003	0,092	0,012	0,057	0,041	0,001	0,016	0,002	0,0002	0,0025
415618	368177	K10	0,179	0,349	1,12	0,007	0,0003	0,094	0,012	0,058	0,041	0,001	0,016	0,002	0,0002	0,0025

A04 Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.



[Signature]
POISSONNET
Test House Manager

Dillinger France
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais
Date 11.02.15

A01



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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 14/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C70-C99 Chemical composition % - Product analysis

B07.2 Heat	B07.1 Test No.	C01	C ✓	SI ✓	MN ✓	P ✓	S ✓	CU ✓	MO ✓	NI ✓	CR ✓	V ✓	NB ✓	TI ✓	B ✓	CA ✓
415618	368188	K10	0,187	0,352	1,13	0,007	0,0004	0,094	0,012	0,058	0,041	0,001	0,016	0,002	0,0002	0,0028
415618	368189	K10	0,164	0,349	1,11	0,006	0,0002	0,089	0,012	0,056	0,040	0,001	0,014	0,002	0,0002	0,0027
415618	368190	K10	0,186	0,353	1,13	0,007	0,0003	0,094	0,012	0,058	0,041	0,001	0,017	0,003	0,0002	0,0027
415618	377166	K10	0,181	0,360	1,16	0,008	0,0005	0,097	0,013	0,058	0,041	0,001	0,017	0,002	0,0002	0,0021
415879	364012	K10	0,171	0,360	1,14	0,006	0,0004	0,162	0,027	0,365	0,063	0,001	0,017	0,003	0,0003	0,0022
415879	364013	K10	0,164	0,341	1,15	0,007	0,0006	0,169	0,024	0,368	0,054	0,001	0,017	0,003	0,0002	0,0017
415879	364025	K10	0,170	0,360	1,14	0,006	0,0006	0,169	0,028	0,363	0,061	0,001	0,018	0,003	0,0002	0,0019
415879	364026	K10	0,169	0,364	1,15	0,006	0,0004	0,161	0,027	0,369	0,063	0,001	0,017	0,003	0,0003	0,0022
415879	364027	K10	0,167	0,356	1,14	0,006	0,0004	0,161	0,026	0,364	0,062	0,001	0,017	0,003	0,0002	0,0021
415879	366124	K10	0,166	0,350	1,14	0,006	0,0008	0,169	0,026	0,361	0,056	0,001	0,017	0,003	0,0003	0,0019
415879	371380	K10	0,168	0,346	1,11	0,007	0,0006	0,162	0,027	0,371	0,064	0,001	0,017	0,003	0,0003	0,0023
415879	371381	K10	0,170	0,348	1,11	0,006	0,0004	0,160	0,027	0,369	0,064	0,001	0,017	0,003	0,0003	0,0025
415881	366017	K10	0,153	0,313	1,14	0,007	0,0008	0,172	0,019	0,367	0,035	0,001	0,015	0,002	0,0002	0,0015
415881	366121	K10	0,160	0,322	1,15	0,007	0,0005	0,162	0,025	0,370	0,042	0,001	0,017	0,003	0,0002	0,0011
415881	366125	K10	0,161	0,335	1,14	0,007	0,0005	0,168	0,024	0,368	0,051	0,001	0,016	0,003	0,0002	0,0015
415881	366126	K10	0,151	0,307	1,14	0,007	0,0007	0,175	0,019	0,365	0,033	0,001	0,015	0,002	0,0002	0,0014
415881	368001	K10	0,149	0,304	1,13	0,007	0,0006	0,167	0,019	0,365	0,035	0,001	0,015	0,002	0,0002	0,0014
415881	368002	K10	0,150	0,303	1,15	0,007	0,0005	0,176	0,019	0,367	0,034	0,001	0,015	0,002	0,0002	0,0012
415881	368026	K10	0,155	0,316	1,15	0,007	0,0005	0,173	0,021	0,366	0,044	0,001	0,016	0,003	0,0002	0,0014
415881	368027	K10	0,148	0,308	1,11	0,007	0,0009	0,174	0,018	0,352	0,029	0,001	0,015	0,002	0,0002	0,0013
415881	368028	K10	0,149	0,299	1,11	0,006	0,0005	0,167	0,020	0,362	0,035	0,001	0,014	0,002	0,0002	0,0009
415881	369010	K10	0,160	0,321	1,14	0,007	0,0003	0,169	0,022	0,371	0,046	0,001	0,016	0,003	0,0002	0,0014
415883	366089	K10	0,157	0,334	1,15	0,007	0,0005	0,164	0,026	0,369	0,044	0,001	0,017	0,003	0,0002	0,0011
415883	366122	K10	0,158	0,325	1,14	0,007	0,0001	0,160	0,027	0,367	0,045	0,001	0,018	0,003	0,0002	0,0009
415883	366123	K10	0,154	0,327	1,13	0,007	0,0006	0,158	0,025	0,362	0,043	0,001	0,015	0,003	0,0002	0,0012

<p>Manufacturer's mark</p>	<p>Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.</p>	<p>POISSONNET Test House Manager</p>	<p>Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais</p>	A01
			<p>Date 11.02.15</p>	<p>ED 1</p>



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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 15/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257	A07.2 No.	
B02/ Steel design. B03 Any suppl. requirements	SA516-70/SA516M-485/A516-70/A516M-485 ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			B01 Product HEAVY PLATES

C70-C99 Chemical composition % - Product analysis

B07.2 Heat	B07.1 Test No.	C01	C	SI	MN	P	S	CU	MO	NI	CR	V	NB	TI	B	CA
415883	379171	K10	0,163	0,330	1,14	0,007	0,0005	0,162	0,027	0,365	0,045	0,001	0,016	0,003	0,0002	0,0010

C94 Product analysis Carbon equivalent / Alloying restrictions

B07.2 Heat	B07.1 Test No.	C01	FO-02=	FO-51=	FO-55=	FO-70=	FO-78=
415111	375109	K10	0,40	0,016	0,59	0,2	0,04
415618	363416	K10	0,40	0,019	0,20	0,2	0,05
415618	363417	K10	0,39	0,017	0,20	0,2	0,05
415618	363418	K10	0,39	0,018	0,20	0,2	0,05
415618	363419	K10	0,39	0,018	0,20	0,2	0,05
415618	363420	K10	0,39	0,018	0,20	0,2	0,05
415618	363421	K10	0,38	0,019	0,21	0,2	0,05
415618	363422	K10	0,38	0,016	0,20	0,2	0,05
415618	363425	K10	0,38	0,017	0,21	0,2	0,05
415618	363426	K10	0,39	0,015	0,21	0,2	0,05
415618	364016	K10	0,38	0,017	0,21	0,2	0,05
415618	367440	K10	0,38	0,017	0,20	0,2	0,05
415618	367447	K10	0,40	0,020	0,21	0,2	0,05
415618	368176	K10	0,39	0,017	0,20	0,2	0,05
415618	368177	K10	0,39	0,017	0,21	0,2	0,05
415618	368188	K10	0,40	0,017	0,21	0,2	0,05
415618	368189	K10	0,37	0,015	0,20	0,2	0,05
415618	368190	K10	0,40	0,018	0,21	0,2	0,05
415618	377166	K10	0,40	0,018	0,21	0,2	0,05
415879	364012	K10	0,41	0,018	0,62	0,3	0,09
415879	364013	K10	0,41	0,018	0,62	0,3	0,08

A04 Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.



[Signature]

POISSONNET
Test House Manager

Dillinger France
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais

Date 11.02.15

ED 1

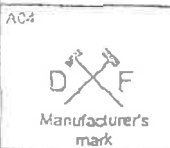


Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 16/...
A05 Established Inspecting body DF	A06 Purchaser Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257	A07.2 No.	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			B01 Product HEAVY PLATES
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C94 Product analysis Carbon equivalent / Alloying restrictions

B07.2 Heat	B07.1 Test No.	C01	✓									
415879	364025	K10 FO-C2=	0,41	FO-51=	0,019	FO-55=	0,62	FO-70=	0,3	FO-78=	0,09	
415879	364026	K10 FO-C2=	0,41	FO-51=	0,018	FO-55=	0,62	FO-70=	0,3	FO-78=	0,09	
415879	364027	K10 FO-C2=	0,41	FO-51=	0,018	FO-55=	0,61	FO-70=	0,3	FO-78=	0,09	
415879	366124	K10 FO-C2=	0,41	FO-51=	0,018	FO-55=	0,61	FO-70=	0,3	FO-78=	0,08	
415879	371380	K10 FO-C2=	0,41	FO-51=	0,018	FO-55=	0,62	FO-70=	0,3	FO-78=	0,09	
415879	371381	K10 FO-C2=	0,41	FO-51=	0,018	FO-55=	0,62	FO-70=	0,3	FO-78=	0,09	
415881	366017	K10 FO-C2=	0,39	FO-51=	0,016	FO-55=	0,59	FO-70=	0,2	FO-78=	0,05	
415881	366121	K10 FO-C2=	0,40	FO-51=	0,018	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07	
415881	366125	K10 FO-C2=	0,40	FO-51=	0,017	FO-55=	0,61	FO-70=	0,3	FO-78=	0,08	
415881	366126	K10 FO-C2=	0,39	FO-51=	0,016	FO-55=	0,59	FO-70=	0,2	FO-78=	0,05	
415881	368001	K10 FO-C2=	0,38	FO-51=	0,016	FO-55=	0,59	FO-70=	0,2	FO-78=	0,05	
415881	368002	K10 FO-C2=	0,39	FO-51=	0,016	FO-55=	0,60	FO-70=	0,2	FO-78=	0,05	
415881	368026	K10 FO-C2=	0,40	FO-51=	0,017	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07	
415881	368027	K10 FO-C2=	0,38	FO-51=	0,016	FO-55=	0,57	FO-70=	0,2	FO-78=	0,05	
415881	368028	K10 FO-C2=	0,38	FO-51=	0,015	FO-55=	0,58	FO-70=	0,2	FO-78=	0,06	
415881	369010	K10 FO-C2=	0,40	FO-51=	0,017	FO-55=	0,61	FO-70=	0,3	FO-78=	0,07	
415883	366089	K10 FO-C2=	0,40	FO-51=	0,018	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07	
415883	366122	K10 FO-C2=	0,40	FO-51=	0,019	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07	
415883	366123	K10 FO-C2=	0,39	FO-51=	0,016	FO-55=	0,59	FO-70=	0,2	FO-78=	0,07	
415883	379171	K10 FO-C2=	0,40	FO-51=	0,017	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07	



Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.

POISSONNET
Test House Manager

Dillinger France
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais
Date 11.02.15

A01



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 17
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			
C94 Carbon equivalent formula / Alloying restrictions				
FO-02 = C+(MN/6)+(CR+MO+V)/5+(NI+CU)/15 FO-51 = V +NB FO-55 = CU+MO+NI+CR FO-70 = CU+MO+CR+NB+V +TI FO-78 = CR+MO				
D01 Marking and identification, surface appearance, shape and dimensional properties				
ITEM NO.: 01-14 EXAMINATION OF MARKING, SURFACE, SHAPE AND DIMENSIONS: THE RESULTS MEET THE REQUIREMENTS. SURFACE AS PER ASME-SA20 (M) THICKNESS AS PER ASTM/ASME-20 (M+US) LENGTH AND WIDTH AS PER ASME-SA20 FLATNESS AS PER ASME-SA20				
D01 Further information about marking and identification, surface appearance, shape and dimensional properties				
ITEM NO.: 01-14 NO WELDING OR WELD REPAIRS HAVE BEEN PERFORMED.				
D02 Non-destructive tests - Ultrasonic testing				
ITEM NO.: 01-14 UT-SPECIFICATION : ASME-SA578 (M) LEVEL C SUPPLEMENTARY REQUIREMENTS S1 ✓ SCANNING PLAN BODY : 100% OF PLATE SURFACE PERSONNEL QUALIFICATION : LEVEL 2 IN ACC. TO EN 473 / ISO 9712 AND SNT-TC-1A THE TEST RESULTS MEET THE REQUIREMENTS OF THE ORDER.				
A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.			A01
 Manufacturer's mark	 POISSONNET Test House Manager		Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15 ED 1	



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations

A02 DETERMINING AVERAGE GRAIN SIZE						Appendix 1		A08/ Manufacture's order/ A03 Certificat No. 399394		Sheet 1/1	
A05 Established DILLINGER FRANCE		Inspecting body		B02 Steel designation SA/A516M-485/SA/A516-70		B07.2 Heat No. 415111	B07.1 Rolled plate/ Test No. 375109	B11 Thickness 38.1 mm	C01 K1	C02/ C01 L	

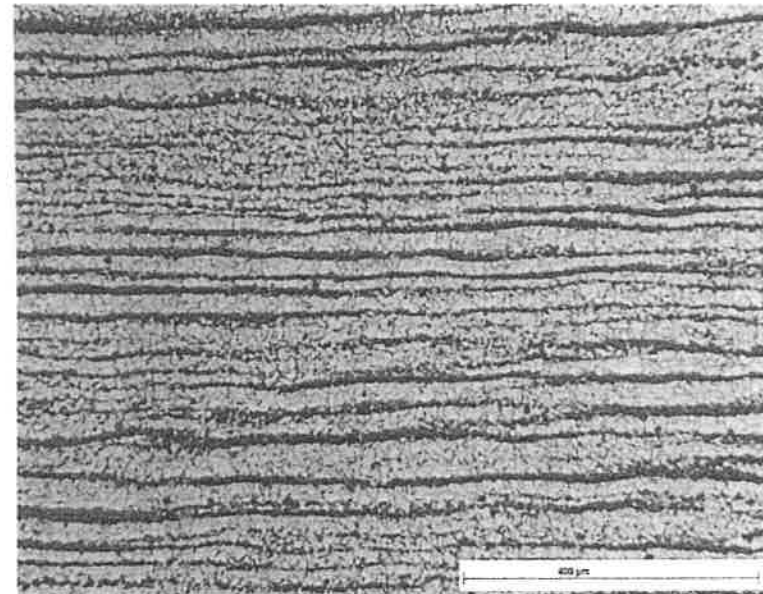
----- C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES -----

DOCUMENTATION OF THE
MICROSTRUCTURE

IMAGE No. 375109

MAGNIFICATION 100:1

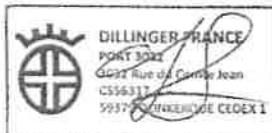
GRAIN SIZE 9



Metallography

Tester: MOREL

Date: 27/01/2015



Z01/Z02/Z03 We certify, that the results are in accordance with the agreement.

Inspector

DILLINGER FRANCE--Groupe Dillinger Hütte A01
Port 3032
3032 rue du Comte Jean – CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité Essais



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations

A02 DETERMINING AVERAGE GRAIN SIZE						Appendix 1		A08/ A03 Manufacture's order/ Certificat No. 399394		Sheet 1/1	
A05 Established DILLINGER FRANCE		Inspecting body		B02 Steel designation SA/A515M-485/SA/A516-70		B07.2 Heat No. 415618	B07.1 Rolled plate/ Test No. 363422	B11 Thickness 15.87 mm	C01 K1	C02/ C01 L	

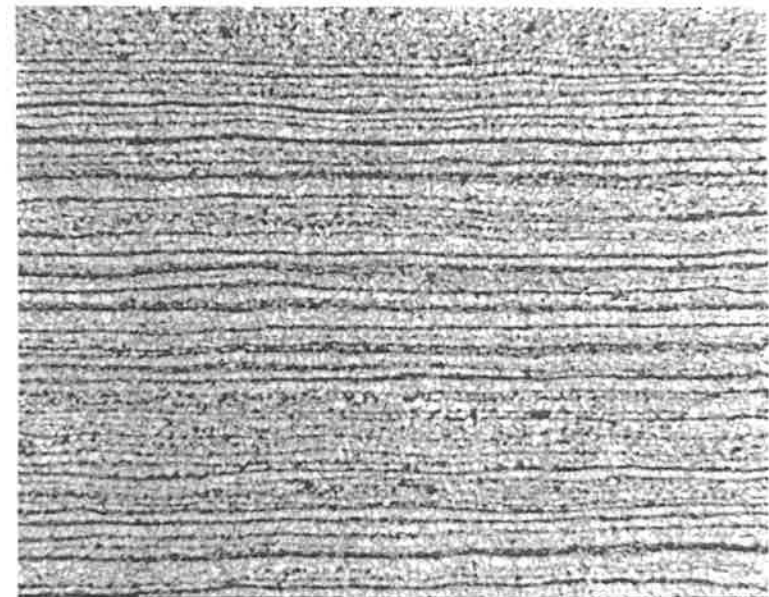
----- C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES -----

DOCUMENTATION OF THE
MICROSTRUCTURE

IMAGE No. 363422

MAGNIFICATION 100:1

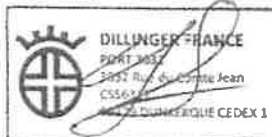
GRAIN SIZE 9



Metallography

Tester: MOREL

Date: 13/01/2015



Z01/Z02/Z03 We certify, that the results are in accordance with the agreement.

Inspector

DILLINGER FRANCE—Groupe Dillinger Hütte A01
Port 3032
3032 rue du Comte Jean – CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
 Service Qualité Essais



Erläuterungen siehe Rückseite/Explications voir au verso.See reverse for explanations

A02 DETERMINING AVERAGE GRAIN SIZE						Appendix 1	A08/ A03 Manufacture's order/ Certificat No. 399394	Sheet 1/1
A05 Established DILLINGER FRANCE	Inspecting body FRANCE	B02 Steel designation SA/A516M-485/SA/A516-70	B07.2 Heat No. 415881	B07.1 Rolled plate/ Test No. 366125	B11 Thickness 25.40 mm	C01 K1	C02/ C01 L	

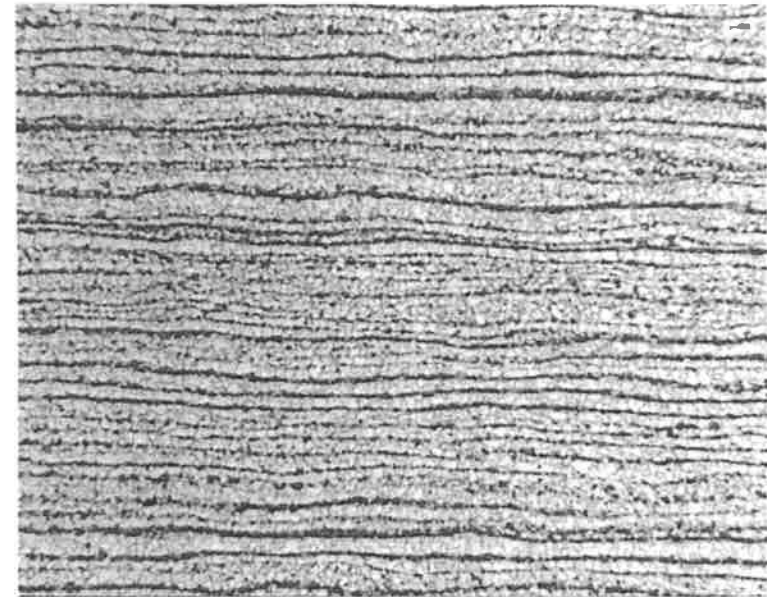
----- C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES -----

DOCUMENTATION OF THE
MICROSTRUCTURE

IMAGE No. **366125**

MAGNIFICATION **100:1**

GRAIN SIZE **9**



Metallography

Tester: **MOREL**

Date: **08/01/2015**



Z01/Z02/Z03 We certify, that the results are in accordance with the agreement.

Inspector

DILLINGER FRANCE—Groupe Dillinger Hütte A01
Port 3032
3032 rue du Comte Jean – CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
 Service Qualité Essais



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations

A02 DETERMINING AVERAGE GRAIN SIZE						Appendix 1		A08/ A03 Manufacture's order/ Certificat No. 399394		Sheet 1/1	
A05 Established Inspecting body DILLINGER FRANCE		B02 Steel designation SA/A516M-485/SA/A516-70			B07.2 Heat No. 415883	B07.1 Rolled plate/ Test No. 366089	B11 Thickness 38.10 mm	C01 K1	C02/ C01 L		

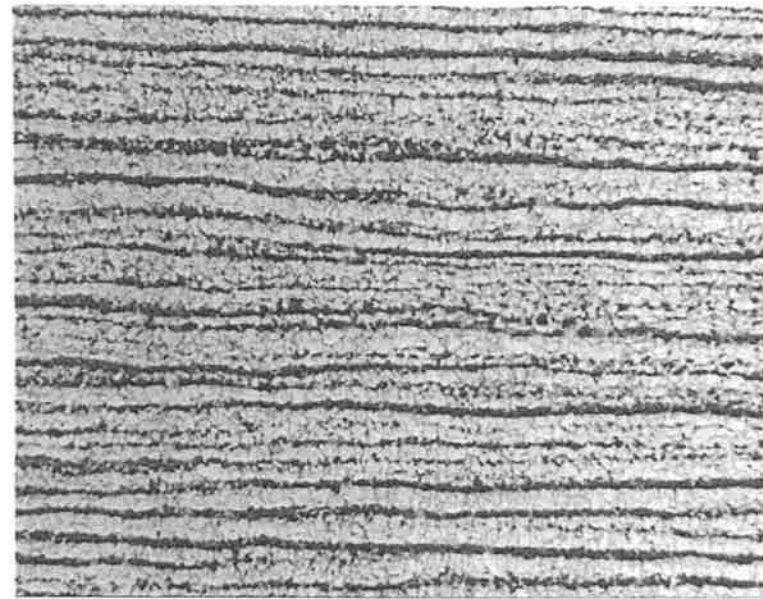
----- C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES -----

DOCUMENTATION OF THE MICROSTRUCTURE

IMAGE No. 366089

MAGNIFICATION 100:1

GRAIN SIZE 8.5



Metallography

Tester: MOREL

Date: 08/01/2015



Z01/Z02/Z03 We certify, that the results are in accordance with the agreement.

Inspector

DILLINGER FRANCE—Groupe Dillinger Hütte A01
 Port 3032
 3032 rue du Comte Jean – CS 56317
 F-59379 Dunkerque Cedex 1 - FRANCE
 Service Qualité Essais



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations

A02 DETERMINING AVERAGE GRAIN SIZE						Appendix 1	A08/ A03 Manufacture's order/ Certificat No. 399394	Sheet 1/1
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A05 Established Inspecting body DILLINGER FRANCE	B02 Steel designation SA/A516M-485/SA/A516-70	B07.2 Heat No. 415879	B07.1 Rolled plate/ Test No. 364013	B11 Thickness 22.22 mm	C01 K1	C02/ C01 L
--	--	--------------------------	---	---------------------------	-----------	------------------

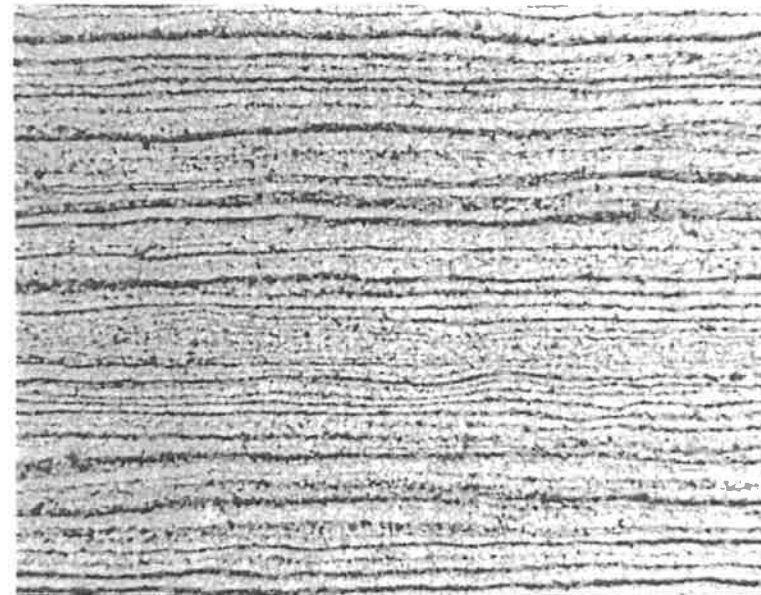
----- C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES -----

DOCUMENTATION OF THE MICROSTRUCTURE

IMAGE No. 364013

MAGNIFICATION 100:1

GRAIN SIZE 9



Metallography

Tester: MOREL

Date: 08/01/2015



Z01/Z02/Z03 We certify, that the results are in accordance with the agreement.

Inspector

DILLINGER FRANCE-Groupe Dillinger Hütte A01
 Port 3032
 3032 rue du Comte Jean - CS 56317
 F-59379 Dunkerque Cedex 1 - FRANCE
 Service Qualité Essais

**BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT**

INSPECTED BY: MICHAEL QUINN

GRADE: SA 516-70MT

DIA SIZE OR WITH: 36"
 NPS OD ID

DATE: OCTOBER 30/2017

HEADS 2:1
 HEMI
 WELD CAP
 OTHER

LENGTH 120"
 THICKNESS
 PIPE PUBLISHED NOM
 PLATE NOM 1.5000"

P.O.# PO-87519

SUPPLIER: CESSCO FABRICATION

SHELL
 PIPE → NDE BY MANUFACTURER
 PLATE HYDRO YES NDE NO
 REPAD NO YES
 STRUCT. NO NO
 OTHER YES YES

PART ID#: VES 25674

REQ. MIN TK: 1.5000"

Weight per foot for pipe over 4"

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35815 //	4	C31891 HT E4F221 F06		1.505"	1.492"	1.492"	1.490"	ok	ok	ok	ml
				1.498"	1.494"	1.498"	1.496"	ok	ok	ok	ml
				1.490"	1.497"	1.493"	1.493"	ok	ok	ok	ml
				1.493"	1.491"	1.490"	1.488"	ok	ok	ok	ml
6" X 24 COUPON	1	C32891 HT E4F221 F06									

W/O# WO-35527

RECEIVED & ACCEPTED BY: ol

REQUIRED CODE MARKINGS:

CUSTOMER: ARC RESOURCES
GENERAL PARTNERSHP

DATE: DEC 12 2017

ALL MARKINGS STAMPED ONTO PLATE BY MANUFACTURE



7310 99 Street
 Edmonton, AB T6E 3R8
 Ph: 780-433-9531
 Fax: 780-432-7899

CERTIFICATE OF COMPLIANCE - SHELLS

Cessco Job No.: 170530 Tag No.: WO 35527/35528
 Customer: Bromley Mechanical, a div. of Argo Sales PO No.: 87519
 Material: SA-516-70N Shell Completion: Tacked

Item	Description	Log Number	Quantity	Form Procedure	Recorded Nom. Thk.		Required Nom. Thk.	
A-10	1-1/2" Plt x 36" OD x 10'-0" LG	4- C32399 4- C31891	8	Cessco FP-1	1-1/2	inches	1-1/2	inches
A-20	3/8" Plt x 36" OD x 10'-0" LG	1- C32509 1- C32510	2	Cessco FP-1	3/8	Inches	3/8	inches

This is to certify that the pressure equipment listed above was manufactured in compliance with the following as applicable:
 ASME Section VIII DIV I UG-79; UG80 & UCS-79
 Meets the requirements of ASME Section II Part A Latest Edition and applicable project specific requirements.

ASME Section VIII DIV I UG-11(b)
 ASME Section VIII DIV I UCS-79(f)
 Cold Formed
 Other Heat Treatment:

Other Additional NDE:

Additional Information:

Carey Gaasbeek
Cessco QC
Oct 24 / 2017
Date

Signature



Test Certificate

Form TC1: Revision 2: Date 23 Apr 2014

12400 Highway 43 North, Axis, Alabama 36505, US

Customer: SAMUEL & SON LIMITED (A DIVISION OF SAMUEL SALES) 2360 DIXIE ROAD MISSISSAUGA ON L4Y1Z7	Customer P.O.No.: U01762 & 41-397372	Mill Order No.: 41-397374-06	Shipping Manifest: AR184974
	Product Description: ASTM A516-70(10)/ASME SA516-70(13) NACE MR0175 ANNEX A2.1.2 COMPLIANT LCVN 20 FT-LBS @ -50F/A673-P;BHN 200 MAX NORMALIZED		Ship Date: 07 Jul 14 Cert No: 081452981 (Page 1 of 1)
	Size: 1.500 X 120.0 X 480.0 (IN)		

Tested Pieces:				Tensiles:					Charpy Impact Tests												
Heat Id	Plate Id	Tested Thickness	Test Loc	YS (KSI)	UTS (KSI)	%RA	Elong % 2in 8in	Test Dir	Hardness	Abs. Energy(FTLB)				% Shear			Test Tmp	Test Dir	Test Siz (mm)	BDWTT Tmp %Shr	
										1	2	3	Avg	1	2	3	Avg				
E4F221	F06	1.513 (DISCRT)	C	49	74		30	T	144 HBW	94	117	102	104					-50F	L	10.	

Heat Id	Chemical Analysis																	ORGN
	C	Mn	P	S	Si	Tot Al	Sol Al	Cu	Ni	Cr	Mo	Cb	V	Ti	B	Cev	U+	
E4F221	.19	1.11	.009	.001	.24	.027	.026	.23	.12	.14	.04	.000	.005	.008	.0003	.43		USA

KILLED STEEL ✓
 MERCURY IS NOT A METALLURGICAL COMPONENT OF THE STEEL AND NO MERCURY WAS INTENTIONALLY ADDED DURING THE MANUFACTURE OF THIS PRODUCT.
 KILLED STEEL, PRODUCED TO A FINE GRAIN PRACTICE ✓
 $CEV (IIW) = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15$
 MTR EN 10204:2004 INSPECTION CERTIFICATE 3.1 COMPLIANT
 NORMALIZED PLATES. HEATED AT 1665F FOR 63 MINUTES. ✓
 TEST COUPONS TAKEN FROM HEAT TREATED PLATE.
 PRODUCTS SHIPPED:



E4F221 F06 6534633 PCES: 1, LBS: 24503 E4F221 F06 6534632 PCES: 1, LBS: 24503 31891
 31892

BROMLEY MECHANICAL SERVICES
 Checked to ASME

SAMUEL, SON & CO., LTD.
 CERTIFIED COPY OF
 TEST REPORT

V535815

Sec. HA 2015 Ed. min 1.488"
 SA 20 08 12/12/17
 Date

CUSTOMER NO. K04253
 OUR ORDER: 382008
 DATE: 08/29/14
 FILED BY: [Signature]

CHEMICAL & PHYSICALS
 CHECKED
 A.S.M.E. Ed. 2015
 @Cessco By Linda Pritchard
 09/23/2015

(P) Cust Part #: _____ WE HEREBY CERTIFY THAT THIS MATERIAL WAS TESTED IN ACCORDANCE WITH, AND MEETS THE REQUIREMENTS OF, THE APPROPRIATE SPECIFICATION Justin Ward +1 251 662 4400 SENIOR METALLURGIST - PRODUCT

BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT

DIA SIZE OR WITH: 36" X 120"
 NPS OD ID

INSPECTED BY: MICHAEL QUINN

GRADE: SA 516-70 MT EE

DATE: JUNE 28/2017

HEADS 2:1
 HEMI
 WELD CAP
 OTHER

LENGTH _____
 THICKNESS _____
 PIPE PUBLISHED NOM _____
 PLATE NOM 0.3750"

P.O.# PO-86907

SUPPLIER: EDMONTON EXCHANGERS LTD.

SHELL
 PIPE → NDE BY MANUFACTURER
 PLATE HYDRO YES NDE NO
 REPAD NO YES
 STRUCT. NO NO
 ROLLED YES YES

PART ID#: VES 36120

Weight per foot for pipe over 4"

REQ. MIN TK: 0.3750"

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKING	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35658	282'	N2B440-FA49878301	0.395"	0.399"	0.402"	0.399"	0.395"*	ok	ok	ok	MJ
				0.397"	0.396"	0.397"	0.396"	ok	ok	ok	MJ
				0.399"	0.399"	0.397"	0.399"	ok	ok	ok	MJ

W/O# _____

RECEIVED & ACCEPTED BY: *[Signature]*

REQUIRED CODE MARKINGS: _____

CUSTOMER: BMS STOCK

DATE: 8/2/17

ALL MARKINGS STAMPED ONTO PLATE BY MANUFACTURE



edmonton exchanger
& manufacturing ltd.

CERTIFICATE OF COMPLIANCE

5545-89 Street Edmonton, Alberta Canada T6E 5W9 www.edmontonexchanger.com tel 780.468.6722 • QC fax 780.466.4668 • sales fax 780.466.5155

Customer **BROMLEY MECHANICAL SERVICES LT** PO 86907 Work Order C115201 Date 2017/06/27 CofC# 64439 Page 1 of 2

Item#	Description	Qty	Heat#	Brinell Hardn.	Weld Proc.	Form. Proc.
S115201-1-1	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48881-02	MTR	WP600	4
S115201-1-2	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48881-02	MTR	WP600	4
S115201-1-3	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48881-02	MTR	WP600	4
S115201-1-4	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48888-02	MTR	WP600	4
S115201-1-5	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48888-02	MTR	WP600	4
S115201-1-6	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48888-02	MTR	WP600	4
S115201-1-7	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48888-02	MTR	WP600	4
S115201-1-8	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48094-02	MTR	WP600	4
S115201-1-9	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48894-02	MTR	WP600	4
S115201-1-10	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48894-02	MTR	WP600	4
S115201-2	COUPON(S) - 1.5000" NOM X 24" X 6" (Material Spec: SA 516-70 Normalized)	1	442036 48881-02	-	-	-
S115201-4-1	SKIRT(S) - 0.3750" NOM X 36" OD X 120" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	N28440 FA49878301	MTR	WP600	4
S115201-4-2	SKIRT(S) - 0.3750" NOM X 36" OD X 120" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	N28440 FA49878301	MTR	WP600	4
S115201-4-3	SKIRT(S) - 0.3750" NOM X 36" OD X 120" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	N28440 FA49878301	MTR	WP600	4

Forming Procedure:

4. Cold Formed With no additional Heat Treatment(s)

NOTE: All items which were heat treated during or after forming shall be documented as a forming procedure per UG-79(c) and UCS-79(f).

Brinell Equipment: Newage Calibrated Pin
Brinell Hardness Tester

Supplementary Requirements



edmonton exchanger
& manufacturing ltd.

CERTIFICATE OF COMPLIANCE

5545-89 Street Edmonton, Alberta Canada T6E 5W9 www.edmontonexchanger.com tel 780.468.6722 • QC fax 780.466.4668 • sales fax 780.466.5155

Customer **BROMLEY MECHANICAL SERVICES LT**

PO 86907

Work Order C115201 Date 2017/06/27 CofC# 64439

Page 2 of 2

Item S115201-1-2, S115201-1-7 had cosmetic surface repairs done in accordance with ASME Sec.VIII, Div.1 and ASME Sec.IX. Repairs were done per approved Weld Procedure WP-2 (as welded) or WP-63 (PWHT). All repaired areas were MT examined.

Normalized Material Identification Marking:

'MT' indicates normalized by the mill per ASME Code Section II, Part A, SA 20, Paragraph 13.1.1.

'GMT' indicates normalized by Edmonton Exchanger per ASME Code Section II, Part A, SA 20, Paragraph 13.1.2.

'GT' indicates normalized by Edmonton Exchanger per ASME Code Section VIII Division 1, UG-85 or ASME Code Section I, PG-77.4.

The item(s) listed above comply with the requirements of ASME Code Section I, PG-80 and ASME Code Section VIII, Division 1, UCS-79(d), UG-79 & UG-80. All welders and procedures are qualified to ASME Code Section IX. For tacking carbon steel items, roundbar used is 1018 Cold Rolled. Material being supplied conforms to the latest ASME Code Section II, Part A, 2015 Edition.

Steve Zubryckyj (QAM)

Supplementary Examination - Items

Edmonton Exchanger

MPI - Dry MPI

(for -1-2, -1-7)

Acceptable to ASME Code

X SEC. VIII, DIV.1	_ SEC. IV
_ SEC. VIII, DIV.2	_ B31.1
_ SEC. I	_ B31.3
_ Bevelled Edge	_ Backgouge
_ Completed Welds	
X Surface Repair Area	

FF Procedure: MPI-001 REV.16
 Material: SA 516-70 N
 Thickness: 1.5"
 Parker B300 Yoke
 Magnaflux 8A-Red (Dry)
 AC Continuous
 Light: Natural
 Tech: Tracy Enman (#11226)
 CGSB / SNT: Level II
 Date: 2017/06/17
 Time: Day Shift



edmonton exchanger
& manufacturing ltd.

CERTIFICATE OF COMPLIANCE

MTR List

5545-89 Street Edmonton, Alberta Canada T6E 5W9 www.edmontonexchanger.com tel 780.468.6722 • QC fax 780.466.4668 • sales fax 780.466.5155

Customer BROMLEY MECHANICAL	PO 86907	Work Order C115201 Date 2017/06/27	CofC# 64439	Page 1 of 1
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Email to barbh@argosales.com

Email to michaelq@argosales.com

Email to kolsen@edmontonexchanger.com

MTR ID	Pages	Heat#	Thickness	Material Grades
17636	6	380618-99903-01	1.5"	SA 516-70 N
19032	9	396636-26385-01	1.5"	SA 516-70 N
		396636-26385-02	1.5"	SA 516-70 N
19398	14	N28440-FA49878301	.375"	SA 516-70 N
19668	5	415939-08727-02	1.5"	SA 516-70 N
20641	7	442036-48881-02	1.5"	SA 516-70 N
		442036-48898-02	1.5"	SA 516-70 N
20643	6	442036-48880-01	1.5"	SA 516-70 N
		442036-48888-02	1.5"	SA 516-70 N
		442036-48894-02	1.5"	SA 516-70 N

Heat#	Material Grades	MTR ID	Item#
380618 99903-01	SA 516-70 N	17636	H115201-3
396636 26385-01	SA 516-70 N	19032	H115201-3
396636 26385-02	SA 516-70 N	19032	H115201-3
415939 08727-02	SA 516-70 N	19668	H115201-3
442036 48880-01	SA 516-70 N	20643	H115201-3
442036 48881-02	SA 516-70 N	20641	S115201-1
			S115201-2
442036 48888-02	SA 516-70 N	20643	S115201-1
442036 48894-02	SA 516-70 N	20643	S115201-1
442036 48898-02	SA 516-70 N	20641	H115201-3
N28440 FA49878301	SA 516-70 N	19398	S115201-4

Heat#	Thickness	Grade	HIC Report Filename
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검사증명서

MILL TEST CERTIFICATE



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Eukbusanu-ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호 Order No. : F141000167
 품명 Commodity : Hot Rolled Steel Plate 고객사 Customer : EDMONTON STEEL PLATE
 제품규격 Specification : ASME SA516-70 MT 주문자 Contractor : 현대중합상사(주) 증정서 번호 Certificate No. : 20141128-PS-092-001
 발행일자 Date of issue : 2014-11-28

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hard- ness Test HB	화학성분 Chemical Composition(%)																	
						YP	TS	EL	YP-EL	RA	YR	YP Mtd			단위 Unit 2 : x100 3 : x1,000 4 : x10,000 5 : x100,000																	
															C	Si	Mn	P	S	Cr	Ni	B	Ca	Cu	Mo	N	Nb	Ti	V	Sol -Al	CEO	
0.375" x 96.5" x 480"	1	4,925	N28440	FA49851301	T	56.0	79.3	40				2	Good	153.7	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
						(KSI)	(%)	(%)	(%)	(%)					C	1,507	349	1,168	136	14	18	17	2	13	132	0	29	14	2	1	36	402
0.375" x 96.5" x 480"	1	4,925	N28440	FA49851302	T	56.0	79.3	40				2	Good	153.7	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
															C	1,507	349	1,168	136	14	18	17	2	13	132	0	29	14	2	1	36	402
0.375" x 96.5" x 480"	1	4,925	N28440	FA49851303	T	56.0	79.3	40				2	Good	153.7	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
															C	1,507	349	1,168	136	14	18	17	2	13	132	0	29	14	2	1	36	402
0.375" x 96.5" x 480"	1	4,925	N28440	FA49851401	T	54.3	78.5	39				2	Good	153.0	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
															C	1,534	348	1,152	131	15	18	17	2	14	132	0	32	13	2	1	35	402

BROYLEY TECHNICAL SERVICES
Checked to ASME

NOTE

- Position - T:Top, M:Middle, B:Bottom
- Tensile test - Direction:Transverse, Gauge length:50.8mm (Rectangular), YP Mtd : 2 (0.2% of f-set), 5 (0.5% underload), U (Upper yield point), L (Lower yield point)
- U.S.T - Ultrasonic test
- Impact test - Direction:Longitudinal, Size:10mmX7.5mm, SF:Shear fracture, LE:Lateral Expansion
- Division - C:Check analysis, L:Ladle analysis

ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION. SULPHIDE SHAPE CONTROL
 The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum dephosing process were applied. The Certificate has been issued in compliance with EN :0204 (2004) 3.1.

SECT. IIA 2015 Ed. MIN 0.395"
 SA 20
 US 35658
 8/2/17
 Date

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
 WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature
S. B. Park
 SURVEYOR TO Chief Of Quality Assurance Team

* 본 검사증명서는 원본인 전자문서(전자서명 정보 포함)로부터 출력된 사본입니다. 전자문서의 내용은 현대제철 고객포탈에서 확인하실 수 있습니다.(http://sm.hyundai-steel.com/cs/cm/login.jsp)
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검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukbu.sanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호 : F141000167
Order No.

품명 : Hot Rolled Steel Plate
Commodity

제품규격 : ASME SA516-70 MT
Specification

고객사 : EDMONTON STEEL PLATE
Customer

주문자 : 현대중합상사(주)
Contractor

증명서 번호 : 20141128-PS-092-001
Certificate No.

발행일자 : 2014-11-28
Date of Issue

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50.8 °F		
		Energy	SF	LE
		(F-Lbs)	(%)	(mm)
FA49851301	T	1: 145		
		2: 145		
		3: 174		
		A: 155		
FA49851302	T	1: 145		
		2: 145		
		3: 174		
		A: 155		
FA49851303	T	1: 145		
		2: 145		
		3: 174		
		A: 155		
FA49851401	T	1: 142		
		2: 142		
		3: 128		
		A: 137		

NOTE

- ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION. SULPHIDE SHAPE CONTROL
- The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3,1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature

S. B. Park

SURVEYOR TO : Chief Of Quality Assurance Team

* 본 검사증명서는 원본인 전자문서(전자서명 정보 포함)로부터 출력된 사본입니다. 전자문서의 내용은 현대제철 고객포탈에서 확인하실 수 있습니다.(<http://sm.hyundai-steel.com/cs/cm/login.jsp>)
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검사증명서

MILL TEST CERTIFICATE



당진제철소 : 충남 당진시 송악읍 목부신로 1480
1483 Bukbusanup-Ro, Songak-Eup, Dengjin-Si, Chungnam, Korea

주문번호 : F141000167
Order No.

품명 : Hot Rolled Steel Plate
Commodity

제품규격 : ASME SA516-70 MT
Specification

고객사 : EDMONTON STEEL PLATE
Customer

주문자 : 현대중합상사(주)
Contractor

증명서 번호 : 20141128-PS-092-002
Certificate No.

발행일자 : 2014-11-28
Date of Issue

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hard- ness Test HB	화학성분 Chemical Composition(%)																	
						YP	TS	EL	YP-EL	RA	YR	yp Mtd			단위 Unit 2: x100 3: x1,000 4: x10,000 5: x100,000																	
						(KSI)	(%)	(%)	(%)	(%)	(%)	Division			C	Si	Mn	P	S	Cr	Ni	B	Ca	Cu	Mo	N	Nb	Ti	V	Sol -Al	CEQ	
0.375" x 96.5" x 480"	1	4,925	N28440	FA49851402	T	54.3	78.5	39				2	Good	153.0	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
															C	1,534	348	1,152	131	15	18	17	2	14	132	0	32	13	2	1	35	402
0.375" x 96.5" x 480"	1	4,925	N28440	FA49851403	T	54.3	78.5	39				2	Good	153.0	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
															C	1,534	348	1,152	131	15	18	17	2	14	132	0	32	13	2	1	35	402
0.375" x 96.5" x 480"	1	4,925	N28444	FA49851501	T	54.9	79.6	39				2	Good	153.7	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411
															C	1,583	354	1,167	150	14	18	17	1	13	129	1	34	13	2	1	43	411
0.375" x 96.5" x 480"	1	4,925	N28444	FA49851502	T	54.9	79.6	39				2	Good	153.7	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411
															C	1,583	354	1,167	150	14	18	17	1	13	129	1	34	13	2	1	43	411

NOTE

- Position - T:Top, M:Middle, B:Bottom
- Tensile test - Direction:Transverse, Gauge length:50.8mm (Rectangular), YP Mtd : 2 (0.2% off-set), 5 (0.5% underload), U (Upper yield point), L (Lower yield point)
- U.S.T - Ultrasonic test
- Impact test - Direction:Longitudinal, Size:10mmX7.5mm, SF:Shear fracture, LE:Lateral Expansion
- Division - C:Check analysis, L:Ladle analysis

ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION, SULPHIDE SHAPE CONTROL
The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature: **S. B. Park**
SURVEYOR TO: Chief Of Quality Assurance Team

* 본 검사증명서는 원본인 전자문서(전자서명 정보 포함)로부터 출력된 사본입니다. 전자문서의 내용은 현대제철 고객포탈에서 확인하실 수 있습니다.(<http://sm.hyundai-steel.com/cs/cm/login.jsp>)
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검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukkusanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호 Order No. : F141000167	고객사 Customer : EDMONTON STEEL PLATE	증명서 번호 Certificate No. : 20141128-PS-092-002
품명 Commodity : Hot Rolled Steel Plate	주문자 Contractor : 현대중합상사(주)	발행일자 Date of Issue : 2014-11-28
제품규격 Specification : ASME SA516-70 MT		

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50.8°F		
		Energy	SF	LE
		(Ft-Lbs)	(%)	(mm)
FA49851402	T	1: 142		
		2: 142		
		3: 128		
		A: 137		
FA49851403	T	1: 142		
		2: 142		
		3: 128		
		A: 137		
FA49851501	T	1: 153		
		2: 145		
		3: 150		
		A: 150		
FA49851502	T	1: 153		
		2: 145		
		3: 150		
		A: 150		

NOTE

• ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION. SULPHIDE SHAPE CONTROL
• The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature **S. B. Park**
SURVEYOR TO: Chief Of Quality Assurance Team

* 본 검사증명서는 원본인 전자문서(전자서명 정보 포함)로부터 출력된 사본입니다. 전자문서의 내용은 현대제철 고객포탈에서 확인하실 수 있습니다.(<http://sm.hyundai-steel.com/cs/cm/login.jsp>)
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검사증명서

MILL TEST CERTIFICATE



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukbusanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호 : F141000167
Order No.

품명 : Hot Rolled Steel Plate
Commodity

제품규격 : ASME SA516-70 MT
Specification

고객사 : EDMONTON STEEL PLATE
Customer

주문자 : 현대중합상사(주)
Contractor

증명서 번호 : 20141128-PS-092-003
Certificate No.

발행일자 : 2014-11-28
Date of Issue

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hard- ness Test HB	화학성분 Chemical Composition(%)														단위 Unit			
						YP	TS	EL	YP-EL	RA	YR	YP Mtd			Chemical Composition(%)														2: x100	3: x1,000	4: x10,000	5: x100,000
															C	Si	Mn	P	S	Cr	Ni	B	Ca	Al	Mo	N	Nb	Ti	V	Sol- -A	CEO	
0.375" x 96.5" x 480"	1	4,925	N28444	FA49851503	T	54.9	79.6	39				2	Good	153.7	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411
															C	1,583	354	1,167	150	14	18	17	1	13	129	1	34	13	2	1	43	411
0.375" x 96.5" x 480"	1	4,925	N28444	FA49851601	T	54.8	79.5	39				2	Good	153.7	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411
															C	1,568	354	1,157	140	14	17	17	1	12	132	0	33	14	2	1	40	404
0.375" x 96.5" x 480"	1	4,925	N28444	FA49851602	T	54.8	79.5	39				2	Good	153.7	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411
															C	1,568	354	1,157	140	14	17	17	1	12	132	0	33	14	2	1	40	404
0.375" x 96.5" x 480"	1	4,925	N28444	FA49851603	T	54.8	79.5	39				2	Good	153.7	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411
															C	1,568	354	1,157	140	14	17	17	1	12	132	0	33	14	2	1	40	404

*** Sub Total(001) *** 12 59,100(Lbs)

NOTE

- Position - T:Top, M:Middle, B:Bottom
- Tensile test - Direction:Transverse, Gauge length:50.8mm (Rectangular), YP Mtd : 2 (0.2% off-set), 5 (0.5% underload), U (Upper yield point), L (Lower yield point)
- U.S.T - Ultrasonic test
- Impact test - Direction:Longitudinal, Size:10mmX7.5mm, SF:Shear fracture, LE:Lateral Expansion
- Division - C:Check analysis, L:Ladle analysis

• ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 M LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION, SULPHIDE SHAPE CONTROL
• The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

심기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature

S. B. Park

SURVEYOR TO : Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukbusanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호 Order No. : F141000167	고객사 Customer : EDMONTON STEEL PLATE	증명서 번호 Certificate No. : 20141128-PS-092-003
품명 Commodity : Hot Rolled Steel Plate	주문자 Contractor : 현대중합상사(주)	발행일자 Date of Issue : 2014-11-28
제품규격 Specification : ASME SA516-70 MT		

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50.8 °F		
		Energy	SF	LE
		(Ft-Lbs)	(%)	(mm)
FA49851503	T	1: 153		
		2: 145		
		3: 150		
		A: 150		
FA49851601	T	1: 142		
		2: 108		
		3: 107		
		A: 119		
FA49851602	T	1: 142		
		2: 108		
		3: 107		
		A: 119		
FA49851603	T	1: 142		
		2: 108		
		3: 107		
		A: 119		

*** Sub Total(001) *** 12 59,100(Lbs)

NOTE

• ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION. SULPHIDE SHAPE CONTROL
• The plate is fully killed and line grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature **S. B. Park**
SURVEYOR TO : Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukbu sanup-ro, Songak-eup, Dangjin-si, Chungnam, Korea

주문번호 Order No. : F141000167
 품명 Commodity : Hot Rolled Steel Plate 고객사 Customer : EDMONTON STEEL PLATE
 제품규격 Specification : ASME SA516-70 MT 주문자 Contractor : 현대중합상사(주) 증명서 번호 Certificate No. : 20141128-PS-092-004
 발행일자 Date of Issue : 2014-11-28

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hard- ness Test HB	화학성분 Chemical Composition(%)																	
						YP	TS	EL	YP-EL	RA	YR	YP Mid			단위 Unit 2 : x 100 3 : x 1,000 4 : x 10,000 5 : x 100,000																	
						(KSI)	(%)	(%)	(%)	(%)	(%)				C	Si	Mn	P	S	Cr	Ni	B	Ca	Cu	Mo	N	Nb	Ti	V	Sol -Al	CEO	
*** Heat Treatment : Normalized : 1634.0°F 23 Min.																																
*** UST Application Spec. => ASME SA578(LEVEL B)																																
0.375" x 120.5" x 480"	1	6,151	N28444	FA49822801	T	55.8	79.5	37				2	Good	148.0	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411
															C	1,568	348	1,155	139	14	17	17	2	12	132	0	28	13	2	1	38	404
0.375" x 120.5" x 480"	1	6,151	N28444	FA49822802	T	55.8	79.5	37				2	Good	148.0	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411
															C	1,568	348	1,155	139	14	17	17	2	12	132	0	28	13	2	1	38	404
0.375" x 120.5" x 480"	1	6,151	N28444	FA49822803	T	55.8	79.5	37				2	Good	148.0	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411
															C	1,568	348	1,155	139	14	17	17	2	12	132	0	28	13	2	1	38	404

NOTE

- Position - T:Top, M:Middle, B:Bottom
- Tensile test - Direction:Transverse, Gauge length:50.8mm (Rectangular), YP Mid : 2 (0.2% off-set), 5 (0.5% underload), U (Upper yield point), L (Lower yield point)
- U.S.T - Ultrasonic test
- Impact test - Direction:Longitudinal, Size:10mmX7.5mm, SF:Shear fracture, LE:Lateral Expansion
- Division - C:Check analysis, L:Ladle analysis

ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION, SULPHIDE SHAPE CONTROL
 The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
 WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature: **S. B. Park**
 SURVEYOR TO : Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukbusenup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호
Order No. : F141000167

품명
Commodity : Hot Rolled Steel Plate

제품규격
Specification : ASME SA516-70 MT

고객사
Customer : EDMONTON STEEL PLATE

주문자
Contractor : 현대중합상사(주)

증명서 번호
Certificate No. : 20141128-PS-092-004

발행일자
Date of Issue : 2014-11-28

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50.8°F		
		Energy	SF	LE
		(Ft-Lbs)	(%)	(mm)
*** Heat Treatment : Normalized : 1634.0°F 23 Min.				
*** UST Application Spec. => ASME SA578(LEVEL B)				
FA49822801	T	1: 170 2: 144 3: 150 A: 155		
FA49822802	T	1: 170 2: 144 3: 150 A: 155		
FA49822803	T	1: 170 2: 144 3: 150 A: 155		
NOTE	* ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION, SULPHIDE SHAPE CONTROL. * The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.			
	상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다. WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS			Signature SURVEYOR TO : Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukbusanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호 : F141000167
Order No.

품명 : Hot Rolled Steel Plate
Commodity

제품규격 : ASME SA516-70 M⁺
Specification

고객사 : EDMONTON STEEL PLATE
Customer

주문자 : 현대중합상사(주)
Contractor

증명서 번호 : 20141128-PS-092-005
Certificate No.

발행일자 : 2014-11-28
Date of Issue

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hard- ness Test HB	화학성분 Chemical Composition(%)														단위 Unit			
						YP	TS	EL	YP-EL	RA	YR	YP Mtd																	2 : x100	3 : x1,000		
						(KSI)	(%)	(%)	(%)	(%)	(%)				C	S	Mn	P	S	Cr	Ni	B	Ca	Cu	Mo	N	Nb	Ti	V	Sol -Al	CEQ	
0.375" x 120.5" x 480"	1	6,151	N28440	FA49878201	T	54.2	78.0	40				2	Good	150.6	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
															C	1,546	329	1,153	129	12	18	17		17	136	0	33	14	1	1	29	403
0.375" x 120.5" x 480"	1	6,151	N28440	FA49878202	T	54.2	78.0	40				2	Good	150.6	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
															C	1,546	329	1,153	129	12	18	17		17	136	0	33	14	1	1	29	403
0.375" x 120.5" x 480"	1	6,151	N28440	FA49878203	T	54.2	78.0	40				2	Good	150.6	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
															C	1,546	329	1,153	129	12	18	17		17	136	0	33	14	1	1	29	403
0.375" x 120.5" x 480"	1	6,151	N28440	FA49878301	T	54.8	78.2	38				2	Good	149.7	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
															C	1,553	329	1,152	130	13	18	17		17	135	0	34	13	1	1	29	404

NOTE

- Position - T:Top, M:Middle, B:Bottom
- Tensile test - Direction:Transverse, Gauge length:50.8mm (Rectangular), YP Mtd : 2 (0.2% off-set), 5 (0.5% underload), U (Upper yield point), L (Lower yield point)
- U.S.T - Ultrasonic test
- Impact test - Direction:Longitudinal, Size:10mmX7.5mm, SF:Shear fracture, LE:Lateral Expansion
- Division - C:Check analysis, L:Ladle analysis

ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION, SULPHIDE SHAPE CONTROL
The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

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Signature: **S. B. Park**
SURVEYOR TO : Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진제철소 : 중남 당진시 송악읍 북부산업로 1480
1480 Bukbusanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호
Order No. : F141000167

품명
Commodity : Hot Rolled Steel Plate

제품규격
Specification : ASME SA516-70 MT

고객사
Customer : EDMONTON STEEL PLATE

주문자
Contractor : 현대중합상사(주)

증명서 번호
Certificate No. : 20141128-PS-092-005

발행일자
Date of Issue : 2014-11-28

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50.8°F		
		Energy	SF	LE
		(Ft-Lbs)	(%)	(mm)
FA49878201	T	1: 144		
		2: 145		
		3: 143		
		A: 144		
FA49878202	T	1: 144		
		2: 145		
		3: 143		
		A: 144		
FA49878203	T	1: 144		
		2: 145		
		3: 143		
		A: 144		
FA49878301	T	1: 150		
		2: 144		
		3: 153		
		A: 150		

NOTE

- ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION, SULPHIDE SHAPE CONTROL
- The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

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Signature

S. B. Park

SURVEYOR TO : Chief Of Quality Assurance Team

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검사증명서 MILL TEST CERTIFICATE



당진제철소 : 중남 당진시 송악읍 북부산업로 1480
1480 Bukbusanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea

주문번호
Order No. : F141000167

품명
Commodity : Hot Rolled Steel Plate

제품규격
Specification : ASME SA516-70 MT

고객사
Customer : EDMONTON STEEL PLATE

주문자
Contractor : 현대중합상사(주)

증명서 번호
Certificate No. : 20141128-PS-092-006

발행일자
Date of Issue : 2014-11-28

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hard- ness Test HB	화학성분 Chemical Composition(%)														단위 Unit			
						YP	TS	EL	YP-EL	RA	YR	YP Mtd																	2 : x 100	3 : x 1,000		
						(KSI)	(%)	(%)	(%)	(%)	(%)				C	Si	Mn	P	S	Cr	Ni	Al	Ca	Cu	Mo	N	Nb	Tr	V	Sol -Al	CEQ	
0.375" x 120.5" x 480"	1	6,151	N28440	FA49878302	T	54.8	78.2	38				2	Good	149.7	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
															C	1,553	329	1,152	130	13	18	17	1	17	135	0	34	13	1	1	29	404
0.375" x 120.5" x 480"	1	6,151	N28440	FA49878303	T	54.8	78.2	38				2	Good	149.7	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
															C	1,553	329	1,152	130	13	18	17	1	17	135	0	34	13	1	1	29	404
0.375" x 120.5" x 480"	1	6,151	N28444	FA49878401	T	53.9	79.0	39				2	Good	154.6	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411
															C	1,621	347	1,148	142	12	18	17	1	14	134	0	35	13	1	1	42	410
0.375" x 120.5" x 480"	1	6,151	N28444	FA49878402	T	53.9	79.0	39				2	Good	154.6	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411
															C	1,621	347	1,148	142	12	18	17	1	14	134	0	35	13	1	1	42	410

NOTE

- Position - T:Top, M:Middle, B:Bottom
- Tensile test - Direction:Transverse, Gauge length:50.8mm (Rectangular), YP Mtd : 2 (0.2% off-set), 5 (0.5% underload), U (Upper yield point), L (Lower yield point)
- U.S.T - Ultrasonic test
- Impact test - Direction:Longitudinal, Size:10mmX7.5mm, SF:Shear fracture, LE:Lateral Expansion
- Division - C:Check analysis, L:Ladle analysis

• ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION, SULPHIDE SHAPE CONTROL
• The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature
S. B. Park
SURVEYOR TO : Chief of Quality Assurance Team

* 본 검사증명서는 원본인 전자문서(전자서명 정보 포함)로부터 출력된 사본입니다. 전자문서의 내용은 현대제철 고객포탈에서 확인하실 수 있습니다.(http://sm.hyundai-steel.com/cs/cm/login.jsp)
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검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진제철소 : 중남 당진시 송악읍 북부산업로 1480
1480 Bukbusanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호 Order No.	F141000167	고객사 Customer	EDMONTON STEEL PLATE	증명서 번호 Certificate No.	20141128-PS-092-006
품명 Commodity	Hot Rolled Steel Plate	주문자 Contractor	현대중합상사(주)	발행일자 Date of Issue	2014-11-28
제품규격 Specification	ASME SA516-7C MT				

제품번호 Product No.	Position	충격시험 Impact Test VNotch -50.8°F		
		Energy	SF	LE
		(Ft-Lbs)	(%)	(mm)
FA49878302	T	1: 150 2: 144 3: 153 A: 150		
FA49878303	T	1: 150 2: 144 3: 153 A: 150		
FA49878401	T	1: 149 2: 101 3: 165 A: 139		
FA49878402	T	1: 149 2: 101 3: 165 A: 139		

NOTE

• ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION. SULPHIDE SHAPE CONTROL
• The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

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WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature **S. B. Park**
SURVEYOR TO: Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukbusanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호 : F141000167
Order No.

품명 : Hot Rolled Steel Plate
Commodity

제품규격 : ASME SA516-70 MT
Specification

고객사 : EDMONTON STEEL PLATE
Customer

주문자 : 현대중합상사(주)
Contractor

증명서 번호 : 20141128-PS-092-007
Certificate No.

발행일자 : 2014-11-28
Date of Issue

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hard- ness Test HB	화학성분 Chemical Composition(%)														단위 Unit			
						YP	TS	EL	YP-EL	RA	YR	YP Mtd			C	S	Mn	P	S	Cr	N	B	Ca	Cu	Mo	N	Nb	Ti	V	Sol -Al	CEQ	
						(KSI)	(%)	(%)	(%)	(%)	(%)	4																				3
0,375" x 120,5" x 480"	1	6,151	N28444	FA49878403	T	53.9	79.0	39				2	Good	154.6	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411
															C	1,621	347	1,148	142	12	18	17	1	14	134	0	35	13	1	1	42	410

*** Sub Total(002) *** 12 73.8 2(Lbs)

*** Heat Treatment : Normalized : 1634.0°F 23 Min.

*** UST Application Spec. => ASME SA578(LEVEL B)

NOTE

- Position - T:Top, M:Middle, B:Bottom
- Tensile test - Direction:Transverse, Gauge length:50.8mm (Rectangular), YP Mtd : 2 (0.2% off-set), 5 (0.5% underload), U (Upper yield point), L (Lower yield point)
- U.S.T - Ultrasonic test
- Impact test - Direction:Longitudinal, Size:10mmX7.5mm, SF:Shear fracture, LE:Lateral Expansion
- Division - C:Check analysis, L:Ladle analysis

- ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION. SULPHIDE SHAPE CONTROL
- The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

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WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature

S. B. Park

SURVEYOR TO : Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukbusanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호 Order No. : F141000167	고객사 Customer : EDMONTON STEEL PLATE	증명서 번호 Certificate No. : 20141128-PS-092-007
품명 Commodity : Hot Rolled Steel Plate	주문자 Contractor : 현대중합상사(주)	발행일자 Date of Issue : 2014-11-28
제품규격 Specification : ASME SA516-70 MT		

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50, E °F		
		Energy	SF	LE
		(Ft-Lbs)	(%)	(mm)
FA49878403	T	1: 149 2: 101 3: 165 A: 139		

*** Sub Total(002) *** 12 73,8 2(Lbs)
 *** Heat Treatment : Normalized : 1634.0°F 23 Min.
 *** UST Application Spec. => ASME SA578(LEVEL: E)



NOTE

• ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION, SULPHIDE SHAPE CONTROL
 • The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
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Signature

 SURVEYOR TO : Chief Of Quality Assurance Team

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Material Test Report

FVC Heat Nbr: C1017BN

FVC Canada Ltd.

An AFGlobal Company

7410A-5 Street, S.E. Calgary, Alberta T2H 2L9

ISO 9001:2008 Certified

Sales: (403) 255-9011 Fax: (403) 255-7239

BROMLEY MECHANICAL 00011652	PO: 88128	Sales Order: C15999	Line: 1
A Division of Argo Sales Ltd	Item Code: LWN040600100A004A1	Qty: 8	
T1A 8R1 MEDICINE HAT, AB	Item Desc: LWN, SA350LF2, 600#, 4"x10", RF		
CA	Mill Heat: A14760		
Spec: ASTM A350 (17) / ASME SA350 (17) Section II Part A, - LF2 CL1			

Product compliant with NACE MR0175/ISO 15156-2:2015, Annex A (A.2.1.2, A2.1.3).
Product compliant with NACE MR0103/ISO 17945:2015, Section 13.1.1 and 13.1.3.

YIELD STRENGTH CALCULATED AT 0.2% OFFSET.

FVC STANDARD MANUFACTURING PRACTICES:

- 1) FLANGE DIMENSIONS & BOLTING COMPLY - ASME B16.5
- 2) SELF-REINFORCING NOZZLES COMPLY WITH SPECIFICATION OF SECTION VIII DIV. 1 OR DIV. 2 PER CUSTOMER DESIGN/FVC DESIGN
- 3) MATERIAL SPECIFICATION COMPLIES WITH ASME SECT. II PART A
- 4) ALL FVC MATERIAL MANUFACTURED PER FINE GRAIN PRACTICE
- 5) ALL FVC MATERIAL CERTIFIED PER EN 10204 TYPE 3.1 UNLESS OTHERWISE SPECIFIED
- 6) CERTIFICATE OF INSURANCE AVAILABLE UPON REQUEST

The recording of false, fictitious, or fraudulent statement or entries on this document may be punishable as a felony under federal statute.

EPCRA Supplier Notification: This product may contain one or more toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (Title III of the Superfund Amendments and Reauthorization Act of 1986) and 40 C.F.R. Part 372. Potentially reportable chemicals are indicated with a checkmark in the "EPCRA" column and a Chemical Abstract Services (CAS) registry number is provided for each such chemical in addition to the percent by weight of the chemical present in this product. It is your responsibility alone to determine whether your facility is required to submit a Toxic Release Inventory Report under EPCRA Section 313.

Certification No.: 1309166
Certification Date: 12/14/2017
Issued By: Bryun Jantzen


Bryun Jantzen

This report is issued in compliance with the requirements of EN10204 3.1 / ISO 10474 3.1.b

Material Test Report

FVC Heat Nbr: CTD

FVC Canada Ltd.

An AFGlobal Company

7410A-5 Street, S.E. Calgary, Alberta T2H 2L9

ISO 9001:2008 Certified

Sales: (403) 255-9011 Fax: (403) 255-7239

BROMLEY MECHANICAL 00011652	PO: 88128	Sales Order: C15999	Line: 2
A Division of Argo Sales Ltd	Item Code: LWN030600090A004A1	Qty: 8	
T1A 8R1 MEDICINE HAT, AB	Item Desc: LWN, SA350LF2, 600#, 3"x9", RF		
CA	Mill Heat: CB137093		
Spec: ASTM A350(17)/ASME SA350(17) - LF2 CL1 & ASTM A105/A105M(14)/ASME SA105/SA105M(15)			

Product compliant with NACE MR0175/ISO 15156-2:2015, Annex A (A.2.1.2, A2.1.3).
Product compliant with NACE MR0103/ISO 17945:2015, Section 13.1.1 and 13.1.3.

We hereby certify that the material represented by this document has been tested and is in conformance with the Purchase Order and Specification Requirements.

YIELD STRENGTH CALCULATED AT 0.2% OFFSET.

FVC STANDARD MANUFACTURING PRACTICES:

- 1) FLANGE DIMENSIONS & BOLTING COMPLY - ASME B16.5
- 2) SELF-REINFORCING NOZZLES COMPLY WITH SPECIFICATION OF SECTION VIII DIV. 1 OR DIV. 2 PER CUSTOMER DESIGN/FVC DESIGN
- 3) MATERIAL SPECIFICATION COMPLIES WITH ASME SECT. II PART A
- 4) ALL FVC MATERIAL MANUFACTURED PER FINE GRAIN PRACTICE
- 5) ALL FVC MATERIAL CERTIFIED PER EN 10204 TYPE 3.1 UNLESS OTHERWISE SPECIFIED
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Certification No.: 1309167
Certification Date: 12/14/2017
Issued By: Bryun Jantzen


Bryun Jantzen

This report is issued in compliance with the requirements of EN10204 3.1 / ISO 10474 3.1.b



SAN ENG STEEL FORGING CO LTD
 311, Jen Hsin Road, Jen Wu District
 Kaohsiung, Taiwan, R.O.C.
 TEL:07-3724249; FAX:07-3712923
 URL: www.saneng.com.tw
 e-mail: saneng@ksts.seed.net.tw

MILL TEST CERTIFICATE

EN10204-3.1.B(DIN50049/3.1.B)
 Customer: SEYBOLD INTERNATIONAL CORP.
 Order No.: 7010155(1)-CCTF

Certificate No.: SE10155A
 Date: 06/03/2015
 Page: 1 OF 1

PO# 4897077

PRODUCT		MATERIAL SPECIFICATIONS						DIMENSIONAL SPECIFICATIONS										
FORGED CARBON STEEL FLANGES		ASTM A105-14/ASME SA-105-14						ASME B16.5-13 CSA Z245.12										
Item No.	CODE NO	DESCRIPTION	QUANTITY	CHEMICAL COMPOSITION (%)													CE(*3)	
				C	Si	Mn	P	S	Cu	Cr	Ni	Mo	V	Nb	N			
				Min	0.350	0.100	0.600	-	-	-	-	-	-	-	-	-	-	
				Max	0.350	0.350	1.050	0.035	0.040	0.400	0.300	0.400	0.120	0.080	0.020			
1	7534442	150 WNRF XS 18" A105N	15 PCE		0.210	0.190	1.020	0.014	0.007	0.080	0.090	0.040	0.010	0.001	0.001	0.008		0.408
2	7535732	150 BLRF 4" A105N	400 PCE		0.220	0.220	1.150	0.018	0.004	0.006	0.020	0.010	0.002	0.006	0.001	0.007		0.418
3	7535848	150 BLRF 24" A105N	8 PCE		0.220	0.200	1.020	0.015	0.007	0.080	0.120	0.070	0.020	0.001	0.001	0.009		0.428
4	7535848	150 BLRF 24" A105N	1 PCE		0.200	0.180	1.020	0.013	0.011	0.100	0.110	0.040	0.010	0.001	0.001	0.009		0.404
5	7535848	150 BLRF 24" A105N	1 PCE		0.210	0.190	1.020	0.014	0.007	0.080	0.090	0.040	0.010	0.001	0.001	0.008		0.408
6	7534728	300 WNRF STD 16" A105N	5 PCE		0.200	0.190	1.030	0.019	0.009	0.110	0.130	0.050	0.020	0.002	0.001	0.008		0.413
7	7530560	600 WNRF S160 2" A105N	300 PCE		0.211	0.230	1.070	0.010	0.007	0.007	0.034	0.047	0.005	0.008	0.005	0.007		0.402

Item No.	Heat No.	T.S. (*1) (MPA)	Y.S. (*1) (MPA)	E.L. (*1) (%)	Hardness (HB)	R.A. (*1) (%)	Impact Test Temp:			Material Supplier	HEAT TREATMENT (*2)	
							Minimum:	Joule			<input checked="" type="checkbox"/> N	REMARKS
		Min	485.0	250.0	22.0	-	30.0	1	2	3		
		Max	-	-	-	187	-					
1	Y402355	520.0	362.0	35.4	153/151	69.5				KOTOBUKI	<input checked="" type="checkbox"/> N	880°CX4HRS
2	4723468	531.0	360.0	36.2	154/151	71.3				ACOMINAS	<input checked="" type="checkbox"/> N	CONFORMS WITH NACE MRO103-12 AND NACE MRO175/ISC15156.2-09 CLAUSE 7.2.1.4 REGION 3 AND ANNEX A.
3	Y402268	531.0	383.0	33.2	154/152	70.4				KOTOBUKI	<input checked="" type="checkbox"/> N	CONFORMS WITH Z245.12 CAT I GR248 SOUR SERVICE-09(FOR USE AS WELDING NECK AND BLIND FLANGES ONLY)
4	Y402256	524.0	383.0	36.4	153/151	69.5				KOTOBUKI	<input checked="" type="checkbox"/> N	MN TO C RATIO IS GREATER THAN 3.0"
5	Y402355	520.0	362.0	35.4	153/151	69.5				KOTOBUKI	<input checked="" type="checkbox"/> N	
6	Y402255	525.0	364.0	31.8	154/151	68.6				KOTOBUKI	<input checked="" type="checkbox"/> N	
7	522176	514.0	345.0	35.4	152/150	71.3				NTMK	<input checked="" type="checkbox"/> N	

*1: T.S. = Tensile Strength, Y.S.=Yield Strength, E.L.=Elongation, R.A.=Reduction of Area.
 *2: N=Normalized, A=Annealed, Q=Quenched, T=Tempered, S.T=Solution Treated, S.R=Stress Relieved, A.C=Air Cooled, F.C=Furnace Cooled, W.C=Water Cooled, O.C=Oil Cooled.
 *3: C.E. Value = C + (Mn /6) + (Cr + Mo +V) / 5 + (Ni + Cu) / 15

We hereby certify that the material has been tested in accordance with the above specification and also with the requirements called for by the above order.

Manager of Quality Assurance Dept

BROMLEY MECHANICAL SERVICES

MATERIAL INSPECTION REPORT

INSPECTED BY: MICHAEL QUINN

GRADE: SA 106B

DIA SIZE OR WITH: 2"
 NPS OD ID

DATE: MAY 9/2017

- HEADS 2:1
 HEMI
 WELD CAP
 OTHER

LENGTH: 20'

P.O.#: PO-86718

THICKNESS: 160

PIPE PUBLISHED NO: 0.344"

SUPPLIER: BHD TUBULAR LIMITED

- SHELL
 PIPE **NDE BY MANUFACTURER**

PLATE NOM

PART ID#: SPI 46449

- PLATE HYDRO YES NDE NO
 REPAD NO YES
 STRUCT. NO NO
 OTHER YES YES

Weight per foot for pipe over 4"

7.44

REQ. MIN TK:

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35556	145'	352145	0.339"	0.351"	0.348"	0.347"	0.350"	OK	OK	OK	ML
				0.349"	0.349"	0.348"	0.349"	OK	OK	OK	ML
				0.350"	0.344"	0.350"	0.347"	OK	OK	OK	ML
				0.343"	0.344"	0.339"	0.340"	OK	OK	OK	ML
				0.344"	0.345"	0.350"	0.353"	OK	OK	OK	ML
				0.356"	0.350"	0.345"	0.356"	OK	OK	OK	ML
				0.345"	0.356"	0.357"	0.344"	OK	OK	OK	ML

W/O#	RECEIVED & ACCEPTED BY: <i>[Signature]</i>	REQUIRED CODE MARKINGS:
CUSTOMER:	DATE: <u>6/2/17</u> <u>10/16/17</u>	TIANJIN PIPE(GROUP) CORPORATION-MADE IN CHINA ALL MARKING STENCILED ONTO PIPE BY MANUFACTURE
BMS STOCK		



MANUFACTURER: TIANJIN PIPE (GROUP) CORPORATION
 ADD: JINTANG ROAD DOXGLI DISTRICT, TIANJIN, CHINA
 TEL: 86-22-24801073
 FAX: 86-22-24801291

QUALITY CERTIFICATE

QR-11-8.2.4-19

Licence No.:

No: THM1510200014001

Contract No. TPCO-15255E L/C No. O.D.*W.T. 21N SCH160(60.30mm*8.74mm) Packing IN BUNDLES
 Order Product SEAMLESS STEEL LINE PIPE Steel grade Cat I Gr.290 SS /B/X42/Gr.B Total pieces 212
 P.O. No. Port of desti. Man. Method HOT ROLLING SEAMLESS Total metres
 Standard CSA Z245.1-14 /API SPEC 5L 45H/ASTM A106 -2014/ASME SA106 -2013 Length range 38-44FT Total Tons 30.177

Heat No.	Lot No.	Quantity				Delivery condition	Sample No.	1* Tem °C	Tensile test(MPa)					Shrink %	2* Tem °C	Impact test(J)							
		Pieces	Meters	Bundles	Tons				T.S.	Type	Y.S.	Elong.%	Size			AK1 Shear %	AK2 Shear %	AK3 Shear %	AVE	Shear %			
352145	71	212			30.177	As rolled	71-09-1086	A	25	515	Rt0.5	360	37.0										

BROMLEY MECHANICAL SERVICES
 Checked to ASME
 2017 6/11/18
 Sect. IIA 2015 MIN 0.339"
SA 530 US 35556 6/12/18
 Date 6/12/18

Heat No.	Lot No.	Sample No.	HV10	Hardness test (inside)				Hardness test (middle)				Hardness test (outside)				NDE	Date	Fla. test(1)	Fla. test(2)		
				1	2	3	4	AVE	1	2	3	4	AVE	1	2					3	4
352145	71	71-09-1086		172.0	172.0	173.0	172.0	172.0	167.0	166.0	166.0	166.0	166.0	167.0	168.0	169.0	168.0	168.0	ET+UT/Ø1.8+1.3		

Heat No.	Material	Chemical composition % (L: Ladle analysis P: Product analysis)																Hydro. Test				
		C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Al	V	Nb	Ti	B	Ca	N		H	O	CE(PCM)	CE(IW)
352145	L	0.14	0.25	1.04	0.010	0.003	0.04	0.07	0.03	0.06	0.029	0.04	<0.01	<0.01	<0.0005	0.0011				0.33	0.35	3010PSI/8S
	P	0.14	0.26	1.08	0.010	0.002	0.03	0.07	0.04	0.04	0.031	0.04	<0.01	<0.01	<0.0005	0.0013				0.34	0.35	
	P	0.14	0.26	1.08	0.010	0.002	0.03	0.07	0.04	0.04	0.031	0.04	<0.01	<0.01	<0.0005	0.0012				0.34	0.35	

5 NDE (100%) Visual and Dimension Hydro. Test Pipe End NDE Pipe End Beveling Residual Mag. Test SSC HIC We hereby state that all pipes are manufactured and inspected according to above standards and order. Seal for certification.

No. _____ Date _____
 Page (1) 2015-11-5 (FOR EXPORT ONLY)

NOTE: MR 0103-2010/NACE MR 0175-2009/ISO 15156-2:2009/CE (CSA) C-F (Mn+Si+Cu+Ni+V+Nb) / (S+SB) CE (IW)
 Note: C=Mn+Cr+Mo+V+Ni+Cu+Ni+P; ALUMINUM KILLED STEEL. EAF-FC-CONTINUOUS CASTING; ISO10474/EN10204-3.1; Silicon and calcium treated for inclusion morphology control in Steel
 Melting Visual inspection and Dimensional inspection & dimension controls as per ASME B36.10M

Remark: desti.=destination; Tem.=Temperature; speci.= specification; Man.=Manufacture; Fla.=Flattening; G=Good; Hydro.=Hydrostatic; Mag=Magnetic



edmonton exchanger
& manufacturing ltd.

CERTIFICATE OF COMPLIANCE

5545-89 Street Edmonton, Alberta Canada T6E 5W9 www.edmontonexchanger.com tel 780.468.6722 • QC fax 780.466.4668 • sales fax 780.466.5155

Customer **BROMLEY MECHANICAL SERVICES LT** PO 82429 Work Order C106685 Date 2014/12/08 CoC# 53669 Page 1 of 1

Item#	Description	Qty	Heat#	Brinell Hardn.
P106685-1	PLATE(S) - 1.0000" NOM X 96.5" X 48" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2009 Annex A</i>	1	N19328-FA47146301	MTR
P106685-2	PLATE(S) - 0.5000" NOM X 96.5" X 48" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2009 Annex A</i>	2	M13160-PA08436002	151
P106685-3	PLATE(S) - 0.2500" NOM X 96.5" X 48" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2009 Annex A</i>	2	0399A3-AM0777	151

Brinell Equipment: Newage Calibrated Pin
Brinell Hardness Tester

Material being supplied conforms to the latest ASME Code Section II, Part A, 2013 Edition. All welders and procedures are qualified to ASME Code Section IX.

Steve Zubryckyj (QAM)

Supplementary Examination - Items



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& manufacturing ltd.

CERTIFICATE OF COMPLIANCE

MTR List

5545-89 Street Edmonton, Alberta Canada T6E 5W9 www.edmontonexchanger.com tel 780.468.6722 • QC fax 780.466.4668 • sales fax 780.466.5155

Customer BROMLEY MECHANICAL	PO 82429	Work Order C106685	Date 2014/12/08	CofC# 53669	Page 1 of 1
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Email to barbh@argosales.com

Email to michaelq@argosales.com

Email to kolsen@edmontonexchanger.com

MTR ID	Pages	Heat#	Thickness	Material Grades
15930	1	M13160-PA08436002	.5"	SA 516-70 N
19061	8	N19328-FA47146301	1"	SA 516-70 N
19066	4	0399A3-AM0777	.25"	SA 516-70 N

Heat#	Material Grades	MTR ID
0399A3-AM0777	SA 516-70 N	19066
M13160-PA08436002	SA 516-70 N	15930
N19328-FA47146301	SA 516-70 N	19061

Heat#	Thickness	Grade	HIC Report Filename
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검사증명서

MILL TEST CERTIFICATE



당진제철소 · 충남 당진시 송악읍 북부산업로 1483
1483 Gukjearu-ro, Songak-Eup, Dangjin-Si, Chyngnam, Korea

주문번호 : E140700097
Order No.

품명 : Hot Rolled Steel Plate
Commodity

제품규격 : ASME SA516-70 MT LTV
Specification

고객사 : EDMONTON STEEL PLATE
Customer

주운자 : HYUNDAI CANADA INC.
Contractor

증명서 번호 : 20140921-PS-002-018
Certificate No.

발행일자 : 2014-09-21
Date of issue

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test						U,S,T	경도 시험 Hard- ness Test HB	화학성분 Chemical Composition(%)																					
						YP	TS	EL	YP-EL	RA	YR			YP Mtd	단위 Unit 2 : x100 3 : x1,000 4 : x10,000 5 : x100,000																				
						(KSI)	(%)	(%)	(%)	(%)	(%)				C	Si	Mn	P	S	Cr	N	3	Ca	Cu	Mo	N	Nb	Ti	V	Sol- Al	CEQ				
1" x 120.5" x 480"	1	16,407	N19331	FA47011101	T	51.7	76.1	50				2	Good	151.1	L	1,546	350	1,163	12E	14	18	18	2	4	4	3	2	4	3	3	3	3	3	3	407
															C	1,474	345	1,143	114	13	17	18	1	15	131	0	31	13	2	1	27	383	393		
1" x 120.5" x 480"	1	16,407	N19331	FA47145001	T	50.8	75.6	51				2	Good	158.0	L	1,546	350	1,163	12E	14	18	18	2	17	132	1	34	14	2	1	30	407			
															C	1,486	349	1,164	124	12	18	18	1	17	131	0	30	14	2	1	30	400			
1" x 120.5" x 480"	1	16,407	N19331	FA47145002	T	50.6	75.6	51				2	Good	156.0	L	1,546	350	1,163	12E	14	18	18	2	17	132	1	34	14	2	1	30	407			
															C	1,486	349	1,164	124	12	18	18	1	17	131	0	30	14	2	1	30	400			
1" x 120.5" x 480"	1	16,407	N19331	FA47145102	T	51.6	75.6	52				2	Good	146.1	L	1,546	350	1,163	12E	14	18	18	2	17	132	1	34	14	2	1	30	407			
															C	1,505	354	1,171	11E	16	18	18	1	15	132	0	31	14	2	2	27	403			

NOTE

- Position - T:Top, M:Middle, B:Bottom
- Tensile test - Direction:Transverse. Gauge length:50.8mm (Rectangular), YP Mtd : 2 (0.2% off-set),5 (0.5% underload). U (Upper yield point), L (Lower yield point)
- U.S.T - Ultrasonic test
- Impact test - Direction:Longitudinal, Size:10mmX10mm, SF:Shear fracture, LE:Lateral Expansion
- Division - C:Check analysis, L:Ladle analysis

ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2010 EDITION. SULPHIDE SHAPE CONTROL

The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied.
Applicable Code is ASME Section II Part A 2010 Edition. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature

S. B. Park

SURVEYOR TO : Chief Of Quality Assurance Team

* 본 검사증명서는 원본인 전자문서(전자서명 정보 포함)로부터 출력된 사본입니다. 전자문서의 내용은 현제제철 고객포털에서 확인하실 수 있습니다.(<http://sm.hyundai-steel.com/cs/cm/login.jsp>)
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검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진제철소 · 송남 당진시 송악읍 북부산업로 1482
1482 Bukbuan-ro, Songnam-Eup, Daejeon-Si, Chungnam, Korea



주문번호 Order No. : E140700097	고객사 Customer : EDMONTON STEEL PLATE	증명서 번호 Certificate No. : 20140921-PS-002-018
품명 Commodity : Hot Rolled Steel Plate	주문자 Contractor : HYUNDAI CANADA INC.	발행일자 Date of Issue : 2014-09-21
제품규격 Specification : ASME SA516-70 MT LTV		

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50.8°F		
		Energy (ft-Lbs)	SF (%)	LE (mm)
FA47011101	T	1: 272		
		2: 212		
		3: 210		
		A: 232		
FA47145001	T	1: 237		
		2: 175		
		3: 221		
		A: 211		
FA47145002	T	1: 237		
		2: 175		
		3: 221		
		A: 211		
FA47145102	T	1: 266		
		2: 249		
		3: 228		
		A: 247		

NOTE

- * ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2010 EDITION. SULPHIDE SHAPE CONTROL
- * The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied.
- Applicable Code is ASME Section II Part A 2010 Edition. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature: **S. B. Park**
SURVEYOR TO : Chief of Quality Assurance Team

* 본 검사증명서는 원본인 전자문서(전자서명 정보 포함)로부터 출력된 사본입니다. 전자문서의 내용은 현대제철 고객포탈에서 확인하실 수 있습니다.(<http://sm.hyundai-steel.com/cs/cm/login.jsp>)
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검사증명서 MILL TEST CERTIFICATE



당진제철소 · 충남 당진시 송악읍 북부산업로 1460
1460 Bukbeunup-Ro, Songak-Eup, Dangjin-Si Chungnam, Korea



주문번호 : E140700097
Order No.

품명 : Hot Rolled Steel Plate
Commodity

제품규격 : ASME SA516-70 MT LTV
Specification

고객사 : EDMONTON STEEL PLATE
Customer

주문자 : HYUNDAI CANADA INC.
Contractor

증명서 번호 : 20140921-PS-002-019
Certificate No.

발행일자 : 2014-09-21
Date of Issue

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hard- ness Test HB	화학성분 Chemical Composition(%)														단위 Unit				
						YP	TS	EL	YP-EL	RA	YR	YP Mtd			C	Si	Mn	P	S	Cr	Ni	B	Ca	Cu	Mo	N	Nb	Ti	V	Sol- Al	CEO		
						(KSI)	(%)	(%)	(%)	(%)	(%)				4	3	3	4	4	2	2	4	4	3	2	4	3	3	3	3	3		
1" x 120.5" x 480"	1	16,407	N19331	FA47145201	T	51.9	75.9	52				2	Good	150.2	L	1,546	350	1,163	125	14	18	18	2	17	132	1	34	14	2	1	30	407	
															C	1,553	346	1,173	130	13	18	18	1	19	137	0	26	14	2	2	29	408	
1" x 120.5" x 480"	1	16,407	N19331	FA47145202	T	51.9	75.9	52				2	Good	150.2	L	1,546	350	1,163	125	14	18	18	2	17	132	1	34	14	2	1	30	407	
															C	1,553	346	1,173	130	13	18	18	1	19	137	0	26	14	2	2	29	408	
1" x 120.5" x 480"	1	16,407	N19328	FA47145301	T	53.1	77.0	52				2	Good	152.4	L	1,538	348	1,172	132	13	18	18	2	15	130	0	38	14	2	2	26	406	
															C	1,522	343	1,162	123	12	17	18	1	13	128	0	32	13	2	1	25	401	
1" x 120.5" x 480"	1	16,407	N19328	FA47145302	T	53.1	77.0	52				2	Good	152.4	L	1,538	348	1,172	132	13	18	18	2	15	130	0	38	14	2	2	26	406	
															C	1,522	343	1,162	123	12	17	18	1	13	128	0	32	13	2	1	25	401	

NOTE
 * Position - T:Top, M:Middle, B:Bottom
 * Tensile test - Direction:Transverse, Gauge length:50.8mm (Rectangular), YP Mtd : 2 (0.2% off-set), 5 (0.5% underload), U (Upper yield point), L (Lower yield point)
 * U.S.T - Ultrasonic test
 * Impact test - Direction:Longitudinal, Size:10mmX10mm, SF:Shear fracture, LE:Lateral Expansion
 * Division - C:Check analysis, L:Ladle analysis

* ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2010 EDITION, SULPHIDE SHAPE CONTROL
 * The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied.
 Applicable Code is ASME Section II Part A 2010 Edition. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature
S. B. Park
 SURVEYOR TO : Chief Of Quality Assurance Team

* 본 검사증명서는 원본인 전자문서(전자서명 정보 포함)로부터 출력된 사본입니다, 전자문서의 내용은 현대제철 고객포털에서 확인하실 수 있습니다.(http://sm.hyundai-steel.com/cs/cm/login.jsp)
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검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진개설소 : 충남 당진시 송악읍 북부산업로 1489
1489 Bukbuanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호 Order No. : E140700097	고객사 Customer : EDMONTON STEEL PLATE	증명서 번호 Certificate No. : 20140921-PS-002-019
품명 Commodity : Hot Rolled Steel Plate	주문자 Contractor : HYUNDAI CANADA INC.	발행일자 Date of Issue : 2014-09-21
제품규격 Specification : ASME SA516-70 MT LTV		

제품번호 Product No.	Position	중격시험 Impact Test V Notch -50,8 °F		
		Energy	SF	LE
		(ft-Lbs) (mm)	(%)	(mm)
FA47145201	T	1: 228 2: 250 3: 195 A: 224		
FA47145202	T	1: 228 2: 250 3: 195 A: 224		
FA47145301	T	1: 245 2: 224 3: 234 A: 235		
FA47145302	T	1: 245 2: 224 3: 234 A: 235		

ORIGINAL

NOTE

- ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2010 EDITION. SULPHIDE SHAPE CONTROL
- The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied.
- Applicable Code is ASME Section II Part A 2010 Edition. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature **S. B. Park**
SURVEYOR TO : Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE



당진제철소 · 충남 당진시 중악읍 북부산업로 1483
1483 Bukbuan-ro, Songguk-eup, Dangjin-si, Chungnam, Korea



주문번호
Order No. : E140700097

품명
Commodity : Hot Rolled Steel Plate

제품규격
Specification : ASME SA516-70 MT LTV

고객사
Customer : EDMONTON STEEL PLATE

주요자
Contractor : HYUNDAI CANADA INC.

증명서 번호
Certificate No. : 20140921-PS-002-020

발행일자
Date of Issue : 2014-09-21

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hard- ness Test HB	화학성분 Chemical Composition(%)																	
						YP	TS	EL	YP-EL	RA	YR	YP Mtd			C	Si	Mn	P	S	Cr	Ni	B	Ca	Cu	Mo	N	Nb	Ti	V	S ₁	CEQ	
						(KSI)	(%)	(%)	(%)	(%)	(%)	4																				3
1" x 120.5" x 480"	1	16,407	N19328	FA47146101	T	53.3	78.2	51				2	Good	151.5	L	1,538	348	1,172	132	13	18	18	2	15	130	0	38	14	2	2	26	406
															C	1,626	331	1,137	130	13	17	18	1	14	129	0	30	13	2	1	25	407
1" x 120.5" x 480"	1	16,407	N19328	FA47146102	T	53.3	78.2	51				2	Good	151.5	L	1,538	348	1,172	132	13	18	18	2	15	130	0	38	14	2	2	26	406
															C	1,626	331	1,137	130	13	17	18	1	14	129	0	30	13	2	1	25	407
1" x 120.5" x 480"	1	16,407	N19328	FA47146202	T	53.3	76.6	51				2	Good	152.9	L	1,538	348	1,172	132	13	18	18	2	15	130	0	38	14	2	2	26	406
															C	1,554	343	1,157	125	12	17	18	1	15	127	0	33	13	2	1	24	403
1" x 120.5" x 480"	1	16,407	N19328	FA47146301	T	52.0	76.6	52				2	Good	149.6	L	1,538	348	1,172	132	13	18	18	2	15	130	0	38	14	2	2	26	406
															C	1,588	343	1,158	126	15	17	18	1	15	127	0	32	14	2	1	26	406

NOTE

- Position - T:Top, M:Middle, B:Bottom
- Tensile test - Direction:Transverse, Gauge length:50.8mm (Rectangular), YP Mtd : 2 (0.2% off-set), 5 (0.5% underload), U (Upper yield point), L (Lower yield point)
- U.S.T - Ultrasonic test
- Impact test - Direction:Longitudinal, Size:10mmX10mm, SF:Shear fracture, LE:Lateral Expansion
- Division - C:Check analysis, L:Ladle analysis

• ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2010 EDITION. SULPHIDE SHAPE CONTROL
 • The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied.
 Applicable Code is ASME Section II Part A 2010 Edition. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

BROWLEY MECHANICAL SERVICES
 Checked to ASME
 2017 08 11/16/18
 Sect. IIA 2013 Edd. min 0.999"
 SA 20
 Signature: S. B. Park Date: 11/8/15
 SURVEYOR TO: Chief Of Quality Assurance Team

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
 WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

US 33782

* 본 검사증명서는 원본인 전자문서(전자서명 정보 포함)로부터 출력된 사본입니다. 전자문서의 내용은 현대제철 고객포탈에서 확인하실 수 있습니다.(http://sm.hyundai-steel.com/cs/cm/login.jsp)
 * This Mill Test Certificate is a copy that has been printed from original electronic document(with digital signing).
 You are able to check an original electronic document at hyundaisteel's customer portal.(http://sm.hyundai-steel.com/cs/cm/login.jsp) * QRcode scanner App : 'QReal'

검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진제철소 : 충남 당진시 송악읍 옥부산업로 1480
1480 Bukhuseon-ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호 : E140700097
Order No.

품명 : Hot Rolled Steel Plate
Commodity

제품규격 : ASME SA516-70 MT LTV
Specification

고객사 : EDMONTON STEEL PLATE
Customer

주문자 : HYUNDAI CANADA INC.
Contractor

증명서 번호 : 20140921-PS-002-020
Certificate No.

발행일자 : 2014-09-21
Date of Issue

ORIGINAL

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50.8 °F		
		Energy	SF	LE
		(FT-Lbs)	(%)	(mm)
FA47146101	T	1: 240 2: 209 3: 232 A: 226		
FA47146102	T	1: 240 2: 209 3: 232 A: 226		
FA47146202	T	1: 249 2: 246 3: 245 A: 246		
FA47146301	T	1: 237 2: 235 3: 119 A: 198		

NOTE

• ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2010 EDITION. SULPHIDE SHAPE CONTROL
• The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied.
Applicable Code is ASME Section II Part A 2010 Edition, The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

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Signature

S. B. Park

SURVEYOR TO : Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE



당진개철소 · 충남 당진시 송악읍 북부신영로 1483
14830 Bukhusanuc-Ro, Songgok-Eup, Daejeon-Si, Chungnam, Korea



주문번호 : E140700097
Order No.

품명 : Hot Rolled Steel Plate
Commodity

제품규격 : ASME SA516-70 MT LTV
Specification

고객사 : EDMONTON STEEL PLATE
Customer

주문자 : HYUNDAI CANADA INC.
Contractor

증명서 번호 : 20140921-PS-002-021
Certificate No.

발행일자 : 2014-09-21
Date of Issue

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hard- ness Test H-B	화학성분 Chemical Composition(%)													단위 Unit							
						YP	TS	EL	YP-EL	RA	YR	YP			Mtd	C	Si	Mn	P	S	O	N	B	Ca	Cu	Mo	Ni	Nb	Ti	V	S _{total}	CEQ			
						(KSI)	(%)	(%)	(%)	(%)	(%)	(%)																					4	3	3
1" x 120.5" x 480"	1	16,407	N19328	FA47146302	T	52.0	76.6	52				2	Good	149.6	L	1,538	348	1,172	132	13	18	18	2	2	4	4	3	2	4	3	3	3	3	3	406
															C	1,588	343	1,158	125	15	17	18	1	15	127	0	32	14	2	1	26	406			
1" x 120.5" x 480"	1	16,407	N19331	FA47146401	T	53.5	76.8	51				2	Good	151.3	L	1,546	350	1,163	125	14	18	18	2	17	132	1	34	14	2	1	30	407			
															C	1,595	329	1,141	119	13	17	18	1	18	132	0	29	13	2	1	28	405			
1" x 120.5" x 480"	1	16,407	N19331	FA47146402	T	53.5	76.8	51				2	Good	151.3	L	1,546	350	1,163	125	14	18	18	2	17	132	1	34	14	2	1	30	407			
															C	1,595	329	1,141	119	13	17	18	1	13	132	0	29	13	2	1	28	405			

*** Sub Total(007) *** 15 246,105(Lbs)

*** Heat Treatment : Normalized : 1634,0°F 46 Min

*** UST Application Spec. => ASME SA578(LEVEL B)

NOTE

- Position - T:Top, M:Middle, B:Bottom
- Tensile test - Direction:Transverse. Gauge length:50.8mm (Rectangular), YP Mtd : 2 (0.2% off-set), 5 (0.5% underload), U (Upper yield point), L (Lower yield point)
- U.S.T - Ultrasonic test
- Impact test - Direction:Longitudinal, Size:10mmX10mm, SF:Shear fracture, LE:Lateral Expansion
- Division - C:Check analysis, L:Ladle analysis

• ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2010 EDITION. SULPHIDE SHAPE CONTROL
• The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied.
Applicable Code is ASME Section II Part A 2010 Edition. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은검사의 결과 지정된 규격에 합격한 것을 증명합니다.
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Signature

S. B. Park

SURVEYOR TO: Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE (Attached Sheet)



당첨지점소 : 충남 당진시 중앙읍 북부산업로 1483
1480 Bukbueon-ro, Sangak-Eup, Dangjin-Si Chungnam, Korea



주문번호
Order No. : E140700097

품명
Commodity : Hot Rolled Steel Plate

제품규격
Specification : ASME SA516-70 MT LTV

고객사
Customer : EDMONTON STEEL PLATE

주문자
Contractor : HYUNDAI CANADA INC.

증명서 번호
Certificate No. : 20140921-PS-002-021

발행일자
Date of Issue : 2014-09-21

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50.8°F		
		Energy	SF	LE
		(F-Lbs)	(%)	(mm)
FA47146302	T	1: 237 2: 235 3: 119 A: 198		
FA47146401	T	1: 250 2: 225 3: 230 A: 235		
FA47146402	T	1: 250 2: 225 3: 230 A: 235		
*** Sub Total(007) *** 15 246,105(Lbs)				
*** Heat Treatment : Normalized : 1634 (°F) 46 Min.				
*** UST Application Spec. => ASME SA578(LEVEL B)				
NOTE	* ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2010 EDITION. SULPHIDE SHAPE CONTROL. * The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. * Applicable Code is ASME Section II Part A 2010 Edition. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.			
	상기의 제품은 검사 결과 지정된 규격에 합격한 것을 증명합니다. WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS			
				Signature SURVEYOR TO : Chief Of Quality Assurance Team



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FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS
(Alternate Form for Single Chamber, Completely Shop or Field Fabricated Vessels Only)
As Required by the Provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1

1. Manufactured and certified by Bromley Mechanical Services, A Division of Argo Sales Inc. 925 23 St. SW, Medicine Hat AB T1A 8R1 CANADA
(Name and address of Manufacturer)

2. Manufactured for Arc Resources General Partnership, 1200, 308 - 4th Avenue SW, Calgary, Alberta T2P 0H7 **Ab719520**
(Name and address of Purchaser)

3. Location of installation LSD: 03-18-080-14 W6M
(Name and address)

4. Type Vertical Gp Separator 35528-04 V4393.231 33915-REG Rev.0 N/A 2018
(Horizontal or vertical, tank) (Manufacturer's serial number) (CRN) (Drawing number) (National Board number) (Year built)

5. ASME Code, Section VIII, Division 1 2015 Edition N/A N/A
[Edotopm amd Addemda. if applicable (date)] (Code Case numbers) [Special service per UG-120(d)]

6. Shell SA516-70N 1.500" 0.125" 36" OD 10'-0" S/S
(Material spec. number, grade) (Nominal thickness) (Corr. allow.) (Inner diameter) [Length (overall)]

Body Flanges on Shells

No.	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Location	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
N/A												

7. Seams Butt (Type 1) Full 100 1150°F 1.5 Butt (Type 1) Full 100 1
[Long. (welded, dbl., snl., lap, butt)] [R. T. (spot or full)] (Eff., %) (H. T. temp.) (Time, hr) [Girth (welded, dbl., snl., lap, butt)] [R. T. (spot or full)] (Eff., %) (No. of courses)

8. Heads: (a) Material SA516-70N (b) Material SA516-70N
(Spec. no., grade) (Spec. no., grade)

	Location (Top, Bottom, Ends)	Minimum Thickness	Corrosion Allowance	Crown Radius	Knuckle Radius	Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side To Pressure (Convex or Concave)
(a)	TOP	1.4375"				2:1				Concave
(b)	BOTTOM	1.4375"				2:1				Concave

Body Flanges on Heads

	Location	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
(a)	N/A											
(b)	N/A											

9. MAWP 1440 Psig N/A at max. temp. 130°F N/A
(Internal) (External) (Internal) (External)
 Min. design metal temp. -20°F at 1440 Ps Hydro., pneu., or comb. test pressure 1872 Psig

Proof test N/A

10. Nozzles, inspection, and safety valve openings:

Purpose (Inlet, Outlet, etc.)	No.	Diameter or Size	Type	Material		Nozzle Thickness		Reinforcement Material	Attachment Details		Location (Insp. Open.)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
Inlet	1	4"	CL600RFLWN	A350LF2Cl	A350LF2Cl	1.000"	0.125"		UW-16.1(c)		Shell
Outlet	1	4"	CL600RFLWN	A350LF2Cl	A350LF2Cl	1.000"	0.125"		UW-16.1(c)		Inspection
LSHH	1	3"	CL600RFLWN	A350LF2Cl	A350LF2Cl	0.810"	0.125"		UW-16.1(c)		Shell
TI	1	3"	CL600RFLWN	A350LF2Cl	A350LF2Cl	0.810"	0.125"		UW-16.1(c)		Inspection
Bridle Conn.	3	2"	CL600RFLWN	SA106B	SA105N	0.344"	0.125"		UW-16.1(a)	Type 1	Shell
PSV, LG(4), PIT	6	2"	CL600RFLWN	SA106B	SA105N	0.344"	0.125"		UW-16.1(a)	Type 1	Shell
Dump(2), Drain	3	2"	CL600RFLWN	SA106B	SA105N	0.344"	0.125"		UW-16.1(a)	Type 1	atum head, sh

11. Supports: Skirt Yes Lugs 0 Legs 0 Other 0 Attached Datum head weld
(Yes or no) (Number) (Number) (Describe) (Where and how)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report: CA: 0.125", PSV suppl by others per UG125, No-Impact testing exempt per UCS-66(a)(b) & UG20(f)(1-5)
(Name of part, item number, Manufacturer's name and identifying stamp)

Volume: 64.5 cu ft or 1.84 cu m, Construction drawing Cad. No. 35528-Group Rev.0

FORM U-1A (Back)

A671952

CERTIFICATE OF SHOP / FIELD COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. "U" Certificate of Authorization Number 30634

expires 10/26/2019 Date Jan 22, 2018 Co. name Bromley Mechanical Services, A Division of Argo Sales Inc. (Manufacturer) Signed [Signature] (Representative)

CERTIFICATE OF SHOP / FIELD INSPECTION

Vessel constructed by Bromley Mechanical Services, A Division of Argo Sales Inc. at 925 23 St. SW, Medicine Hat, AB T1A 8R1 CANADA

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and employed by Alberta Boiler's Safety Association (ABSA)

have inspected the component described in this Manufacturer's Data Report on Jan 22, 2018, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. By signing this certificate neither the Inspector nor his/her employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his/her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date Jan 22, 2018 Signed [Signature] (Authorized Inspector) Commissions NB 10304 D00003103 [National Board (incl. endorsements)]

BROMLEY MECHANICAL SERVICES

Pressure Vessel Travel Sheet

Travel Sheet AI Review/Date: <u>Dec 17/17</u>	Travel Sheet Initiation :Merle K	Travel Sheet Revision Number :
---	----------------------------------	--------------------------------

Customer : Arc Resources Ltd.

DRAWING/CAD#: 35528-GROUP	DRAWING/CAD REVISION #: 0	WO-35528	SERIAL # : 35528-04
---------------------------	---------------------------	----------	---------------------

W/O DESIGNATION : 36" OD x 10'0" x 1440 Psi Test Separator

Seq.	Item	Comments	Q.C.I.	Date	A.I. Hold Points	A.I.	Date	Owner	Date
1.	Calculations in File		OK	12/11/17	R	OK	Dec 17/17	D. Hage	MAY 07 2018
2.	Release of App'd Dwg.		OK	12/11/17	R	OK	Dec 17/17	D. Hage	MAY 07 2018
3.	Heat Numbers Recorded		OK	JAN 19 2018	W	OK	Jan 19/18	D. Hage	MAY 07 2018
4.	Material Examination		OK	JAN 19 2018				D. Hage	MAY 07 2018
5.	MTRs Checked		OK	JAN 19 2018	W	OK	Jan 22/18	D. Hage	MAY 07 2018
6.	WPS(s) Checked		OK	12/11/17	R	OK	Dec 17/17	D. Hage	MAY 07 2018
7.	Welder(s) Qualified		OK	12/12/17	W	OK	Jan 19/18	D. Hage	MAY 07 2018
8.	Thicknesses Verified & Recorded		OK	JAN 19 2018				D. Hage	MAY 07 2018
9.	Shell(s) & Head(s) Fit-up Inspection		OK	JAN 19 2018	W	OK	Jan 19/18	D. Hage	MAY 07 2018
10.	Nozzles & Fittings Fit-up Inspection		OK	JAN 19 2018				D. Hage	MAY 07 2018
11.	Nozzle Orientation		OK	JAN 19 2018				D. Hage	MAY 07 2018
	Nozzle & Flange Rating Checked		OK	JAN 19 2018				D. Hage	MAY 07 2018
13.	Impact Tests	Exempt						D. Hage	MAY 07 2018
14.	Internals Checked	Per UG-76(C)	OK	JAN 11 2018	W	OK	Jan 11/18	D. Hage	MAY 07 2018
15.	Final Internal Inspection		OK	JAN 19 2018	H	OK	Jan 19/18	D. Hage	MAY 07 2018
16.	Weld Size Checked		OK	JAN 19 2018				D. Hage	MAY 07 2018
17.	Welder I.D. Checked		OK	12/12/17	R	OK	Jan 11/18	D. Hage	MAY 07 2018
18.	Final External Inspection		OK	JAN 19 2018	W	OK		D. Hage	MAY 07 2018
19.	Radiography	RT - 1	OK	1/17/18	W	OK	Jan 19/18	D. Hage	MAY 07 2018
20.	Other N.D.E. MPI	MPI LIFT LUGS	OK	1/17/18				D. Hage	MAY 07 2018
21.	Final Ext. Prior to P.W.H.T.	1150F for 135 minutes	OK	JAN 19 2018	W	OK	Jan 19/18	D. Hage	MAY 07 2018
22.	PWHT Details		OK	1/22/18	R	OK	Jan 22/18	D. Hage	MAY 07 2018
23.	PWHT Chart Checked		OK	1/22/18	R	OK	Jan 19/18	D. Hage	MAY 07 2018
24.	Hydrostatic Test 1872 Psig	Shell Side Gauge # FLU17 FLUG.	OK	1/22/18	H	OK	Jan 22/18	D. Hage	MAY 07 2018
25.	CRN Drawing	V 4393.231	OK	12/11/17	R	OK	Dec 17/17	D. Hage	MAY 07 2018
26.	N.C.R. #							D. Hage	MAY 07 2018
27.	Nameplate Stamping		OK	1/22/18	W	OK	Jan 22/18	D. Hage	MAY 07 2018
28.	Manuf. Data Report Completed & Verified		OK	1/22/18	R	OK	Jan 22/18	D. Hage	MAY 07 2018
29.	Nameplate Installation							D. Hage	MAY 07 2018

Authorized Inspector shall be presented with the Travel Sheet prior to construction so that he can designate addition inspection points and/or Hold Points. Any revisions shall be marked with a delta symbol with revision number and described at bottom of this page.

I/R Denotes Inspection/Review Point W/H Denotes Witness/Hold Point

Z:\BMSDOCS\travel sheet.doc

VESSEL SERIAL NUMBER: 35528-0.4 MATERIAL THICKNESS VERIFICATION AND IDENTIFICATION				WPS / WELD I.D. / WELDER SYMBOLS / FIT-UP					
Designation	Thickness	Material Spec. & Grade	Heat & Slab Number or I.D. Number	WPS	Weld I.D.	Welder Symbol	Verify Fit Up & Type 1 Joint	Date	ABSA USE
Shell 1	1.500"	SA516-70N	C 32 399	BA-1	L-1	M6	DS	Dec 14 2018	Jan 11/18
					L-				
					L-				
Head 1	1.500"	SA516-70N	393188 5028101	BA-1	L-				
Head 2	1.500"	SA516-70N	C32392		C-1	S3	DS	Jan 15 2018	Jan 19/18
)					C-2	S3	DS	Jan 15 2018	Jan 9/18
Welding Consumable Heat Number			H# 3897 8435T		C-				

ATTACHMENT AND / OR NOZZLE MATERIAL THICKNESS VERIFICATION AND IDENTIFICATION						WELDER ID / WPS & ABSA USE				
Mark	Mat. I.D.	Neck	Fitting	Flange	Repad or Attachment	Cal. B, C	Cal D	WPS	ABSA USE	
N1 N2	Spec.-Grd.			SA350LF2	CL1		G8			
	Thk./Rating			4"-CL 600	RFLWN (1.0") WT		M2			
	Heat# or ID			C1017BN			K2			
N3 N4	Spec.-Grd.			SA350LF2	CL1		M2			
	Thk./Rating			3" CL 600	RFLWN (0.81")		K2			
	Heat# or ID			CTD						
N8 Thru N12	Spec.-Grd.	SA106B		SA105N	RFWN	KH	G8			
	Thk./Rating	2"s160(0.343")		2"-600 s160			AG			
	Heat# or ID	VJ3.5.5.56		522176			CM			
	Spec.-Grd.						W3			
	Thk./Rating									
	Heat# or ID									
	Spec.-Grd.									
	Thk./Rating									
	Heat# or ID									
	Spec.-Grd.									
	Thk./Rating									
	Heat# or ID									
	Spec.-Grd.									
	Thk./Rating									
	Heat# or ID									

Used for recording miscellaneous information (Skirt/ Lift Lug Heat numbers, Another shell etc...)				
	Material	Heat Number	WPS	Remarks
Skirt 3/8" x 27 3/16"	SA516-70N	VJ 35658	AG	
Lift Lug 1"	SA516-70N	VJ 33732	G8	

Shells & Heads			Final		
Task	Name/Welder symbol	Date	Task	Name/Welder symbol	Date
Layout / Checked by			Weld ID/ Material code/ Vessel Serial number stamped	CM W3 M2 K2 AG KH D1 K3 G8	JAN 19 2018
Shell cut by			Vessel completed by	AG K3	JAN 19 2018
Internals by	AG D1	1/10/18	Final Quality Control check		JAN 19 2018


FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS
 (Alternate Form for Single Chamber, Completely Shop or Field Fabricated Vessels Only)

As Required by the Provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1

1. Manufactured and certified by Bromley Mechanical Services, A Division of Argo Sales Inc. 925 23 St. SW, Medicine Hat AB T1A 8R1 CANADA
 (Name and address of Manufacturer)
2. Manufactured for Arc Resources General Partnership, 1200, 308 - 4th Avenue SW, Calgary, Alberta T2P 0H7 **A671952**
 (Name and address of Purchaser)
3. Location of installation LSD: 03-18-080-14 W/M
 (Name and address)
4. Type Vertical Gp Separator 35528-04 V4393.231 33915-REG Rev 0 N/A 2018
 (Horizontal or vertical, tank) (Manufacturer's serial number) (CRN) (Drawing number) (National Board number) (Year built)
5. ASME Code, Section VIII, Division 1 2015 Edition N/A N/A
 [Edition and Addenda, if applicable (date)] (Code Case numbers) [Special service per UG-120(f)]
6. Shell SA516-70N 1.500" 0.125" 36" OD 10'-6" S/S
 (Material spec. number, grade) (Nominal thickness) (Corr. allow.) (Inner diameter) (Length overall)

Body Flanges on Shells

Bolting

No.	CERTIFIED BY:		BROMLEY		Medicine Hat, Alberta		
N/A			MECHANICAL SERVICES		(800) 215 - 9806		
			A DIVISION OF ARGO SALES INC.		(403) 526 - 3142		
7. S	 U W RT-1 HT	M.A.W.P.	<u>1440</u>	PSI AT	<u>130</u>	°F	
8. H		M.D.M.T.	<u>-20</u>	°F AT	<u>1440</u>	PSI	
(a)		MFR'S SER. NO.	<u>35528-04</u>	YR. BUILT	<u>2018</u>		
(b)		VESSEL TYPE	<u>VERTICAL SEPARATOR</u>				
9. N		TAG	<u>ARC RESOURCES LTD.</u>				
10.		M.A.W.P.	<u>9929</u>	KPA AT	<u>54</u>	°C	
(link)		SHELL NOM.	<u>1.500"</u>	MATERIAL	<u>SA516-70N</u>		
		HEAD MIN.	<u>1.4375"</u>	MATERIAL	<u>SA516-70N</u>		
		C.A.	<u>0.125"</u>	CRN	<u>V4393.231</u>		
11.		A 671952					

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report: CA: 0.125", PSV suppl by others per UG125, No-impact testing exempt per UCS-66(a)(b) & UG20(f)(1-5)
 (Name of part, item number, Manufacturer's name and identifying stamp)
- Volume: 64.5 cu ft or 1.84 cu m, Construction drawing Cad. No. 35528-Group Rev 0

CERTIFIED BY:



Medicine Hat, Alberta
(800) 215 - 9806
(403) 526 - 3142

4
W
RT-1
HT.

M.A.W.P. 1440 PSI AT 130 °F

M.D.M.T. -20 °F AT 1440 PSI

MFR'S SER. NO. [] YR. BUILT 2018

VESSEL TYPE VERTICAL SEPARATOR

TAG ARC RESOURCES LTD.

M.A.W.P. 9929 KPA AT 54 °C

SHELL NOM. 1.500" MATERIAL SA516-70N

HEAD MIN. 1.4375" MATERIAL SA516-70N

C.A. 0.125" CRN V4393-231

35528-03
to
35528-04

16 Jan
2018

WAF 35528-Gr.
Jave.

Integrity Engineering Ltd

403-362-5757 1-800-442-8721

DATE: Dec 19 2017

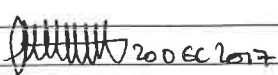


PAGE 1 OF 1

CLIENT ADDRESS	<u>Bromley Mechanical</u>	VIE JOB NO.	<u>BMS-110</u>	TOTAL HRS	<u>6.0</u>	KM'S	
		P.O. NO.		IN	<u>18:00</u>	DAILY SUBS	
JOB LOCATION	<u>Arc</u>	AFE NO.		OUT	<u>00:00</u>	ROOMS	
		WORK ORDER #	<u>35528</u>	IN		DAILY MEALS	
CONTRACTOR	<u>BMS</u>	PROJECT NO.		OUT		LATE MEAL	

TECHNIQUE NO.	<u>R7001 tech 04</u>	WT	WALL THICKNESS	WELD DEFECTS 1. SLIGHT 2. MEDIUM 3. REJECT					
MAX SOURCE SIZE	<u>2.7 x 2.9 mm</u>	WS	WELDER SYMBOL	AB	ARC BURN	C	CRACK	S	SLAG
TYPE OF MATERIAL	<u>C.S</u>	EX	NUMBER OF EXPOSURES	EP	EXCESSIVE PENETRATION		HL	HIGH LOW	
LEAD SCREENS FRONT	<u>01010</u>	SO	SOURCE TO OBJECT DISTANCE OR C FOR CONTACT	IP	INCOMPLETE PENETRATION		P	POROSITY	
LEAD SCREENS BACK	<u>01010</u>			IC	INTERNAL CONCAVITY		LC	LOW COVER	
FILM PER CASSETTE	<u>1</u>	SSF	MAX. DISTANCE FROM SOURCE SIDE OF OBJECT TO FILM	IUC	INTERNAL UNDERCUT		CR	CONCAVE ROOT	
FILM DENSITY	<u>2.6 - 3.4</u>			EUC	EXTERNAL UNDERCUT		LF	LACK OF FUSION	
FILM BRAND	<u>Agfa</u>	EW	ASTM ESSENTIAL WIRE #	BT	BURN THROUGH		HB	HOLLOW BEAD	

WELD NO.	WELD SIZE	WT	WS	NO. EX	SO	SSF	EW #	FILM TYPE	CODE	LIST ACCEPTABLE DEFECTS	OK	SHOW LOCATION OF UNACCEPTABLE DEFECTS	REJECT
1													
2													
3													
4	<u>36"</u>	<u>1.5"</u>	<u>N2</u>	<u>8</u>	<u>26"</u>	<u>1.69</u>	<u>11</u>	<u>05</u>	<u>4</u>				
5	<u>0-15</u>										✓		
6	<u>15-30</u>										✓		
7	<u>30-45</u>										✓		
8	<u>45-60</u>										✓		
9	<u>60-75</u>										✓		
10	<u>75-90</u>										✓		
11	<u>90-105</u>										✓		
12	<u>105-120</u>										✓		
13													
14													
15													
16	<u>36"</u>	<u>1.5"</u>	<u>N2</u>	<u>8</u>	<u>26"</u>	<u>1.69</u>	<u>11</u>	<u>05</u>	<u>4</u>				
17	<u>0-15</u>										✓		
18	<u>15-30</u>										✓		
19	<u>30-45</u>										✓		
20	<u>45-60</u>										✓		
21	<u>60-75</u>										✓		
22	<u>75-90</u>										✓		
23	<u>90-105</u>										✓		
24	<u>105-120</u>										✓		
25													
26													
27													
28													
29													
30													

Film used 16 - 4 1/2" x 17"
SNT # 5335 L1 2 RT MT PT

AUTHORIZED BY (signature): 	WELDING CODES: <u>UWSI-1S</u>	TECHNICIANS SIGNATURE 	 Kevin Hayward RT, MT, PT Level II CGSB/SNT-TC-1A # 5335 INTERPRETED BY (stamp)
		ASSISTANT Jessica M L II	

587-353-6630

1-800-442-8721

DATE: Jan 16 2018


PAGE 1 of 2

CLIENT ADDRESS	Bromley Mechanical	VIE JOB NO.	BMS-110	Total Hrs	4	KM'S	
		P.O. NO.	88241	IN	20:00	DAILY SUBS	
		AFE NO.		OUT	0:00	ROOMS	
JOB LOCATION	ARC	WORK ORDER #	35528	IN		DAILY MEALS	
CONTRACTOR	BMS	PROJECT NO.		OUT		LATE MEAL	

TECHNIQUE NO.	RT001 tech04	WT	WALL THICKNESS	WELD DEFECTS 1. SLIGHT 2. MEDIUM 3. REJECT					
MAX SOURCE SIZE	3.64mm	WS	WELDER SYMBOL	AB	ARC BURN	C	CRACK	S	SLAG
TYPE OF MATERIAL	C.S	EX	NUMBER OF EXPOSURES	EP	EXCESSIVE PENETRATION		HL	HIGH LOW	
LEAD SCREENS FRONT	0.010	SO	SOURCE TO OBJECT	IP	INCOMPLETE PENETRATION		P	POROSITY	
LEAD SCREENS BACK	0.010	DISTANCE OR C FOR CONTACT		IC	INTERNAL CONCAVITY		LC	LOW COVER	
FILM PER CASSETTE	1	SSF	MAXIMUM DISTANCE FROM	IU	INTERNAL UNDERCUT		CR	CONCAVE ROOT	
FILM BRAND	agfa	SOURCE SIDE OF OBJECT TO FILM		EU	EXTERNAL UNDERCUT		LF	LACK OF FUSION	
FILM DENSITY	2.5 - 2.8	EW	ASTM ESSENTIAL WIRE #	BT	BURN THROUGH		HB	HOLLOW BEAD	

Weld No.	Size	WT	WS	No. EX	SO	SSF	EW #	film type	CODE	LIST ACCEPTABLE DEFECTS	OK	SHOW LOCATION OF UNACCEPTABLE DEFECTS		REJECT
WO#35528 SN#35528-04														
C1	36"	1.5"	S3	1	16.5	1.69	10	D5	4					
0-15											✓			
15-30											✓			
30-45											✓			
45-60											✓			
60-75											✓			
75-90											✓			
90-105											✓			
105-0											✓			
C2	36"	1.5"	S3	1	16.5	1.69	10	D5	4					
0-15											✓			
15-30											✓			
30-45											✓			
45-60											✓			
60-75											✓			
75-90											✓			
90-105											✓			
105-0											✓			

Film used 16- 4 1/2" X 17" SNT#5335 Level 2 RT, MT, PT

AUTHORIZED BY: (signature)
 170118

WELDING CODES:
UW51-15

TECHNICIANS SIGNATURE

CEDO Jessie Marshall

 Kevin Hayward
RT, MT, PT Level II
CGSB/SNT-TC-1A # 5335
Interpreted by: (stamp)



Integrity Engineering Ltd

MAGNETIC PARTICLE EXAMINATION REPORT

DATE Jan 16 2018

Report No. 806021

CLIENT	Bromley Mechanical	VIE Job#	BMS-110	PAGE		2 of 2	
Address:		W.O. #	88241	SUBSISTENCE			
Location:		P.O. #	35528	<input type="checkbox"/> Breakfast	<input type="checkbox"/> Lunch	<input type="checkbox"/> Dinner	
Project:	Arc	AFE #		<input type="checkbox"/> Room	<input type="checkbox"/> Late Meal	<input type="checkbox"/> 1 Day	
Contractor	BMS			in	out	in	out
						hours	km's
						me 1	-

VISION PROCEDURE AND CODE REFERENCE	
PROCEDURE >	MT001
REVISION >	REV03
TECHNIQUE >	1
LIGHTING EQUIPMENT	
<input checked="" type="checkbox"/> Flash Light	<input type="checkbox"/> Trouble Light
<input checked="" type="checkbox"/> Output > 100fc@Surface	<input type="checkbox"/> Sun Light
	<input type="checkbox"/> Halogen Lamp
	<input type="checkbox"/> Output > 1000µW/cm²
BLACK LIGHT MODEL / S/N# >	
LIGHT METER MODEL / S/N# >	LX10108/S674492
CALIBRATION DUE DATE >	

MT EQUIPMENT EMPLOYED	
METHOD >	<input checked="" type="checkbox"/> Wet <input type="checkbox"/> Dry <input checked="" type="checkbox"/> AC <input type="checkbox"/> DC
	<input type="checkbox"/> Fluorescent <input checked="" type="checkbox"/> Visible <input checked="" type="checkbox"/> Yoke
SERIAL NUMBER >	9064
MAKE & MODEL >	ES-X
CALIBRATION DATE >	Jan 16 2018
LIFT TEST VERIFIED PRIOR TO USE >	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
TEST BAR WEIGHT >	<input checked="" type="checkbox"/> 10 lbs <input type="checkbox"/> 40 lbs
TEST BAR SERIAL NUMBER >	ATI-002
DEMAG REQUIRED >	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

CONSUMABLE MATERIALS			
PARTICLE BRAND >	Magnaflux	PRODUCT # >	7HF
SUSPENSION >	<input type="checkbox"/> Water <input type="checkbox"/> Oil <input checked="" type="checkbox"/> N/A	COLOUR >	<input type="checkbox"/> Grey <input type="checkbox"/> Red <input type="checkbox"/> Yellow <input checked="" type="checkbox"/> Black <input type="checkbox"/> Green
CONTRAST PAINT BRAND >	Magnaflux	PRODUCT # >	WCP-2
		BATCH # >	16F04K
		BATCH # >	14H12K

SURFACE CONDITIONS			
The Technique Has Been Demonstrated Over a Painted Surface >	<input type="checkbox"/> YES (In-Service Applications Only)	<input type="checkbox"/> NO	<input checked="" type="checkbox"/> Not Applicable
SURFACE CONDITION >	<input type="checkbox"/> As Ground <input checked="" type="checkbox"/> As Welded	<input type="checkbox"/> Machined	<input type="checkbox"/> Shot Blasted
SURFACE TEMPERATURE >	<input checked="" type="checkbox"/> 4°C/40°F To 50°C/120°F	<input type="checkbox"/> 50°C/120°F to 316°C/600°F	<input type="checkbox"/> Other



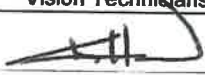
Arc wo# 35528

Black on white MPI inspection was performed on 2 lifting lugs.

1.1 SN# 35528-04 2 lifting lugs MPI-OK

No relevant indications were present at the time of inspection.

SNT # 5335 w-1 2RT MT PT

 170118 Authorized by: (signature)	Acceptance Standards	Vision Technicians	 KEVIN HAYWARD CGSB #5335 LEVEL II RT MT PT
	Asme Sec 8 Div 1 Assistant CEDO Jessie Marshall		

Heat Treatment Instructions

Customer:	Argo / Seven Generations / Arc	Date:	1/20/2018
WO No.(s):	WO-35558, 35549, 35528		

COMPONENT DESCRIPTION:

Dwg No. / Line No. / Serial No.	Diameter	Thk. (in.)	Material	Length	Weight (lbs)
SN:35558-04	36"	1.500	P1	120"	8000
SN:35528-03, 04	36"	1.500	P1	120"	13200
SN:35549-06	36"	1.500	P1	112"	8450

TYPE OF HEAT TREATMENT:

PRESSURE VESSEL STRESS RELIEF P-No. 1

HEATING

Temperature to be raised from 800°F (427°C) to 1150°F (621°C) at a maximum rate of

266 °F/hr, (**130** °C /hr)

NOTE: THIS VALUE MUST NEVER EXCEED 400°F (222°C) PER HOUR.

[Calculated rate = 400 degrees F /hr. (222 degrees C/hr) divided by the maximum metal thickness of the shell or head plate in inches.]

HOLDING

Temperature to be held at a minimum of 1150°F (621°C) for:

90 minutes

[Holding time to be determined by Table UCS-56 for Nominal Thickness as specified in UW-40(f)]

COOLING

Temperature to be lowered from 1150°F (621°C) to 800°F (427°C) at a maximum rate of

333 °F/hr, (**167** °C /hr)

NOTE: THIS VALUE MUST NEVER EXCEED 500°F (278°C) PER HOUR.

[Calculated rate = 500 degrees F /hr. (278 degrees C/hr) divided by the maximum metal thickness of the shell or head plate in inches.]

From 800°F (427°C) items may be cooled in still air

ADDITIONAL REQUIREMENTS

1. Job Number and description required on heat treatment charts along with the operator's signature and date.
2. Reporting of thermocouple attachment method and location and verification of furnace thermocouple calibration is required.
3. A sufficient number of thermocouples shall be located to control and maintain uniform distribution of temperature on all vessels and parts. Thermocouples shall be directly attached to the item or provision shall be made for thermocouple placement at bottom, centre and top of the furnace charge in accordance with the ASME Code
4. During the heating period, there shall not be a greater variation in temperature throughout the portion of the vessel being heated than 250°F (139°C) within any 15 ft. (4.6m) interval of length. An adequate number of thermocouples must be used to ensure this Code requirement is met. This limitation is also applicable to the temperature variations between the different thicknesses of various vessel components
5. During the holding period, there shall not be a greater difference than 150°F (83°C) between the highest and lowest temperature throughout the portion of the vessel being heat treated, except where the range is further limited by these instructions.
6. If Capacitor Discharge welding is used to attach thermocouples an ASME Code Section IX Welding Procedure Specification is required (WPS qualification is not required), and the energy output must be limited to 125 W-Seconds.
7. The method of thermocouple removal shall not damage the heat treated item.

APPROVALS

Quality Control Inspector Signature

[Signature]
Capacitor Discharge/per UW 40

Date

[Signature]
Jan 22, 2018

Thermocouple Attachment Method/Locations

#1-20-JAN-2018

Furnace Heat Number:

Furnace Operator Signature:

[Signature]

Date:

1/20/18



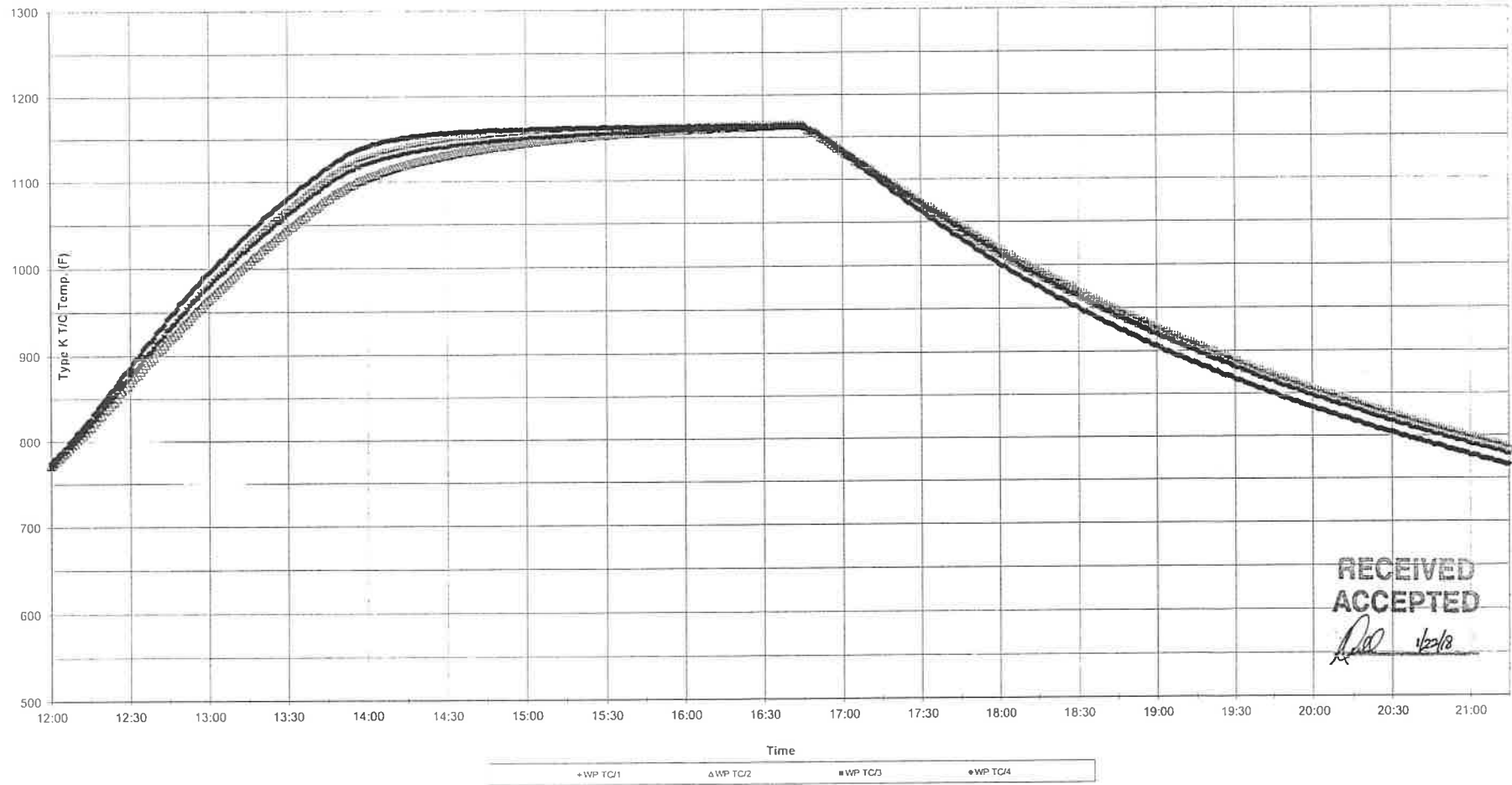
925 23 Street S.W. Medicine Hat, AB T1A 8R1
HEAT TREATMENT SERVICES

Date Started:	20-Jan-18	Date Finished:	20-Jan-18
Customer/WO Ref:	Argo / Seven Generations / Arc Resources		
	WO-35558, 35549, 35528		
Furnace S/N	23600		
Furnace Cal Date:	9/1/2017		
Procedure:	Internal PWHT Instructions/Cust Supplied		
Heat Treating Per:	A.S.M.E		

Rate of Rise:	800°F to 1150°F at 266°F per hour.
Holding Temp:	1150°F
Holding Time:	90 min. Minimum
Cooling Rate:	1150°F to 800°F at 333°F per hour.
Material(s):	P1
Operator:	Barry Gutfriend

Notes:	(1) 36" X 10'-0" X 1440 psi SN.35558-04		
	(1) 36" X 9'-4" X 1440 psi SN.35549-06		
	(2) 36" X 10'-0" X 1440 psi SN.35528-03 SN.35528-04		
Signature:		Date:	Jan 22, 18
Heat Number:	# 20-JAN-2018		

HEAT TREATMENT RECORD



RECEIVED
ACCEPTED

1/22/18

SUPERHEAT FGH CONTROL UNIT CERTIFICATE OF CALIBRATION

Asset Number _____ Supercontroller Number 23600

Range 0 - 2000°F Sensor Type K

Calibration Procedure Number C1-TP-02-CMTE (Rev. 2)

Date September 2, 2017 Calibration Due February 28, 2018

This instrument has been calibrated within the manufacturer's specifications.

These specifications state that the maximum allowable error is $\pm 6^{\circ}\text{F}$

During calibration, if the "°F As Found"/"°F As Left" numbers (values) are the same and no adjustments have been made, only one number (value) will be noted.


Zone 1A	Input Signal	200	600	1000	1400	1800
	°F As Found	203	603	1003	1403	1803
	°F As Left					
Zone 7A	Input Signal	200	600	1000	1400	1800
	°F As Found					
	°F As Left					
Zone 1B	Input Signal	200	600	1000	1400	1800
	°F As Found					
	°F As Left					
Zone 7B	Input Signal	200	600	1000	1400	1800
	°F As Found					
	°F As Left					

Environmental Conditions: Temperature (°F): 50.0

The above unit has been calibrated and tested. It is directly traceable to the National Institute of Standards & Technology (N.I.S.T) or the National Research Council (N.R.C).

Max Kohut

Calibrated By


Signature

MEASURING & TEST EQUIPMENT USED

Make: FGH Type: Ezecal Model: MK3

Serial No.	Cert. Date	Due Date
3450	April 28, 2017	October 27, 2017



C000000053189



"Two great brands coming together."

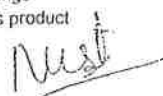
107 North Fifth Street • Saddle Brook, NJ 07663-6167 • 888-4TE-WIRE • 201-845-9400 • www.tewire.com

CERTIFICATE OF CONFORMANCE

INVOICED TO:	AIRCOM INSTRUMENTATION	DELIVERED TO:	AIRCOM INSTRUMENTATION
	ATTN: ACCTS PAYABLE 9328-37 AVENUE EDMONTON, AB, CANADA T6E5K3		9328-37 AVENUE EDMONTON, AB, CANADA T6E5K3

CERTIFICATE NO:	DATE:	CUSTOMER PO:	SALES ORDER:	PAGE:	
C000000053189	8-Jan-14	20321	P105099	1 of 1	
DATE OF MFG:					
1/8/2014					
ITEM	PRODUCT	LOT #	# of Spools	Shipping QTY	Total
2	FW6381 CEFIR2200 ULTRA-20-KK Your Part N215-241	15014-115	2	1000ft	1000ft
<p>CALIBRATION RESULTS ARE TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) AND MEET DEVIATION TOLERANCES AS DEFINED IN ISA MC96.1 (FORMERLY ANSI) AND ASTM-E-230.</p> <p>ALL PRODUCTS MANUFACTURED IN THE USA.</p>					

This is to certify that the materials furnished on this shipment are in conformance with the requirements, specifications, and drawings of the above referenced customer purchase order. Inspection and test records are on file and available for customer review. This product contains no metallic Mercury or Mercury compounds and is free from Mercury contamination.

Signed by: 

Date: 1/8/2014

PRESSURE-TEST REPORT

DATE OF TEST: Jan 22 2008 HYDRO-TEST NO.: 1-22-18 AVZ

CUSTOMER: Arc Resources Ltd LOCATION: Bromley Mechanical
(LSD OR ADDRESS)

WORK ORDER NO.: 35528 SIZE: DIAMETER: 36"
LENGTH: 10'-0"

SERIAL NO.: 35528-03-35528-04

NUMBER OF ITEMS TESTED: Two

HYDRO-TEST PRESSURE: 1872 PSI OR 12907 KPA

MEDIUM: WATER MEDIUM TEMPERATURE: See Chart

TIME: HYDRO-TEST ON 1145 A M AMBIENT TEMP: SEE CHART PRESSURE: 1872 PSI INIT: [Signature]

HYDRO-TEST OFF 13:56 P M AMBIENT TEMP: SEE CHART PRESSURE: 1872 PSI INIT: [Signature]

LENGTH OF TEST: 131 MINUTES

TEST GAUGE No.: FLU 17 RANGE: 0-10⁰⁰⁰ PSI

TEST GAUGE No.: FLU 6 RANGE: 0-10⁰⁰⁰ PSI

CHART RECORDER NO.: _____ RANGE: _____



QCI WITNESSED BY: [Signature]

OWNER WITNESSED BY: [Signature]

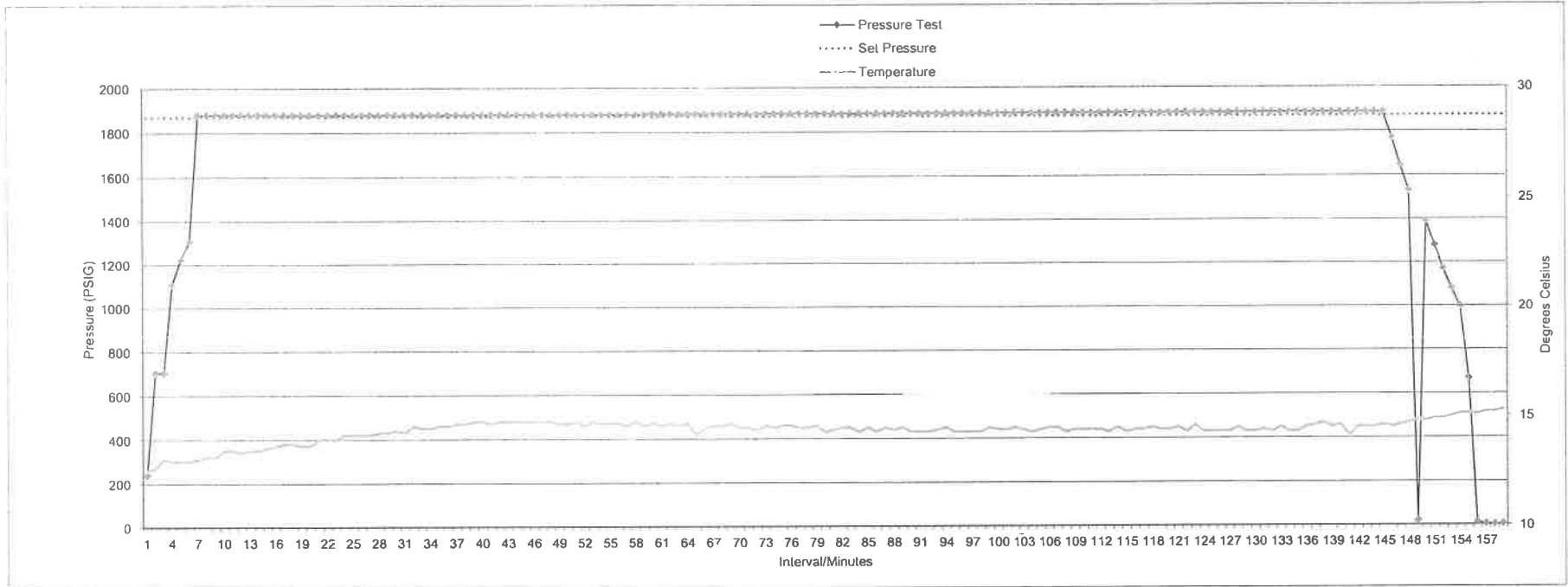
QCM APPROVED BY: [Signature]

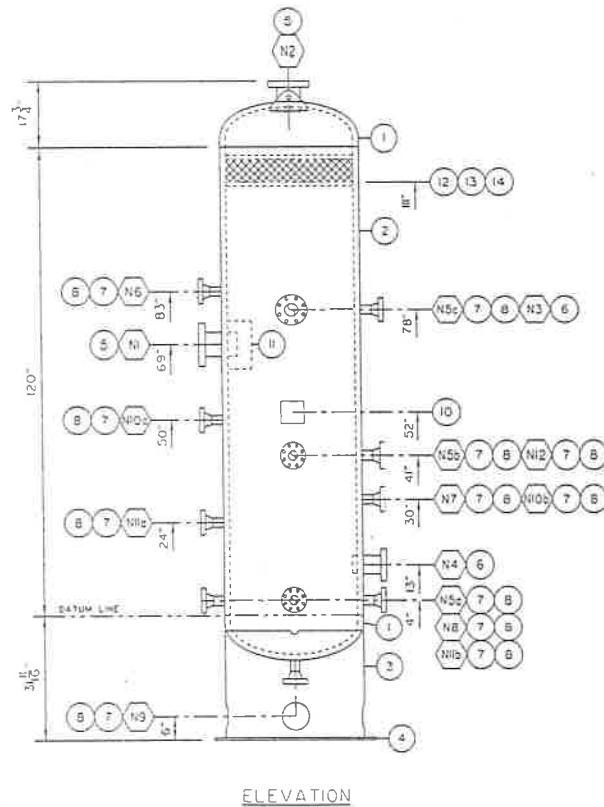


Date Started	1/22/2018	Date Finished	1/22/2018
Customer / WO Ref:	Arc Resources WO 35528		
Notes:	Vessel SN 35528-03-04		
	FLU17		
Gauge Details	FLUKE. 700G, 3812477, 4.04		
Interval	1 minutes		

Witnessed by:	DEREK HOPE 
Approved by:	M. KANEWISCHER 

PRESSURE TEST RECORD





BROMLEY

MECHANICAL SERVICES
A DIVISION OF ARGO SALES INC.

MATERIAL REPORT

DATE: Jan 22 2018

CUST: ARC Resources Ltd.

CHECKED: [Signature]

SERIAL NO: 35528 -04

SIZE: 36" OD X 10'-0"

PRESSURE: 1440 PSI

W.O: 35528

CRN: V4393.231

DRAWING NO.: 33915-REG Rev.0

CAD NO: 35528-GROUP

ITEM	DESCRIPTION	HEAT NUMBER	HEAT NUMBER	MATERIAL	MIN.THK.
1a	SE HEAD 36"OD X 1.500" NOM(1.4375" MIN)(HOT FORMED)	393188	50281 01	SA516-70N	
1b	SE HEAD 36"OD X 1.500" NOM(1.4375" MIN)(HOT FORMED)	C32392		SA516-70N	1.452"
2	SHELL, 36" OD X 1.500" X 10'-0" LONG	C32399		SA516-70N	1.500"
3	ROLLED PLATE, 36"OD X 0.375" X 27 3/16" LONG	VS35658		SA516-70N	0.375"
4	BASE PLATE - PLATE, 1/2" (SEE DETAIL)			SA36/44W	0.500"
5	RFLWN, 4" 600 ANSI X 10" OAL	C1017BN		SA350LF2 CL1	1.000"
6	RFLWN, 3" 600 ANSI X 9" OAL	CTD		SA350LF2 CL1	0.810"
7	RFWN, 2" 600 ANSI SCH.160	522176		SA105N	0.344"
8	PIPE, 2" SCH.160 (0.344") X 2 7/8" LONG	VS35556		SA106B	0.344"
9	LIFT LUG - PLATE, 1" (SEE DETAIL)	VS33732		SA516-70N	1.000"
10	TAG PLATE HOLDER & VESSEL ID PLATE			SA36/ALUM	
11	INLET DIVERTER - PLATE 3/8" (SEE DETAIL)			SA36/44W	0.375"

BROMLEY MECHANICAL SERVICES MATERIAL INSPECTION REPORT

INSPECTED BY: **MICHAEL QUINN**

DATE: **OCTOBER 17/2017**

P.O.#: **PO-87390**

SUPPLIER: **EDMONTON EXCHANGER**

PART ID#: **VES 37604**

REQ. MIN TK: **1.3750"**

GRADE: **SA 516-70 MTEE**

DIA SIZE OR WITH: **36"**
 NPS OD ID

HEADS 2:1
 HEMI
 WELD CAP
 OTHER

SHELL

PIPE **NDE BY MANUFACTURER**

PLATE **HYDRO** YES **NDE** NO
 NO

REPAD NO YES
 NO

STRUCT. NO NO
 YES YES

OTHER YES YES

LENGTH _____
 THICKNESS _____
 PIPE PUBLISHED NOM _____
 PLATE NOM **1.5000"**

Weight per foot for pipe over 4"

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKING	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
	1	393188-50281-01	1.4490"					ok	ok	ok	MJ

W/O# WO-35505	RECEIVED & ACCEPTED BY: <i>[Signature]</i>	REQUIRED CODE MARKINGS:
CUSTOMER: XTO ENERGY CANADA	DATE: 1/23/18	



edmonton exchanger
& manufacturing ltd.

CERTIFICATE OF COMPLIANCE

MTR List

5545-89 Street Edmonton, Alberta Canada T6E 5W9 www.edmontonexchanger.com tel 780.468.6722 • QC fax 780.466.4668 • sales fax 780.466.5155

Customer **BROMLEY MECHANICAL** PO 87390 Work Order C116122 Date 2017/10/07 CofC# 65686 Page 1 of 1

Email to barbh@argosales.com

Email to michaelq@argosales.com

Email to kolsen@edmontonexchanger.com

MTR ID	Pages	Heat#	Thickness	Material Grades
17050	3	371036-61219-01	2.25"	SA 516-70 N
18821	5	393188-50281-01	1.5"	SA 516-70 N
19585	10	G3944-170930128	.375"	SA 516-70 N
20547	8	438465-33950-01	2.25"	SA 516-70 N
		438466-47587-01	2.25"	SA 516-70 N
20564	3	6370C4-BA2158	1"	SA 516-70 N
20647	5	442226-54115-01	2.25"	SA 516-70 N
20762	14	P27167-FA82613901	.375"	SA 516-70 N
20785	4	445203-98563-01	2.25"	SA 516-70 N
20806	4	P33253-FA84552601	1.5"	SA 516-70 N
		P33253-FA84552901	1.5"	SA 516-70 N
20817	14	P33260-FA84456802	.375"	SA 516-70 N

Heat#	Material Grades	MTR ID	Item#
371036 61219-01	SA 516-70 N	17050	S116122-2
393188 50281-01	SA 516-70 N	18821	H116122-7
438465 33950-01	SA 516-70 N	20547	S116122-5
438466 47587-01	SA 516-70 N	20547	S116122-2
			S116122-3
442226 54115-01	SA 516-70 N	20647	H116122-1
445203 98563-01	SA 516-70 N	20785	H116122-1
6370C4 BA2158	SA 516-70 N	20564	H116122-6
G3944 170930128	SA 516-70 N	19585	S116122-11
P27167 FA82613901	SA 516-70 N	20762	S116122-4
P33253 FA84552601	SA 516-70 N	20806	S116122-8
			S116122-10
P33253 FA84552901	SA 516-70 N	20806	S116122-9
P33260 FA84456802	SA 516-70 N	20817	S116122-4

Heat#	Thickness	Grade	HIC Report Filename
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edmonton exchanger & manufacturing ltd.

CERTIFICATE OF COMPLIANCE

5545-89 Street Edmonton, Alberta Canada T6E 5W9 www.edmontonexchanger.com tel 780.468.6722 • QC fax 780.466.4668 • sales fax 780.466.5155

Customer **BROMLEY MECHANICAL SERVICES LT** PO 87390 Work Order C116122 Date 2017/10/07 CofC# 65686 Page 1 of 2

Item#	Description	Qty	Heat#	Brinell Hardn.	Required Min Thk	Recorded Min Thk	Form. Proc.
H116122-1	HEAD(S) - Semi-Elliptical 2:1 - 2.2500" NOM (2.1875" MIN) X 54" ID (Material Spec: SA 516-70 Normalized) Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A	1	442226 54115-01	132	2.1875"	2.1960"	1
		1	445203 98563-01	MTR	2.1875"	2.1950"	1
H116122-6	HEAD(S) - Semi-Elliptical 2:1 - 1.0000" NOM (0.8750" MIN) X 16" OD (Material Spec: SA 516-70 Normalized) Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A	1	6370C4 BA2158	164	0.8750"	0.8800"	1
H116122-7	HEAD(S) - Semi-Elliptical 2:1 - 1.5000" NOM (1.3750" MIN) X 36" OD (Material Spec: SA 516-70 Normalized) Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A	1	393188 50281-01	144	1.3750"	1.4490"	1

Forming Procedure:

1. Hot Formed @ 1650F/899C and Air Cooled

NOTE: All items which were heat treated during or after forming shall be documented as a forming procedure per UG-79(c) and UCS-79(f).

Brinell Equipment: Newage Calibrated Pin
Brinell Hardness Tester

Supplementary Requirements

Normalized Material Identification Marking:

'MT' indicates normalized by the mill per ASME Code Section II, Part A, SA 20, Paragraph 13.1.1.

'GMT' indicates normalized by Edmonton Exchanger per ASME Code Section II, Part A, SA 20, Paragraph 13.1.2.

'GT' indicates normalized by Edmonton Exchanger per ASME Code Section VIII Division 1, UG-85 or ASME Code Section I, PG-77.4.

The item(s) listed above comply with the requirements of ASME Code Section I, PG-29, PG-81 and ASME Code Section VIII, Division 1, UCS-79(d), UG-79 & UG-81. All welders and procedures are qualified to ASME Code Section IX. Material being supplied conforms to the latest ASME Code Section II, Part A, 2015 Edition.

Steve Zubryckj (QAM)



edmonton exchanger
& manufacturing ltd.

CERTIFICATE OF COMPLIANCE

5545-89 Street Edmonton, Alberta Canada T6E 5W9

www.edmontonexchanger.com

tel 780.468.6722 • QC fax 780.466.4668 • sales fax 780.466.5155

Customer **BROMLEY MECHANICAL SERVICES LT**

PO 87390

Work Order C116122 Date 2017/10/07 CofC# 65686

Page 2 of 2

Supplementary Examination - Items

Edmonton Exchanger

UT: SA 435

(for -7)

Acceptable to ASME Code

EE Procedure:	UIP-001 REV.11
Equipment:	Krautkramer USN-58L
Serial No.:	010X9H
Transducer:	Benchmark
Calibration:	Plate
Grid:	6 "
Material:	SA 516-70 N
Examination Surface / Side:	Tight Scale
Trans Type:	1", 2 1/4 MHz, 0 deg
Primary Ref. Res. dB 100%:	44
Scanning Sens. dB:	56
Range Cal. In.:	5
Coaxial Cables:	BNC 8 ft long
Search Unit Serial No.:	00V5J3
Couplant:	Water
Tech:	Tracy Enman (#11226)
CGSB / SNT:	Level II
Time:	Day Shift
Date:	2017/10/02

Edmonton Exchanger

UT: SA 435

(for -1)

Acceptable to ASME Code

EE Procedure:	UIP-001 REV.11
Equipment:	Krautkramer USN-58L
Serial No.:	010X9H
Transducer:	Benchmark
Calibration:	Plate
Grid:	6 "
Material:	SA 516-70 N
Examination Surface / Side:	Tight Scale
Trans Type:	1", 2 1/4 MHz, 0 deg
Primary Ref. Res. dB 100%:	48
Scanning Sens. dB:	60
Range Cal. In.:	8
Coaxial Cables:	BNC 8 ft long
Search Unit Serial No.:	00V5J3
Couplant:	Water
Tech:	Tracy Enman (#11226)
CGSB / SNT:	Level II
Time:	Day Shift
Date:	2017/10/05



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1.B AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 488422-02.04.14	A08/ Manufacturer's order/ A03 Certificate No. 391887-004	Sheet 1/...
A05 Established inspecting body DH	A06 Purchaser EDMONTON STEEL, EDMON Final receiver EDMONTON STEEL, EDMON	A07.1 No. ED10636-J1010-ER A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design. SA516-70	SA20-S5		 18821	
B03 Any suppl. requirements	ASME-IIA:2013 DIL-HUE-3:R33-2014-01-21			

B01-B99 Description of the product

B14 Item No.	B08 Number of pieces	B09 Thickness	B10 Width INCH	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No./ Test No.	A09 Purchaser article number
01	1	1,5000 x	97,00000 x	480,00000	8984	N	393188	50281-01	
01	1	1,5000 x	97,00000 x	480,00000	8984	N	393188	50281-02	
**	2				17968				
03	1	2,2500 x	121,00000 x	480,00000	16810	N	391142	94974-01	
03	1	2,2500 x	121,00000 x	480,00000	16810	N	391142	95029-01	
03	1	2,2500 x	121,00000 x	480,00000	16810	N	392569	94891-01	
**	3				50430				
***	5				68398				

B04 Product delivery condition

ITEM NO.: 01,03
 N: HT: 1670 GR.F +36 -27 GR.F
 SOAKING TIME TO ATTAIN THE TARGET TEMPERATURE OVER THE WHOLE SECTION: 1-1,75 MIN/MM (25-45 MIN/INCH)
 COOLING IN STILL AIR

B06 Marking of the product

ITEM NO.: 01,03
 STEEL DESIGNATION SA516 70 MTLTV SA516 60 MTLTV
 HEAT NO. / TRADEMARK / ROLLED PLATE NO.-TEST NO. / INSPECTOR'S STAMP

B07-B99 Further information about the product

ITEM NO.: 01,03
 THICKNESS REDUCTION RATIO >= 3,0 IS FULFILLED (CF. A/SA20 PAR. 5.3)

A04 Manufacturer's mark	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.			AG der Dillinger Hüttenwerke Postfach 1580, D-66748 Dillingen/Saar Inspection department	A01
		B. BALDAUF Test House Manager	Inspector's stamp	Date 02.04.14	PP 1



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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1.B AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 488422-02.04.14	A06/ Manufacturer's order/ A03 Certificate No. 391887-004	Sheet 2/...
A05 Established Inspecting body DH	A06 Purchaser EDMONTON STEEL, EDMON Final receiver EDMONTON STEEL, EDMON	A07.1 No. ED10636-J1010-ER A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design. SA516-70	SA20-S5			
B03 Any suppl. requirements	ASME-IIA:2013 DIL-HUE-3:R33-2014-C1-21			

C10-C29 Tensile test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/ C01	C03 Temp. GR.F	C10 KSI RP02	C11	C12 RM	C13	A % L0=2IN	C14-C15
01	393188	50281		K1	QV	RT	48,6		74,2		35	
03	391142	94974		K1	QV	RT	48,1		74,2		35	
03	391142	95029		K1	QV	RT	49,0		73,8		30	
03	392569	94891		K1	QV	RT	46,4		73,1		35	

C30-C39 Hardness test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/C01	C03 Temp. GR.F	C30 Method of test	C35	C31 Individual values	C32 Mean value
01	393188	50281		K1	O		RT HBW 10/3000	HB	144 144 143	144
03	391142	94974		K1	O		RT HBW 10/3000	HB	141 141 141	141
03	391142	95029		K1	O		RT HBW 10/3000	HB	136 137 137	137
03	392569	94891		K1	O		RT HBW 10/3000	HB	141 141 141	141

C40-C49 Impact test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/ C01	C03 Temp. GR.F	C41 Width of test piece	C40 Type of test piece	C44 Testing method	C46 Energy	C45	C42 Individual values AV=FT.LBF	C43 Mean value
01	393188	50281		K1	LV	-51		CHP-V			AV 8	89 116 52	86
03	391142	94974		K1	LV	-51		CHP-V			AV 8	90 78 77	82
03	391142	95029		K1	LV	-51		CHP-V			AV 8	89 99 113	100
03	392569	94891		K1	LV	-51		CHP-V			AV 8	89 110 107	102

Z01/Z02/Z03 We hereby certify that the above mentioned materials have been delivered in accordance with the terms of order.



B. Baldauf
B. BALDAUF
Test House Manager



Inspector's stamp

AG der Dillinger Hüttenwerke
Postfach 1580, D-66748 Dillingen/Saar
Inspection department

Date 02.04.14

PP 1

A01



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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1.B AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 488422-02.04.14	A08/ Manufacturer's order/ A03: Certificate No. 391887-004	Sheet 3/...
A05 Established inspecting body DH	A06 Purchaser EDMONTON STEEL, EDMON Final receiver EDMONTON STEEL, EDMON	A07.1 No. ED10636-J1010-ER A07.2 No.	A01 Product HEAVY PLATES	
B02/ Steel design SA516-70	SA20-S5			
B03 Any suppl. requirements	ASME- IIA: 2013 DIL-HUE-3: R33-2014-01-21			

C70-C99 Chemical composition % - Heat analysis

B07.2 Heat	C70	C	SI	MN	P	S	N	CU	MO	NI	CR	V	NB	SN	TI
391142	Y	0,179	0,348	1,17	0,008	0,0006	0,0063	0,024	0,020	0,063	0,218	0,000	0,000	0,000	0,002
392569	Y	0,175	0,378	1,18	0,009	0,0011	0,0064	0,027	0,015	0,035	0,225	0,000	0,000	0,001	0,002
393188	Y	0,182	0,333	1,19	0,009	0,0009	0,0104	0,026	0,014	0,031	0,058	0,000	0,000	0,001	0,002

B07.2 Heat	C70	B	CA	AL-T
391142	Y	0,0002	0,0015	0,033
392569	Y	0,0002	0,0023	0,037
393188	Y	0,0002	0,0014	0,030

C94 Heat analysis Carbon equivalent / Alloying restrictions

B07.2 Heat	FO-02=	0.43	FO-51=	0,000	FO-55=	0,33	FO-78=	0,24	FO-91=	6,5
391142	FO-02=	0,43	FO-51=	0,000	FO-55=	0,33	FO-78=	0,24	FO-91=	6,5
392569	FO-02=	0,42	FO-51=	0,000	FO-55=	0,30	FO-78=	0,24	FO-91=	6,7
393188	FO-02=	0,40	FO-51=	0,000	FO-55=	0,13	FO-78=	0,07	FO-91=	6,5

C95 Ladle treatment



ITEM NO.: 01,03
HEAT OF THE INDICATED ITEM: VACUUM DEGASSED / SULPHIDE SHAPE CONTROL

BROMLEY MECHANICAL SERVICES
Checked to ASME

C95 Further information about ladle treatment

ITEM NO.: 01,03
CALCIUM TREATED

Sect. IIA 2015 Edd. min 1.4490"
SA 20 *[Signature]* 1/23/18
Date

A04  Manufacturer's mark	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	<i>[Signature]</i> B. BALDAUF Test House Manager	 Inspector's stamp	AG der Dillinger Hüttenwerke Postfach 1580; D-66748 Dillingen/Saar Inspection department	A01
		Date 02.04.14	PP 1		



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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1.B AS PER EN 10204:1991+A1:1995 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 488422-02.04.14	A08/ Manufacturer's order/ A03 Certificate No. 391887-004	Sheet 4/...
A05 Established inspecting body DH	A06 Purchaser EDMONTON STEEL, EDMON Final receiver EDMONTON STEEL, EDMON	A07.1 No. ED10636-J1010-ER A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design: SA516-70	.SA20-S5			
B03 Any suppl. requirements	ASME-III:2013 DIL-HUE-3:R33-2014-01-21			

C70-C99 Chemical composition % - Product analysis

B07.2 Heat	B07.1 Test No.	C01	C	SI	MN	P	S	N	CU	MO	NI	CR	V	NB	SN	TI
391142	95029	K1	0,175	0,364	1,16	0,008	0,0008	0,0056	0,022	0,018	0,063	0,196	0,001	0,000	0,000	0,002
392569	94878	K1	0,172	0,374	1,17	0,008	0,0013	0,0060	0,024	0,015	0,035	0,217	0,000	0,000	0,001	0,002
393188	50219	K1	0,174	0,372	1,17	0,009	0,0010	0,0089	0,023	0,012	0,030	0,045	0,000	0,000	0,000	0,002

B07.2 Heat	B07.1 Test No.	C01	B	CA	AL-T
391142	95029	K1	0,0000	0,0015	0,034
392569	94878	K1	0,0000	0,0020	0,035
393188	50219	K1	0,0001	0,0014	0,028

C94 Product analysis Carbon equivalent / Alloying restrictions

B07.2 Heat	B07.1 Test No.	C01	FO-02=	FO-51=	FO-55=
391142	95029	K1	0,42	0,001	0,30
392569	94878	K1	0,42	0,000	0,29
393188	50219	K1	0,38	0,000	0,11

C94 Carbon equivalent formula / Alloying restrictions

FO-02 = C + (MN/6) + (CR+MO+V) / 5 + (NI+CU) / 15
 FO-51 = V + NB
 FO-55 = CU+MO+NI+CR
 FO-78 = CR+MO
 FO-91 = MN/C

<p>Manufacturer's mark</p>	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	<p>B. BALDAUF Test House Manager</p>	<p>Inspector's stamp</p>	AG der Dillinger Hüttenwerke Postfach 1580, D-66748 Dillingen/Saar Inspection department	A01 Date 02.04.14 PP 1



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A02/ INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1.3 AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No/ Date of dispatch 488422-02.04.14	A08/ Manufacturer's order/ A03 Certificate No. 391887-004	Sheet 5
A05 Established inspecting body DH	A06 Purchaser EDMONTON STEEL, EDMON Final receiver EDMONTON STEEL, EDMON	A07.1 No. ED10636-J1010-ER A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design.	SA516-70	SA20-S5		
B03 Any suppl. requirements	ASME- IIA: 2013 DIL-HUE-3: R33-2014-01-21			

D01 Marking and identification, surface appearance, shape and dimensional properties

ITEM NO.: 01,03

EXAMINATION OF MARKING, SURFACE, SHAPE AND DIMENSIONS: THE RESULTS MEET THE REQUIREMENTS.

SURFACE AS PER ASME-SA20
THICKNESS AS PER ASME-SA20
LENGTH AND WIDTH AS PER ASME-SA20
FLATNESS AS PER 1/2-ASME-SA20



A04 Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.



Manufacturer's mark

B. Baldauf

B. BALDAUF
Test House Manager



Inspector's stamp

AG der Dillinger Hüttenwerke
Postfach 1580, D-66748 Dillingen/Saar
Inspection department

Date 02.04.14

PP 1

A01

BROMLEY MECHANICAL SERVICES MATERIAL INSPECTION REPORT

INSPECTED BY: MICHAEL QUINN	GRADE: SA 516-70MT	DIA SIZE OR WITH: 36" <input type="checkbox"/> NPS <input checked="" type="checkbox"/> OD <input type="checkbox"/> ID
DATE: OCTOBER 30/2017	HEADS <input checked="" type="checkbox"/> 2:1 <input type="checkbox"/> HEMI <input type="checkbox"/> WELD CAP <input type="checkbox"/> OTHER	LENGTH _____ THICKNESS _____ PIPE PUBLISHED NOM _____ PLATE NOM 1.5000"
P.O.#: PO-87519	SHELL <input type="checkbox"/>	Weight per foot for pipe over 4"
SUPPLIER: CESSCO FABRICATION	PIPE <input type="checkbox"/> → NDE BY MANUFACTURER	
PART ID#: VES 36015	PLATE <input type="checkbox"/> <u>HYDRO</u> YES <u>NDE</u> NO <input type="checkbox"/>	
REQ. MIN TK: 1.4520"	REPAD <input type="checkbox"/> NO YES <input type="checkbox"/>	
	STRUCT. <input type="checkbox"/> NO NO <input type="checkbox"/>	
	OTHER <input type="checkbox"/> SKIRT YES YES <input type="checkbox"/>	

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35825 <i>111 III</i>	<i>8</i>	C32392 HT-415883 366089-01	<i>1.452"</i>					<i>ok</i>	<i>ok</i>	<i>ok</i>	<i>mq</i>

W/O# WO-35528	RECEIVED & ACCEPTED BY: <i>ol</i>	REQUIRED CODE MARKINGS:
CUSTOMER: ARC RESOURCES GENERAL PARTNERSHP	DATE: DEC 12 2017	ALL MARKINGS STAMPED ONTO PLATE BY MANUFACTURE



7310 99 Street
 Edmonton, AB T6E 3R8
 Ph: 780-433-9531
 Fax: 780-432-7899

CERTIFICATE OF COMPLIANCE - HEADS

Cessco Job No.: 170530
 Customer: Bromley Mechanical, a div. of Argo Sales
 Material: SA-516-70N

Tag No.: WO 35527/35528
 PO No.: 87519
 Head Type: 2: 1 Semi-Ellipsoidal (SE)

Item	Description	Log Number	Quantity	Form Procedure	Recorded Min Thk.		Required Min Thk.	
B30	36" OD x 1-1/2" nom	C32392	16	Cessco HF-1	1.452	inches	1.4375	inches

This is to certify that the pressure equipment listed above was manufactured in compliance with the following as applicable:

ASME Section VIII DIV I UG-79; UG81 & UCS-79

Meets the requirements of ASME Section II Part A Latest Edition and applicable project specific requirements.

ASME Section VIII DIV I UG-11(b)

ASME Section VIII DIV I UCS-79(f)

Hot Formed @ 1650 ° F

Other Heat Treatment:

Other Additional NDE:

Additional Information:

 Carey Gaasbeek
Cessco QC

 NOV 2 / 2017
Date


Signature



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A06 Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 1/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES CESSCO FABRICATION & ENGINEERING LTD LOG No. PREFIX C	
B02 Steel design. SA516-70/SA516M-485/A516-70/A516M-485				
B03 Any suppl. requirements ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014				

B01-B99 Description of the product

B14 Item No.	B08 Number of pieces	B09 Thickness	B10 Width	B11 Length	B12 Theoretical mass	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No./ Test No.	A09 Purchaser article number
			INCH		KG				
01	1	0,5000 x	96,50000 x	384,00000	2383	N ✓	415618	363416-01	- 32330
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363416-02	- 32331
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363416-03	- 32332
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363417-01	- 32327
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363417-02	- 32328
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363420-01	- 32329
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363420-02	- 32333
**	7				16681				
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	363426-01	- 32338
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	363426-02	- 32336
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	367440-01	- 32335
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	367440-02	- 32337
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	377166-01	- 32334
**	5				18600				
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	363425-01	- 32344
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	363425-02	- 32342
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	364016-01	- 32343
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	364016-02	- 32340
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	364016-03	- 32341
**	5				14895				
04	1	0,6250 x	72,50000 x	384,00000	2238	N	415618	363418-01	- 32347
04	1	0,6250 x	72,50000 x	384,00000	2238	N	415618	363418-02	- 32348
04	1	0,6250 x	72,50000 x	384,00000	2238	N	415618	363421-01	- 32346

CHEMICAL & PHYSICALS
 CHECKED
 A.S.M.E. Ed. 2016
 CESSCO By Linda Piccini
 09/21/2015

A04



Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.

[Signature]

POISSONNET
 Test House Manager

Dillinger Franco
 Port 3032
 3032 rue du Comte Jean - CS 56317
 F-59379 Dunkerque Cedex 1 - FRANCE
 Service Qualité-Essais
 Date 11.02.15

AG1

QM-System: Certification as per ISO 9001



DILLINGER HÜTTE

Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 2/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

B01-B99 Description of the product

B14 Item No.	B08 Number of pieces	B09 Thickness	B10 Width	B11 Length	B12 Theoretical mass	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No./ Tget No.	A09 Purchaser article number
			INCH		KG				
04	1	0,6250 x	72,50000 x	384,00000	2238	N	415618	363421-02 - 32345	
**	4				8952				
05	1	0,6250 x	120,50000 x	480,00000	4650	N	415618	363419-01 - 32351	
05	1	0,6250 x	120,50000 x	480,00000	4650	N	415618	363419-02 - 32350	
05	1	0,6250 x	120,50000 x	480,00000	4650	N	415618	363422-01 - 32352	
05	1	0,6250 x	120,50000 x	480,00000	4650	N	415618	363422-02 - 32349	
**	4				18600				
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	367447-01 - 32360	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	367447-02 - 32354	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368176-01 - 32357	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368176-02 - 32355	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368176-03 - 32358	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368177-01 - 32359	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368177-02 - 32353	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368177-03 - 32356	
**	8				28600				
07	1	0,7500 x	146,00000 x	504,00000	7099	N	415618	368188-01 - 32362	
07	1	0,7500 x	146,00000 x	504,00000	7099	N	415618	368189-01 - 32361	
07	1	0,7500 x	146,00000 x	504,00000	7099	N	415618	368190-01 - 32363	
**	3				21297				
08	1	0,8750 x	120,50000 x	480,00000	6510	N	415879	364012-01 - 32369	
08	1	0,8750 x	120,50000 x	480,00000	6510	N	415879	364012-02 - 32366	
08	1	0,8750 x	120,50000 x	480,00000	6510	N	415879	364013-01 - 32368	

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A05
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Manufacturer's mark

ED 1

QM-System: Certification as per ISO 9001




DILLINGER HÜTTE

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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 3/...
A05 Established Inspecting body DF	A06 Purchaser Final receiver CESSCO FAB., EDMONTON CESSCO FAB., EDMONTON	A07.1 No. K-04257	A09 Product HEAVY PLATES	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-11A:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

B01-B99 Description of the product

B14 Item No.	B08 Number of pieces	B09 Thickness	B10 Width	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No./ Test No.	A09 Purchaser article number
			INCH						
08	2	0,8750 x	120,50000 x	480,00000	6510	N	415879	364013-02	- 32367
08	1	0,8750 x	120,50000 x	480,00000	6510	N	415881	368026-01	- 32365
08	1	0,8750 x	120,50000 x	480,00000	6510	N	415881	368026-02	- 32364
**	6				39060				
09	1	1,0000 x	96,50000 x	384,00000	4767	N	415881	368001-01	- 32373
09	1	1,0000 x	96,50000 x	384,00000	4767	N	415881	368001-02	- 32370
09	1	1,0000 x	96,50000 x	384,00000	4767	N	415881	368001-03	- 32371
09	1	1,0000 x	96,50000 x	384,00000	4767	N	415881	368002-01	- 32372
09	1	1,0000 x	96,50000 x	384,00000	4767	N	415881	368002-02	- 32374
←←	5				23835				
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	366017-01	- 32381
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	366017-02	- 32378
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	366125-01	- 32376
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	366125-02	- 32380
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	366126-01	- 32377
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	366126-02	- 32375
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	368027-01	- 32379
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	368027-02	- 32382
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	368028-01	- 32385
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	368028-02	- 32383
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	369010-01	- 32384
**	11				81840				
11	1	1,0000 x	145,00000 x	504,00000	9401	N	415881	366121-01	- 32387

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	AC1
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Manufacturer's mark




Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 4/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

B01-B99 Description of the product

B14 Item No.	B08 Number of pieces	B09 Thickness	B10 Width inCH	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No./ Test No.	A09 Purchaser article number
11	1	1,0000	x 145,00000	x 504,00000	9401	N ✓	415881	366121-02 - 32386	
11	1	1,0000	x 145,00000	x 504,00000	9401	N	415883	366122-01 - 32388	
11	1	1,0000	x 145,00000	x 504,00000	9401	N	415883	366122-02 - 32391	
11	1	1,0000	x 145,00000	x 504,00000	9401	N	415883	366123-01 - 32389	
11	1	1,0000	x 145,00000	x 504,00000	9401	N	415883	366123-02 - 32390	
**	6				56406				
12	1	1,5000	x 96,50000	x 384,00000	7150	N	415883	366089-01 - 32392	*
12	1	1,5000	x 96,50000	x 384,00000	7150	N	415883	366089-02 - 32397	
12	1	1,5000	x 96,50000	x 384,00000	7150	N	415883	366089-03 - 32393	
12	1	1,5000	x 96,50000	x 384,00000	7150	N	415883	379171-01 - 32395	
12	1	1,5000	x 96,50000	x 384,00000	7150	N	415883	379171-02 - 32396	
12	1	1,5000	x 96,50000	x 384,00000	7150	N	415883	379171-03 - 32394	
**	6				42900				
13	1	1,5000	x 120,50000	x 480,00000	11161	N	415111	375109-01 - 32398	
13	1	1,5000	x 120,50000	x 480,00000	11161	N	415879	371380-01 - 32401	
13	1	1,5000	x 120,50000	x 480,00000	11161	N	415879	371380-02 - 32399	
13	1	1,5000	x 120,50000	x 480,00000	11161	N	415879	371381-01 - 32402	
13	1	1,5000	x 120,50000	x 480,00000	11161	N	415879	371381-02 - 32400	
**	5				55805				
14	1	1,5000	x 145,00000	x 504,00000	14101	N	415879	364025-01 - 32406	
14	1	1,5000	x 145,00000	x 504,00000	14101	N	415879	364026-01 - 32405	
14	1	1,5000	x 145,00000	x 504,00000	14101	N	415879	364027-01 - 32404	
14	1	1,5000	x 145,00000	x 504,00000	14101	N	415879	366124-01 - 32403	

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 36317 F-59379 Dunkerque Cedex 9 - FRANCE Service Qualité-Essais Date 11.02.15	A01
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QW-System: Certification as per ISO 9001



DILLINGER HÜTTE

Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 5/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

B01-B99 Description of the product

B14 Item No.	B03 Number of pieces	B09 Thickness	B10 Width INCH	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No./ Test No.	A09 Purchaser article number
**	4				56404				
***	79				483875				

B04 Product delivery condition

ITEM NO.: 01-14
N: HT: 1670 GR.F +27 -27 GR.F
SOAKING TIME TO ATTAIN THE TARGET TEMPERATURE OVER THE WHOLE SECTION: 1-1,75 MIN/MM (25-45 MIN/INCH)
COOLING IN STILL AIR

B06 Marking of the product

ITEM NO.: 01-14
STEEL DESIGNATION SA516 70 MTLTV SA516M 485 MTLTV
HEAT NO. / TRADEMARK / ROLLED PLATE NO.-TEST NO.

B07-B99 Further information about the product

ITEM NO.: 01-14
THICKNESS REDUCTION RATIO >= 3,0 IS FULFILLED (CF. A/SA20 PAR. 5.3)

C10-C29 Tensile test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/ C01 Temp. GR.F	C03 RT	C10 MPA RP02	C11	C12 RM	C13	A % LO=2IN	A % LC=8IN	C14-C15
01	415618	363416		K1	Q0	RT	427		559			25	
01	415618	363417		K1	Q0	RT	401		553			24	
01	415618	363420		K1	Q0	RT	419		555			24	

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	Page 801
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QM-System: Certification as per ISO 9001



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 6/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design. SA516-70/SA516M-485/A516-70/A516M-485				
B03 Any suppl. ASME-III:2013/ASTM-A516:10/ASTM-A516M:10 requirements STKCHEM1001:R05-27.02.2014				

C10-C29 Tensile test

E14 Item No.	B07.2 Heat No.	B07.1 Ref. plate/ Test No.	B05 Reference (heat) treatment	C01	C02/ C01	C03 Temp. GR.F	C10	C11 MPA RP02	C12 RM	C13	A % L0=20N	A % L0=80N	C14-C15
02	415618	363426		K1	Q0	RT		412	554			25	
02	415618	367440		K1	Q0	RT		413	561			23	
02	415618	377166		K1	Q0	RT		405	558			23	
03	415618	363425		K1	Q0	RT		416	559			25	
03	415618	364016		K1	Q0	RT		421	566			24	
04	415618	363418		K1	Q0	RT		401	550			24	
04	415618	363421		K1	Q0	RT		403	552			22	
05	415618	363419		K1	Q0	RT		417	558			24	
05	415618	363422		K1	Q0	RT		420	560			25	
06	415618	367447		K1	Q0	RT		402	553			25	
06	415618	368176		K1	Q0	RT		403	554			25	
06	415618	368177		K1	Q0	RT		405	553			26	
07	415618	368188		K1	Q0	RT		402	552			25	
07	415618	368189		K1	Q0	RT		403	551			26	
07	415618	368190		K1	Q0	RT		401	555			25	
08	415879	364012		K1	Q0	RT		406	557			26	
08	415879	364013		K1	Q0	RT		412	553			26	
08	415881	368026		K1	Q0	RT		404	545			24	
09	415881	368001		K1	Q0	RT		389	532			28	
09	415881	368002		K1	Q0	RT		397	530			27	
10	415881	366017		K1	Q0	RT		391	532			27	
10	415881	366125		K1	Q0	RT		409	550			25	
10	415881	366126		K1	Q0	RT		391	530			26	

A04 Manufacturer's mark	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 58317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01 ED
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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 7/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C10-C29 Tensile test

B14 Item No.	B07.2 Heat No.	B07.1 Rol,plate/ Test No.	B05 Reference (heat) treatment	C01	C02/ C01	C03 Temp. GR.F	C10 MPA RP02	C11	C12 RM	C13	A % LO=21N	A % LO=81N	C14-C15
10	415881	368027		K1	Q0	RT	390		530			26	
10	415881	368028		K1	Q0	RT	394		533			26	
10	415881	369010		K1	Q0	RT	393		534			27	
11	415881	366121		K1	Q0	RT	393		535			27	
11	415883	366122		K1	Q0	RT	396		542			28	
11	415883	366123		K1	Q0	RT	398		542			27	
12	415883	366089		K1	QV	RT	384		535		38		
12	415883	379171		K1	QV	RT	375		531		38		
13	415111	375109		K1	QV	RT	403		549		37		
13	415879	371380		K1	QV	RT	382		542		34		
13	415879	371381		K1	QV	RT	382		543		37		
14	415879	364025		K1	QV	RT	410		548		37		
14	415879	364026		K1	QV	RT	398		547		35		
14	415879	364027		K1	QV	RT	387		544		36		
14	415879	366124		K1	QV	RT	400		544		37		

C30-C39 Hardness test

B14 Item No.	B07.2 Heat No.	B07.1 Rol,plate/ Test No.	B05 Reference (heat) treatment	C01	C02/C01	C03 Temp. GR.F	C30 Method of test	C35	C34 Individual values	C32 Mean value
01	415618	363416		K1	Q0	RT	HBW 5/750	HB	158	
01	415618	363417		K1	Q0	RT	HBW 5/750	HB	156	
01	415618	363420		K1	Q0	RT	HBW 5/750	HB	162	
02	415618	363426		K1	Q0	RT	HBW 5/750	HB	159	
02	415618	367440		K1	Q0	RT	HBW 5/750	HB	161	

A04	 <p>Manufacturer's mark</p>	<p>Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.</p> <p>BROMLEY MECHANICAL SERVICES Checked to ASME</p> <p>POISSONNET Test House Manager</p>	<p>Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais</p> <p>Date 11.02.15</p>	A01
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Sect. IIA 2015 Edd. Min 1.452"
SA 20 08 12/12/17
Date




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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 8/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C30-C39 Hardness test

B14 Item No.	B07.2 Heat No.	B07.1 Rol. plate/ Test No.	B05 Reference (heat) treatment	C01	C02/C01	C03 Temp. GR.F	C30 Method of test	C35 C31 Individual values	C32 Mean value
02	415618	377166		K1	Q0	RT	HBW 5/750	HB 163	
03	415618	363425		K1	Q0	RT	HBW 5/750	HB 157	
03	415618	364016		K1	Q0	RT	HBW 5/750	HB 163	
04	415618	363418		K1	Q0	RT	HBW 5/750	HB 156	
04	415618	363421		K1	Q0	RT	HBW 5/750	HB 155	
05	415618	363419		K1	Q0	RT	HBW 5/750	HB 153	
05	415618	363422		K1	Q0	RT	HBW 5/750	HB 158	
06	415618	367447		K1	Q0	RT	HBW 5/750	HB 158	
06	415618	368176		K1	Q0	RT	HBW 5/750	HB 159	
06	415618	368177		K1	Q0	RT	HBW 5/750	HB 159	
07	415618	368188		K1	Q0	RT	HBW 5/750	HB 162	
07	415618	368189		K1	Q0	RT	HBW 5/750	HB 158	
07	415618	368190		K1	Q0	RT	HBW 5/750	HB 153	
08	415879	364012		K1	Q0	RT	HBW 5/750	HB 162	
08	415879	364013		K1	Q0	RT	HBW 5/750	HB 164	
08	415881	368026		K1	Q0	RT	HBW 5/750	HB 155	
09	415881	368001		K1	Q0	RT	HBW 5/750	HB 150	
09	415881	368002		K1	Q0	RT	HBW 5/750	HB 149	
10	415881	366017		K1	Q0	RT	HBW 5/750	HB 155	
10	415881	366125		K1	Q0	RT	HBW 5/750	HB 160	
10	415881	366126		K1	Q0	RT	HBW 5/750	HB 155	
10	415881	368027		K1	Q0	RT	HBW 5/750	HB 149	
10	415881	368028		K1	Q0	RT	HBW 5/750	HB 150	
10	415881	369010		K1	Q0	RT	HBW 5/750	HB 152	

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A03
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QMS-System: Certification as per ISO 9001



DILLINGER HÜTTE

Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificates)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No 399394-001	Sheet 9/...
A05 Established inspecting body DF	A08 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design. SA516-70/SA516M-485/A516-70/A516M-485 B03 Any suppl. requirements ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEN1001:R05-27.02.2014				

C30-C39 Hardness test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/C01	C03 Temp. GRF	C30 Method of test	C35 C31 individual values	C32 Mean value
11	415881	366121		K1	Q0	RT	HBW 5/750	HB 147	
11	415883	366122		K1	Q0	RT	HBW 5/750	HB 156	
11	415883	366123		K1	Q0	RT	HBW 5/750	HB 147	
12	415883	366089		K1	Q0	RT	HBW 5/750	HB 153	
12	415883	379171		K1	Q0	RT	HBW 5/750	HB 149	
13	415111	375109		K1	Q0	RT	HBW 5/750	HB 165	
13	415879	371380		K1	Q0	RT	HBW 5/750	HB 153	
13	415879	371381		K1	Q0	RT	HBW 5/750	HB 158	
14	415879	364025		K1	Q0	RT	HBW 5/750	HB 157	
14	415879	364026		K1	Q0	RT	HBW 5/750	HB 153	
14	415879	364027		K1	Q0	RT	HBW 5/750	HB 153	
14	415879	366124		K1	Q0	RT	HBW 5/750	HB 156	

C40-C49 Impact test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/ C01	C03 Temp. GRF	C41 Width of test piece	C40 Type of test piece	C44 Testing method	C46 Energy	C49	C42 individual values AV=RT, LBF	C43 Mean value	
01	415618	363416		K1	LO	-51		CHP-V		AV 8	190	195	170	185
01	415618	363417		K1	LO	-51		CHP-V		AV 8	192	147	159	166
01	415618	363420		K1	LO	-51		CHP-V		AV 8	170	147	200	172
02	415618	363426		K1	LO	-51		CHP-V		AV 8	185	130	192	169
02	415618	367440		K1	LO	-51		CHP-V		AV 8	136	117	129	127
02	415618	377166		K1	LO	-51		CHP-V		AV 8	143	147	194	161
03	415618	363425		K1	LO	-51		CHP-V		AV 8	142	132	134	136
03	415618	364016		K1	LO	-51		CHP-V		AV 8	113	118	155	122

Manufacturer's mark	201/202/203 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	POISSONNET Test House Manager	Dillinger France Port 8032 3032 rue du Comte Jean - CS 58317 F-59379 Dunkerque Cedex 9 - FRANCE Service Qualité-Essais Date 11.02.15	Sheet 30
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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08 Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 10/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C40-C49 Impact test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/ C01	C03 Temp. GR.F	C41 Width of test piece	C40 Type of test piece	C44 Testing method	C46 Energy	C45	C42 Individual values AV=FT.LBF	C43 Mech value
04	415618	363418		K1	LO	-51		CHP-V			AV 8	125 108 125	119
04	415618	363421		K1	LO	-51		CHP-V			AV 8	142 197 151	163
05	415618	363419		K1	LO	-51		CHP-V			AV 8	151 139 135	142
05	415618	363422		K1	LO	-51		CHP-V			AV 8	137 119 149	135
06	415618	367447		K1	LO	-51		CHP-V			AV 8	136 119 148	134
06	415618	368176		K1	LO	-51		CHP-V			AV 8	138 120 141	133
06	415618	368177		K1	LO	-51		CHP-V			AV 8	141 134 189	155
07	415618	368188		K1	LO	-51		CHP-V			AV 8	131 120 136	129
07	415618	368189		K1	LO	-51		CHP-V			AV 8	186 129 109	141
07	415618	368190		K1	LO	-51		CHP-V			AV 8	119 116 129	121
08	415879	364012		K1	LO	-51		CHP-V			AV 8	162 156 205	174
08	415879	364013		K1	LO	-51		CHP-V			AV 8	192 191 189	191
08	415881	368026		K1	LO	-51		CHP-V			AV 8	201 201 180	194
09	415881	368001		K1	LV	-51		CHP-V			AV 8	212 188 197	199
09	415881	368002		K1	LV	-51		CHP-V			AV 8	197 184 193	191
10	415881	366017		K1	LV	-51		CHP-V			AV 8	198 193 195	195
10	415881	366125		K1	LV	-51		CHP-V			AV 8	191 187 187	188
10	415881	366126		K1	LV	-51		CHP-V			AV 8	198 197 193	196
10	415881	368027		K1	LV	-51		CHP-V			AV 8	152 197 213	187
10	415881	368028		K1	LV	-51		CHP-V			AV 8	195 207 187	196
10	415881	369010		K1	LV	-51		CHP-V			AV 8	191 145 161	166
11	415881	366121		K1	LV	-51		CHP-V			AV 8	188 165 139	164
11	415883	366122		K1	LV	-51		CHP-V			AV 8	197 198 195	197
11	415883	366123		K1	LV	-51		CHP-V			AV 8	161 149 208	173

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01
 Manufacturer's mark				



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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 11/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C40-C49 Impact test

B14 Item No.	B07.2 Heat No.	B07.1 Ref. plate/ Test No.	B05 Reference (heat) treatment	C01	C02 C01	C03 / Temp. GRF	C41 Width of test piece	C40 Type of test piece	C44 Testing method	C46 Energy	C45	C42 Individual values AV=FT.LBF		C43 Mech values	
12	415883	366089		K1	LV	-51		CHP-V			AV 8	142	168	202	171
12	415883	379171		K1	LV	-51		CHP-V			AV 8	157	128	125	137
13	415111	375109		K1	LV	-51		CHP-V			AV 8	131	156	134	140
13	415879	371380		K1	LV	-51		CHP-V			AV 8	131	134	135	133
13	415879	371381		K1	LV	-51		CHP-V			AV 8	131	89	126	115
14	415879	364025		K1	LV	-51		CHP-V			AV 8	132	143	195	157
14	415879	364026		K1	LV	-51		CHP-V			AV 8	119	135	131	128
14	415879	364027		K1	LV	-51		CHP-V			AV 8	122	201	116	146
14	415879	366124		K1	LV	-51		CHP-V			AV 8	127	133	157	139

C66-C68 Supplementary tests on test samples

ITEM NO.: 12-13

FERRITE GRAIN SIZE ASTM E112 (SEE APPENDIX)

B07.2	B07.1	RESULT
415618	363422	9,0
415879	364013	9,0
415883	366089	8,5
415881	366125	9,0
415111	375109	9,0

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Mansour	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01
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Manufacturer's mark

ED



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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A06/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 12/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME- IIA: 2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C70-C99 Chemical composition % - Heat analysis

B07.2 Heat	C70	C	SI	MN	P	S	CU	MO	NI	CR	V	NS	Ti	S	CA
415111	Y	0,168	0,379	1,17	0,009	0,0007	0,170	0,011	0,371	0,026	0,001	0,016	0,002	0,0001	0,0013
415618	Y	0,180	0,372	1,16	0,007	0,0008	0,098	0,013	0,057	0,040	0,001	0,017	0,002	0,0003	0,0027
415879	Y	0,177	0,369	1,17	0,007	0,0008	0,170	0,028	0,360	0,062	0,001	0,018	0,004	0,0003	0,0023
415881	Y	0,158	0,318	1,18	0,007	0,0009	0,177	0,019	0,362	0,033	0,001	0,016	0,003	0,0003	0,0015
415883	Y	0,163	0,343	1,18	0,007	0,0008	0,168	0,026	0,363	0,043	0,001	0,017	0,003	0,0002	0,0010

B07.2 Heat	C70	AL-T
415111	Y	0,031
415618	Y	0,032
415879	Y	0,042
415881	Y	0,046
415883	Y	0,039

C94 Heat analysis Carbon equivalent / Alloying restrictions

B07.2 Heat	FO-02=	FO-51=	FO-55=	FO-70=	FO-78=
415111	0,41	0,017	0,58	0,2	0,04
415618	0,39	0,018	0,21	0,2	0,05
415879	0,43	0,019	0,62	0,3	0,09
415881	0,40	0,017	0,59	0,2	0,05
415883	0,41	0,018	0,60	0,3	0,07

C95 Ladle treatment

ITEM NO.: 01-14
HEAT OF THE INDICATED ITEM: VACUUM DEGASSED / SULPHIDE SHAPE CONTROL

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01
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BROMLEY MECHANICAL SERVICES
Checked to ASME

V535825 Sect. IIA 2015 Edd. min 1.452"
SA 20 28. 12/12/17

QMI-System: Certification as per ISO 9001



DILLINGER HÜTTE

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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08 Manufacturer's order/ A03 Certificate No 399394-001	Sheet 13/...
A06 Established inspecting body DF	A08 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257	B01 Product HEAVY PLATES	
B02/ Steel design	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-III:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C95 Further information about ladle treatment

ITEM NO.: 01-14
MELTED IN GERMANY BY -AG DER DILLINGER HUETTENWERKE, DILLINGEN/SAAR-

ITEM NO.: 01-14
FULLY KILLED AND MADE TO FINE GRAIN PRACTICE

C70-C99 Further information about heat analysis

ITEM NO.: 01-14
OXYGEN MAX. 0,005% ON LADLE AND ON PRODUCT

C70-C99 Chemical composition % - Product analysis

B07.2 Heat	B07.1 Test No.	C01	C	SI	MN	P	S	CU	MO	NI	CR	V	NB	Ti	AS	CA
415111	375109	K10	0,166	0,364	1,13	0,009	0,0007	0,168	0,011	0,379	0,028	0,001	0,015	0,002	0,0002	0,0013
415618	363416	K10	0,185	0,375	1,14	0,007	0,0006	0,092	0,012	0,055	0,038	0,001	0,018	0,002	0,0001	0,0022
415618	363417	K10	0,182	0,368	1,12	0,007	0,0006	0,091	0,012	0,054	0,038	0,001	0,016	0,002	0,0002	0,0022
415618	363418	K10	0,181	0,354	1,13	0,007	0,0004	0,093	0,012	0,058	0,041	0,001	0,017	0,003	0,0002	0,0024
415618	363419	K10	0,178	0,362	1,14	0,007	0,0003	0,093	0,012	0,058	0,041	0,001	0,017	0,002	0,0002	0,0022
415618	363420	K10	0,176	0,352	1,13	0,007	0,0003	0,092	0,012	0,058	0,041	0,001	0,017	0,002	0,0001	0,0025
415618	363421	K10	0,166	0,367	1,16	0,008	0,0003	0,095	0,013	0,058	0,041	0,001	0,018	0,003	0,0002	0,0022
415618	363422	K10	0,173	0,359	1,13	0,007	0,0004	0,092	0,012	0,057	0,040	0,001	0,015	0,002	0,0002	0,0027
415618	363425	K10	0,175	0,356	1,13	0,007	0,0004	0,094	0,012	0,058	0,041	0,001	0,016	0,002	0,0002	0,0026
415618	363426	K10	0,180	0,347	1,15	0,007	0,0004	0,097	0,012	0,058	0,041	0,000	0,015	0,002	0,0002	0,0018
415618	367440	K10	0,169	0,342	1,13	0,007	0,0003	0,095	0,012	0,057	0,041	0,001	0,016	0,002	0,0002	0,0026
415618	367447	K10	0,173	0,352	1,14	0,007	0,0005	0,093	0,012	0,058	0,041	0,001	0,016	0,002	0,0002	0,0027
415618	368176	K10	0,131	0,362	1,16	0,008	0,0003	0,094	0,013	0,059	0,041	0,001	0,018	0,003	0,0002	0,0024
415618	368176	K10	0,190	0,349	1,11	0,007	0,0003	0,092	0,012	0,057	0,041	0,001	0,016	0,002	0,0002	0,0025
415618	368177	K10	0,179	0,349	1,12	0,007	0,0003	0,094	0,012	0,058	0,041	0,001	0,015	0,002	0,0002	0,0025

A09

2012/2013 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.



Manufacturer's mark

POISSONNET
Test House Manager

Dillinger France
Port 3932
3632 rue du Comte Jean - CE 56347
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais

Date 11.02.15

FD



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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A00/Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 14/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-III:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C70-C99 Chemical composition % - Product analysis

S07.2 Mat	S07.1 Test No.	C01	C	SI	MN	P	S	CU	MO	NI	CR	V	NB	Ti	B	CA
415618	368188	K10	0,187	0,352	1,13	0,007	0,0004	0,094	0,012	0,058	0,041	0,001	0,016	0,002	0,0002	0,0028
415618	368189	K10	0,164	0,349	1,11	0,006	0,0002	0,089	0,012	0,056	0,040	0,001	0,014	0,002	0,0002	0,0027
415618	368190	K10	0,186	0,353	1,13	0,007	0,0003	0,094	0,012	0,058	0,041	0,001	0,017	0,003	0,0002	0,0027
415618	377166	K10	0,181	0,360	1,16	0,008	0,0005	0,097	0,013	0,058	0,041	0,001	0,017	0,002	0,0002	0,0021
415879	364012	K10	0,171	0,360	1,14	0,006	0,0004	0,162	0,027	0,365	0,063	0,001	0,017	0,003	0,0003	0,0022
415879	364013	K10	0,164	0,341	1,15	0,007	0,0006	0,169	0,024	0,368	0,054	0,001	0,017	0,003	0,0002	0,0017
415879	364025	K10	0,170	0,360	1,14	0,006	0,0006	0,169	0,028	0,363	0,061	0,001	0,018	0,003	0,0002	0,0019
415879	364026	K10	0,169	0,364	1,15	0,006	0,0004	0,161	0,027	0,369	0,063	0,001	0,017	0,003	0,0003	0,0022
415879	364027	K10	0,167	0,356	1,14	0,006	0,0004	0,161	0,026	0,364	0,062	0,001	0,017	0,003	0,0002	0,0021
415879	366124	K10	0,166	0,350	1,14	0,006	0,0008	0,169	0,026	0,361	0,056	0,001	0,017	0,003	0,0003	0,0019
415879	371380	K10	0,168	0,346	1,11	0,007	0,0006	0,162	0,027	0,371	0,064	0,001	0,017	0,003	0,0003	0,0023
415879	371381	K10	0,170	0,348	1,11	0,006	0,0004	0,160	0,027	0,369	0,064	0,001	0,017	0,003	0,0003	0,0025
415881	366017	K10	0,153	0,313	1,14	0,007	0,0008	0,172	0,019	0,367	0,035	0,001	0,015	0,002	0,0002	0,0015
415881	366121	K10	0,160	0,322	1,15	0,007	0,0005	0,162	0,025	0,370	0,042	0,001	0,017	0,003	0,0002	0,0011
415881	366125	K10	0,161	0,335	1,14	0,007	0,0005	0,168	0,024	0,368	0,051	0,001	0,016	0,003	0,0002	0,0015
415881	366126	K10	0,151	0,307	1,14	0,007	0,0007	0,175	0,019	0,365	0,033	0,001	0,015	0,002	0,0002	0,0014
415881	368001	K10	0,149	0,304	1,13	0,007	0,0006	0,167	0,019	0,365	0,035	0,001	0,015	0,002	0,0002	0,0014
415881	368002	K10	0,150	0,303	1,15	0,007	0,0005	0,176	0,019	0,367	0,034	0,001	0,015	0,002	0,0002	0,0012
415881	368026	K10	0,153	0,316	1,15	0,007	0,0005	0,173	0,021	0,366	0,044	0,001	0,016	0,003	0,0002	0,0014
415881	368027	K10	0,148	0,308	1,11	0,007	0,0009	0,174	0,018	0,352	0,029	0,001	0,015	0,002	0,0002	0,0013
415881	368028	K10	0,149	0,299	1,11	0,006	0,0005	0,167	0,020	0,362	0,035	0,001	0,014	0,002	0,0002	0,0009
415881	369010	K10	0,160	0,321	1,14	0,007	0,0003	0,169	0,022	0,371	0,046	0,001	0,016	0,003	0,0002	0,0014
415883	366089	K10	0,157	0,334	1,15	0,007	0,0005	0,164	0,026	0,369	0,044	0,001	0,017	0,003	0,0002	0,0011
415883	366122	K10	0,158	0,325	1,14	0,007	0,0001	0,160	0,027	0,367	0,045	0,001	0,018	0,003	0,0002	0,0009
415883	366123	K10	0,154	0,327	1,13	0,007	0,0006	0,158	0,025	0,362	0,043	0,001	0,015	0,003	0,0002	0,0012

A01 Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.



[Signature]

POISSONNET
Test House Manager

Dillinger France
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais

Date 11.02.15

ED



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No / Date of dispatch 6492887-06.02.15	A03 Manufacturer's order/ A03 Certificate No 399394-001	Sheet 15/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design. SA516-70/BA516M-485/A516-70/A516M-485 B03 Any suppl. ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 requirements STKCHEM1001:R05-27.02.2014				

C70-C99 Chemical composition % - Product analysis

B07.2 Heat	B07.1 Test No.	C01	C ✓	SI ✓	MN	P ✓	S ✓	CU ✓	MO ✓	NI ✓	CR ✓	V ✓	NB ✓	Ti ✓	B	CA-
415883	379171	K10	0,163	0,330	1,14	0,007	0,0005	0,162	0,027	0,365	0,045	0,001	0,016	0,003	0,0002	0,0010

C94 Product analysis Carbon equivalent / Alloying restrictions

B07.2 Heat	B07.1 Test No.	C01														
415111	375109	K10 FO-02=	0,40	FO-51=	0,016	FO-55=	0,59	FO-70=	0,2	FO-78=	0,04					
415618	363416	K10 FO-02=	0,40	FO-51=	0,019	FO-55=	0,20	FO-70=	0,2	FO-78=	0,05					
415618	363417	K10 FO-02=	0,39	FO-51=	0,017	FO-55=	0,20	FO-70=	0,2	FO-78=	0,05					
415618	363418	K10 FO-02=	0,39	FO-51=	0,018	FO-55=	0,20	FO-70=	0,2	FO-78=	0,05					
415618	363419	K10 FO-02=	0,39	FO-51=	0,018	FO-55=	0,20	FO-70=	0,2	FO-78=	0,05					
415618	363420	K10 FO-02=	0,39	FO-51=	0,018	FO-55=	0,20	FO-70=	0,2	FO-78=	0,05					
415618	363421	K10 FO-02=	0,38	FO-51=	0,019	FO-55=	0,21	FO-70=	0,2	FO-78=	0,05					
415618	363422	K10 FO-02=	0,38	FO-51=	0,016	FO-55=	0,20	FO-70=	0,2	FO-78=	0,05					
415618	363425	K10 FO-02=	0,38	FO-51=	0,017	FO-55=	0,21	FO-70=	0,2	FO-78=	0,05					
415618	363426	K10 FO-02=	0,39	FO-51=	0,015	FO-55=	0,21	FO-70=	0,2	FO-78=	0,05					
415618	364016	K10 FO-02=	0,38	FO-51=	0,017	FO-55=	0,21	FO-70=	0,2	FO-78=	0,05					
415618	367440	K10 FO-02=	0,38	FO-51=	0,017	FO-55=	0,20	FO-70=	0,2	FO-78=	0,05					
415618	367447	K10 FO-02=	0,40	FO-51=	0,020	FO-55=	0,21	FO-70=	0,2	FO-78=	0,05					
415618	368176	K10 FO-02=	0,39	FO-51=	0,017	FO-55=	0,20	FO-70=	0,2	FO-78=	0,05					
415618	368177	K10 FO-02=	0,39	FO-51=	0,017	FO-55=	0,21	FO-70=	0,2	FO-78=	0,05					
415618	368188	K10 FO-02=	0,40	FO-51=	0,017	FO-55=	0,21	FO-70=	0,2	FO-78=	0,05					
415618	368189	K10 FO-02=	0,37	FO-51=	0,015	FO-55=	0,20	FO-70=	0,2	FO-78=	0,05					
415618	368190	K10 FO-02=	0,40	FO-51=	0,018	FO-55=	0,21	FO-70=	0,2	FO-78=	0,05					
415618	377166	K10 FO-02=	0,40	FO-51=	0,018	FO-55=	0,21	FO-70=	0,2	FO-78=	0,05					
415879	364012	K10 FO-02=	0,41	FO-51=	0,018	FO-55=	0,62	FO-70=	0,3	FO-78=	0,09					
415879	364013	K10 FO-02=	0,41	FO-51=	0,018	FO-55=	0,62	FO-70=	0,3	FO-78=	0,08					

A04 Manufacturer's mark	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	Signature POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 55317 F-58379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.03.15	A01 8D 1
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Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492867-06.02.15	A08/ Manufacturer's order/ A03 Certificate No 399394-001	Sheet 16/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design. SA516-70/SA516M-485/A516-70/A516M-485 B03 Any suppl. requirements ASME-III:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014				

C94 Product analysis Carbon equivalent / Alloying restrictions

E07.2 Heat	B07.1 Test No.	C01	✓									
415879	364025	K10	FO-02=	0,41	FO-51=	0,019	FO-55=	0,62	FO-70=	0,3	FO-78=	0,09
415879	364026	K10	FO-02=	0,41	FO-51=	0,018	FO-55=	0,62	FO-70=	0,3	FO-78=	0,09
415879	364027	K10	FO-02=	0,41	FO-51=	0,018	FO-55=	0,61	FO-70=	0,3	FO-78=	0,09
415879	366124	K10	FO-02=	0,41	FO-51=	0,018	FO-55=	0,61	FO-70=	0,3	FO-78=	0,08
415879	371380	K10	FO-02=	0,41	FO-51=	0,018	FO-55=	0,62	FO-70=	0,3	FO-78=	0,09
415879	371381	K10	FO-02=	0,41	FO-51=	0,018	FO-55=	0,62	FO-70=	0,3	FO-78=	0,09
415881	366017	K10	FO-02=	0,39	FO-51=	0,016	FO-55=	0,59	FO-70=	0,2	FO-78=	0,05
415881	366121	K10	FO-02=	0,40	FO-51=	0,018	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07
415881	366125	K10	FO-02=	0,40	FO-51=	0,017	FO-55=	0,61	FO-70=	0,3	FO-78=	0,08
415881	366126	K10	FO-02=	0,39	FO-51=	0,016	FO-55=	0,59	FO-70=	0,2	FO-78=	0,05
415881	368001	K10	FO-02=	0,38	FO-51=	0,016	FO-55=	0,59	FO-70=	0,2	FO-78=	0,05
415881	368002	K10	FO-02=	0,39	FO-51=	0,016	FO-55=	0,60	FO-70=	0,2	FO-78=	0,05
415881	368026	K10	FO-02=	0,40	FO-51=	0,017	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07
415881	368027	K10	FO-02=	0,38	FO-51=	0,016	FO-55=	0,57	FO-70=	0,2	FO-78=	0,05
415881	368028	K10	FO-02=	0,38	FO-51=	0,015	FO-55=	0,58	FO-70=	0,2	FO-78=	0,06
415881	369010	K10	FO-02=	0,40	FO-51=	0,017	FO-55=	0,61	FO-70=	0,3	FO-78=	0,07
415883	366089	K10	FO-02=	0,40	FO-51=	0,018	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07
415883	366122	K10	FO-02=	0,40	FO-51=	0,019	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07
415883	366123	K10	FO-02=	0,39	FO-51=	0,016	FO-55=	0,59	FO-70=	0,2	FO-78=	0,07
415883	379171	K10	FO-02=	0,40	FO-51=	0,017	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07

A04 Manufacturer's mark	201/202/203 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01
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Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 17
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/AS16-70/AS16M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			
<p>C94 Carbon equivalent formula / Alloying restrictions</p> <p>FO-02 = C+(MN/6) + (CR+MO+V) /5+(NI+CU) /15 FO-51 = V +NB FO-55 = CU+MO+NI+CR FO-70 = CU+MO+CR+NB+V +TI FO-78 = CR+MO</p>				
<p>D01 Marking and identification, surface appearance, shape and dimensional properties</p> <p>ITEM NO.: 01-14 EXAMINATION OF MARKING, SURFACE, SHAPE AND DIMENSIONS: THE RESULTS MEET THE REQUIREMENTS. SURFACE AS PER ASME-SA20 (M) THICKNESS AS PER ASTM/ASME-20 (M+US) LENGTH AND WIDTH AS PER ASME-SA20 FLATNESS AS PER ASME-SA20</p>				
<p>D01 Further information about marking and identification, surface appearance, shape and dimensional properties</p> <p>ITEM NO.: 01-14 NO WELDING OR WELD REPAIRS HAVE BEEN PERFORMED.</p>				
<p>D02 Non-destructive tests - Ultrasonic testing</p> <p>ITEM NO.: 01-14 UT-SPECIFICATION : ASME-SAS78 (M) LEVEL C SUPPLEMENTARY REQUIREMENTS S1 ✓ SCANNING PLAN BODY : 100% OF PLATE SURFACE PERSONNEL QUALIFICATION : LEVEL 2 IN ACC. TO EN 473 / ISO 9712 AND SNT-TC-1A THE TEST RESULTS MEET THE REQUIREMENTS OF THE ORDER.</p>				
A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.			A01
	<p>POISSONNET Test House Manager</p>		Dillinger France Port 3032 3032 rue du Comte Jazn - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15 ED 1	



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations

A02 DETERMINING AVERAGE GRAIN SIZE						Appendix 1	A08/ A03 Manufacture's order/ Certifical No 399394	Sheet 1/1
A05 Established DILLINGER FRANCE	Inspecting body FRANCE	B02 Steel designation SA/A516M-485/SA/A516-70	B07.2 Heat No. 415111	B07.1 Rolled plate/ Test No. 375109	B11 Thickness 38.1 mm	C01 K1	C02/ C0' L	

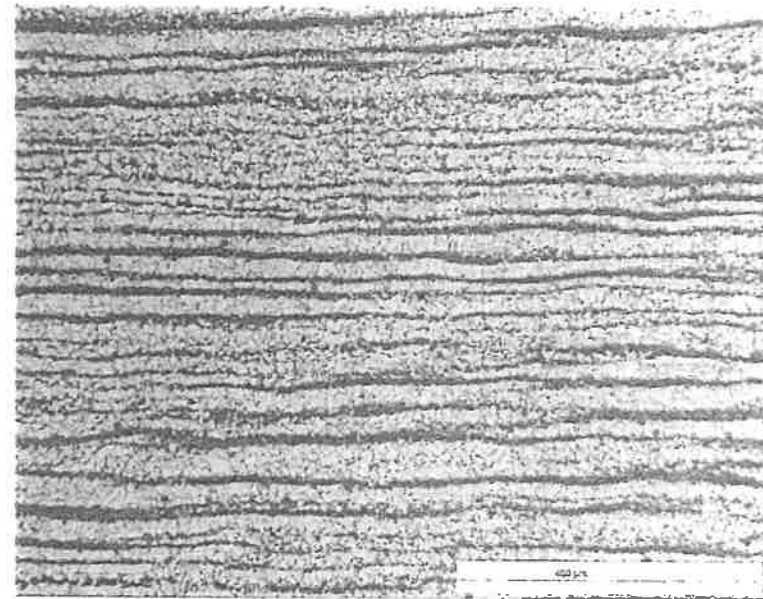
----- C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES -----

DOCUMENTATION OF THE
MICROSTRUCTURE

IMAGE No. 375109

MAGNIFICATION 100:1

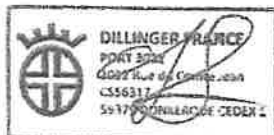
GRAIN SIZE 9



Metallography

Tester: MOREL

Date: 27/01/2015



Z01/Z02/Z03 We certify, that the results are in accordance with the agreement.

Inspector

DILLINGER FRANCE--Groupe Dillinger Hütte A01
 Port 3032
 3032 rue du Comte Jean - CS 56317
 F-59379 Dunkerque Cedex 1 - FRANCE
 Service Qualité Essais



Erläuterungen siehe Rückseite/Explications voir au verso/See revers for explanations

A02						Appendix		A03/ A03		Manufacture's order/ Certificat No		Sheet	
DETERMINING AVERAGE GRAIN SIZE						1		399394		1/1			
A05 Established		Inspecting body		B02 Steel designation		B07.2 Heat No.	B07.1 Rolled plate/ Test No	B11 Thickness		C01	C02/ C01		
DILLINGER		FRANCE		SA/A516M-485/SA/A516-70		415618	363422	15.87 mm		K1	L		

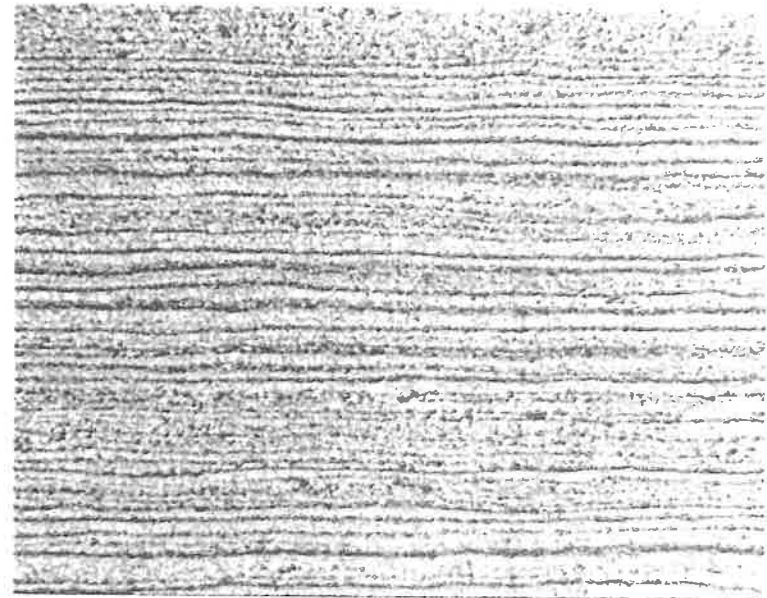
----- C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES -----

DOCUMENTATION OF THE MICROSTRUCTURE

IMAGE No. 363422

MAGNIFICATION 100:1

GRAIN SIZE 9

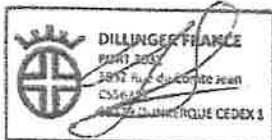


Metallography

Z01/Z02/Z03 We certify, that the results are in accordance with the agreement.

Tester: MOREL

Date: 13/01/2015



Inspector

DILLINGER FRANCE-Groupe Dillinger Hütte A01
 Port 3032
 3032 rue du Comte Jean - CS 56317
 F-59379 Dunkerque Cedex 1 - FRANCE
 Service Qualité Essais



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations

A02 DETERMINING AVERAGE GRAIN SIZE						Appendix 1	A08/A03 Manufacture's order/ Certificat No. 399394	Sheet 1/1
A05 Established DILLINGER FRANCE	Inspecting body	B02 Steel designation SA/A516M-485/SA/A516-70	B07.2 Heat No. 415881	B07.1 Rolled plate/ Test No. 366125	B11 Thickness 25.40 mm	C01 K1	C02/ C01 L	

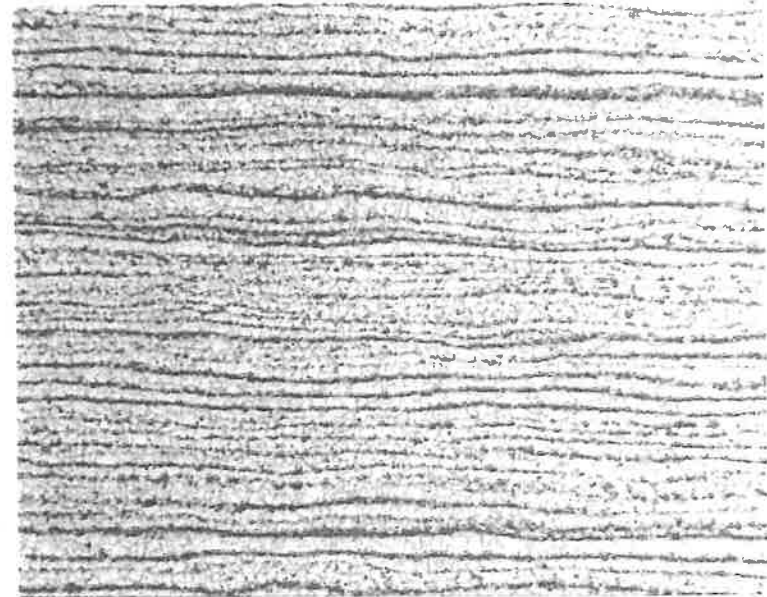
----- C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES -----

DOCUMENTATION OF THE MICROSTRUCTURE

IMAGE No. 366125

MAGNIFICATION 100:1

GRAIN SIZE 9



Metallography

Z01/Z02/Z03 We certify, that the results are in accordance with the agreement.

Tester: MOREL

Date: 08/01/2015



Inspector

DILLINGER FRANCE - Groupe Dillinger Hütte A01
 Port 3032
 3032 rue du Comte Jean - CS 56317
 F-59379 Dunkerque Cedex 1 - FRANCE
 Service Qualité Essais



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations

A02 DETERMINING AVERAGE GRAIN SIZE						Appendix 1	A03: Manufacture's order/ A03: Certificat No 399394	Sheet 1/1
A05 Established	Inspecting body	B02 Steel designation	B07.2 Heat No.	B07.1 Rolled plate/ Test No.	B11 Thickness	C01	C02/ C01	
DILLINGER FRANCE		SA/A516M-485/SA/A516-70	415883	366089	38.10 mm	K1	L	

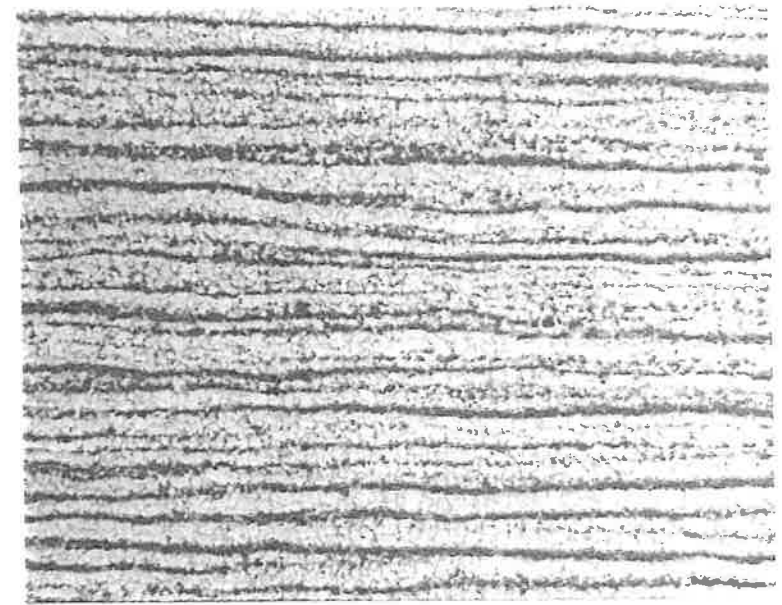
----- C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES -----

DOCUMENTATION OF THE MICROSTRUCTURE

IMAGE No. 366089

MAGNIFICATION 100:1

GRAIN SIZE 8.5

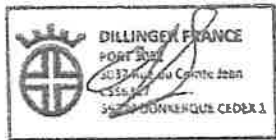


Metallography

Z01/Z02/Z03 We certify, that the results are in accordance with the agreement

Tester: MOREL

Date: 08/01/2015



Inspector

DILLINGER FRANCE-Groupe Dillinger Hütte A01
 Port 3032
 3032 rue du Comte Jean - CS 56317
 F-59379 Dunkerque Cedex 1 - FRANCE
 Service Qualité Essais



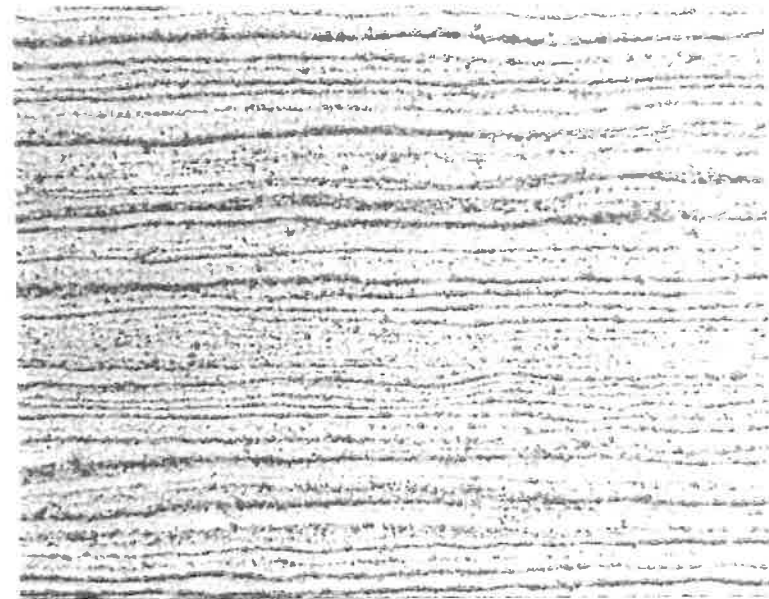
Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations

A02		Appendix				A08/ AC3 Manufacture's order/ Certificate No		Steel
DETERMINING AVERAGE GRAIN SIZE		1				399394		1/1
A05 Established	Inspecting body	B02 Steel designation	B07.2 Heat No.	B07.1 Rolled plate/ Test No	B11 Thickness	C01	C02/ C01	
	DILLINGER FRANCE	SA/A516M-485/SA/A516-70	415879	364013	22.22 mm	K1	L	

C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES

DOCUMENTATION OF THE MICROSTRUCTURE

IMAGE No. 364013
MAGNIFICATION 100:1
GRAIN SIZE 9



Metallography

Z01/Z02/Z03 We certify, that the results are in accordance with the agreement.

Tester: MOREL

Date: 08/01/2015



Inspector

DILLINGER FRANCE - Groupe Dillinger Hütte A01
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité Essais

**BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT**

INSPECTED BY: MICHAEL QUINN	GRADE: SA 516-70MT	DIA SIZE OR WITH: 36" <input type="checkbox"/> NPS <input checked="" type="checkbox"/> OD <input type="checkbox"/> ID
DATE: OCTOBER 30/2017	HEADS <input type="checkbox"/> 2:1 <input type="checkbox"/> HEMI <input type="checkbox"/> WELD CAP <input type="checkbox"/> OTHER	LENGTH 120" THICKNESS PIPE PUBLISHED NOM PLATE NOM 1.5000"
P.O.# PO-87519	SHELL <input checked="" type="checkbox"/>	Weight per foot for pipe over 4"
SUPPLIER: CESSCO FABRICATION	PIPE <input type="checkbox"/> → NDE BY MANUFACTURER	
PART ID#: VES 25674	PLATE <input type="checkbox"/> HYDRO YES <input type="checkbox"/> NDE NO <input type="checkbox"/>	
REQ. MIN TK: 1.5000"	REPAD <input type="checkbox"/> NO <input type="checkbox"/> YES <input type="checkbox"/>	
	STRUCT. <input type="checkbox"/> NO <input type="checkbox"/> NO <input type="checkbox"/>	
	OTHER <input type="checkbox"/> YES <input type="checkbox"/> YES <input type="checkbox"/>	

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35817 <i>VIC</i>	4	C32399 HT 415879 371380-02	1.501"	1.507"	1.509"	1.511"	1.503"	OK	OK	OK	ML
				1.501"	1.501"	1.504"	1.508"	OK	OK	OK	ML
				1.507"	1.513"	1.508"	1.518"	OK	OK	OK	ML
				1.506"	1.507"	1.504"	1.505"	OK	OK	OK	ML
6" X 24 COUPON	1	C32399 HT 415879 371380-02	1.504"	1.504"	1.515"						

W/O# WO-35528	RECEIVED & ACCEPTED BY: <i>DS</i>	REQUIRED CODE MARKINGS:
CUSTOMER: ARC RESOURCES GENERAL PARTNERSHP	DATE: DEC 12 2017	ALL MARKINGS STAMPED ONTO PLATE BY MANUFACTURE



7310 99 Street
 Edmonton, AB T6E 3R8
 Ph: 780-433-9531
 Fax: 780-432-7899

CERTIFICATE OF COMPLIANCE - SHELLS

Cessco Job No.: 170530 Tag No.: WO 35527/35528
 Customer: Bromley Mechanical, a div. of Argo Sales PO No.: 87519
 Material: SA-516-70N Shell Completion: Tacked

Item	Description	Log Number	Quantity	Form Procedure	Recorded Nom. Thk.	Required Nom. Thk.		
A-10	1-1/2" Plt x 36" OD x 10'-0" LG	4- C32399 4- C31891	8	Cessco FP-1	1-1/2	inches	1-1/2	inches
A-20	3/8" Plt x 36" OD x 10'-0" LG	1- C32509 1- C32510	2	Cessco FP-1	3/8	inches	3/8	inches

This is to certify that the pressure equipment listed above was manufactured in compliance with the following as applicable:

ASME Section VIII DIV I UG-79; UG80 & UCS-79

Meets the requirements of ASME Section II Part A Latest Edition and applicable project specific requirements.

ASME Section VIII DIV I UG-11(b)

ASME Section VIII DIV I UCS-79(f)

Cold Formed

Other Heat Treatment:

Other Additional NDE:

Additional Information:

Carey Gaasbeek
 Cessco QC
Oct 24 / 2017
 Date


 Signature



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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A09 Certificate No. 399394-001	Sheet 1/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES 	
B02/ Steel design. SA516-70/SA516M-485/A516-70/A516M-485 B03 Any suppl. ASME- IIA:2013/ASTM-A516:10/ASTM-A516M:10 requirements STKCHEM1001:R05-27.02.2014				

B01-B99 Description of the product

B14 Item No.	B06 Number of pieces	B09 Thickness	B10 Width	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No./ Test No.	A08 Purchaser article number
INCH									
01	1	0,5000 x	96,50000 x	384,00000	2383	N ✓	415618	363416-01 - 32330	
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363416-02 - 32331	
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363416-03 - 32332	
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363417-01 - 32327	
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363417-02 - 32328	
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363420-01 - 32329	
01	1	0,5000 x	96,50000 x	384,00000	2383	N	415618	363420-02 - 32333	
**	7				16681				
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	363426-01 - 32338	
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	363426-02 - 32336	
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	367440-01 - 32335	
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	367440-02 - 32337	
02	1	0,5000 x	120,50000 x	480,00000	3720	N	415618	377166-01 - 32334	
**	5				18600				
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	363425-01 - 32344	
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	363425-02 - 32342	
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	364016-01 - 32343	
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	364016-02 - 32340	
03	1	0,6250 x	96,50000 x	384,00000	2979	N	415618	364016-03 - 32341	
**	5				14895				
04	1	0,6250 x	72,50000 x	384,00000	2238	N	415618	363418-01 - 32347	
04	1	0,6250 x	72,50000 x	384,00000	2238	N	415618	363418-02 - 32348	
04	1	0,6250 x	72,50000 x	384,00000	2238	N	415618	363421-01 - 32346	

CHEMICAL & PHYSICALS
 CHECKED
 A.S.M.E. Ed. 2015
 @Cessco By Linda Pritchard
 09/21/2015

A04 Manufacturer's mark	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01 ED 1
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QM-System: Certification as per ISO 9001




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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 2/...
A05 Established inspecting body DF	A06 Purchaser Final receiver CESSCO FAB., EDMONTON CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

B01-B99 Description of the product

B14 Item No.	B08 Number of pieces	B09 Thickness	B10 Width	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No./ Test No.	A09 Purchaser article number
			INCH						
04	1	0,6250 x	72,50000 x	384,00000	2238	N ✓	415618	363421-02 - 32345	
**	4				8952				
05	1	0,6250 x	120,50000 x	480,00000	4650	N	415618	363419-01 - 32351	
05	1	0,6250 x	120,50000 x	480,00000	4650	N	415618	363419-02 - 32350	
05	1	0,6250 x	120,50000 x	480,00000	4650	N	415618	363422-01 - 32352	
05	1	0,6250 x	120,50000 x	480,00000	4650	N	415618	363422-02 - 32349	
**	4				18600				
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	367447-01 - 32360	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	367447-02 - 32354	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368176-01 - 32357	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368176-02 - 32355	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368176-03 - 32358	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368177-01 - 32359	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368177-02 - 32353	
06	1	0,7500 x	96,50000 x	384,00000	3575	N	415618	368177-03 - 32356	
**	8				28600				
07	1	0,7500 x	146,00000 x	504,00000	7099	N	415618	368188-01 - 32362	
07	1	0,7500 x	146,00000 x	504,00000	7099	N	415618	368189-01 - 32361	
07	1	0,7500 x	146,00000 x	504,00000	7099	N	415618	368190-01 - 32363	
**	3				21297				
08	1	0,8750 x	120,50000 x	480,00000	6510	N	415879	364012-01 - 32369	
08	1	0,8750 x	120,50000 x	480,00000	6510	N	415879	364012-02 - 32366	
08	1	0,8750 x	120,50000 x	480,00000	6510	N	415879	364013-01 - 32368	

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01
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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Steel 3/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

B01-B99 Description of the product

B14 Item No.	B08 Number of pieces	B09 Thickness	B10 Width	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No./ Test No.	A09 Purchaser article number
			INCH						
08	1	0,8750 x	120,50000 x	480,00000	6510	N ✓	415879	364013-02	- 32367
08	1	0,8750 x	120,50000 x	480,00000	6510	N	415881	368026-01	- 32365
08	1	0,8750 x	120,50000 x	480,00000	6510	N	415881	368026-02	- 32364
**	6				39060				
09	1	1,0000 x	96,50000 x	384,00000	4767	N	415881	368001-01	- 32373
09	1	1,0000 x	96,50000 x	384,00000	4767	N	415881	368001-02	- 32370
09	1	1,0000 x	96,50000 x	384,00000	4767	N	415881	368001-03	- 32371
09	1	1,0000 x	96,50000 x	384,00000	4767	N	415881	368002-01	- 32372
09	1	1,0000 x	96,50000 x	384,00000	4767	N	415881	368002-02	- 32374
**	5				23835				
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	366017-01	- 32381
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	366017-02	- 32378
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	366125-01	- 32376
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	366125-02	- 32380
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	366126-01	- 32377
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	366126-02	- 32375
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	368027-01	- 32379
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	368027-02	- 32382
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	368028-01	- 32385
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	368028-02	- 32383
10	1	1,0000 x	120,50000 x	480,00000	7440	N	415881	369010-01	- 32384
**	11				81840				
11	1	1,0000 x	145,00000 x	504,00000	9401	N	415881	366121-01	- 32387

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01 ED 1
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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)				A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 4/...
A05 Established inspecting body DF	A06 Purchaser Final receiver CESSCO FAB., EDMONTON CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES			
B02/ Steel design. B03 Any suppl. requirements	SA516-70/SA516M-485/A516-70/A516M-485 ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014					

B01-B99 Description of the product

B14 Item No.	B08 Number of pieces	B09 Thickness	B10 Width	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No/ Test No.	A09 Purchaser article number
INCH									
11	1	1,0000 x	145,00000 x	504,00000	9401	N ✓	415881	366121-02 - 32386	
11	1	1,0000 x	145,00000 x	504,00000	9401	N	415883	366122-01 - 32388	
11	1	1,0000 x	145,00000 x	504,00000	9401	N	415883	366122-02 - 32391	
11	1	1,0000 x	145,00000 x	504,00000	9401	N	415883	366123-01 - 32389	
11	1	1,0000 x	145,00000 x	504,00000	9401	N	415883	366123-02 - 32390	
**	6				56406				
12	1	1,5000 x	96,50000 x	384,00000	7150	N	415883	366089-01 - 32392	
12	1	1,5000 x	96,50000 x	384,00000	7150	N	415883	366089-02 - 32397	
12	1	1,5000 x	96,50000 x	384,00000	7150	N	415883	366089-03 - 32393	
12	1	1,5000 x	96,50000 x	384,00000	7150	N	415883	379171-01 - 32395	
12	1	1,5000 x	96,50000 x	384,00000	7150	N	415883	379171-02 - 32396	
12	1	1,5000 x	96,50000 x	384,00000	7150	N	415883	379171-03 - 32394	
**	6				42900				
13	1	1,5000 x	120,50000 x	480,00000	11161	N	415111	375109-01 - 32398	
13	1	1,5000 x	120,50000 x	480,00000	11161	N	415879	371380-01 - 32401	
13	1	1,5000 x	120,50000 x	480,00000	11161	N	415879	371380-02 - 32399	
13	1	1,5000 x	120,50000 x	480,00000	11161	N	415879	371381-01 - 32402	
13	1	1,5000 x	120,50000 x	480,00000	11161	N	415879	371381-02 - 32400	
**	5				55805				
14	1	1,5000 x	145,00000 x	504,00000	14101	N	415879	364025-01 - 32406	
14	1	1,5000 x	145,00000 x	504,00000	14101	N	415879	364026-01 - 32405	
14	1	1,5000 x	145,00000 x	504,00000	14101	N	415879	364027-01 - 32404	
14	1	1,5000 x	145,00000 x	504,00000	14101	N	415879	366124-01 - 32403	

<p>Manufacturer's mark</p>	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	<p>POISSONNET Test House Manager</p>	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais	A01 Date 11.02.15
			ED 1	

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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 5/...
A05 Established inspecting body DF	A06 Purchaser Final receiver CESSCO FAB., EDMONTON CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

B01-B99 Description of the product

B14 Item No.	B08 Number of pieces	B09 Thickness	B10 Width	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No./ Test No.	A09 Purchaser article number
**	4		INCH		56404				
***	79				483875				

B04 Product delivery condition

ITEM NO.: 01-14
N: HT: 1670 GR.F +27 -27 GR.F
SOAKING TIME TO ATTAIN THE TARGET TEMPERATURE OVER THE WHOLE SECTION: 1-1,75 MIN/MM (25-45 MIN/INCH)
COOLING IN STILL AIR

B06 Marking of the product

ITEM NO.: 01-14
STEEL DESIGNATION SA516 70 MTLTV SA516M 485 MTLTV
HEAT NO. / TRADEMARK / ROLLED PLATE NO.-TEST NO.

B07-B99 Further information about the product

ITEM NO.: 01-14
THICKNESS REDUCTION RATIO >= 3,0 IS FULFILLED (CF. A/SA20 PAR. 5.3)

C10-C29 Tensile test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B08 Reference (heat) treatment	C01 C02/ C01 GRF	C03 Temp. GRP	C10 MPA RP02	C11	C12 RM	C13	A % LO=ZIN	A % LO=8IN	C14-C15
01	415618	363416		K1	Q0	RT	427	559			25	
01	415618	363417		K1	Q0	RT	401	553			24	
01	415618	363420		K1	Q0	RT	419	555			24	

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01
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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No/ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 6/...
A05 Established inspecting body DP	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C10-C29 Tensile test

B14 Item No.	B07.2 Heat No.	B07.1 Rot.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/ C01	C03 Temp. GR.F	C10	C11 ✓ MPA RP02	C12 ✓ RM	C13	A % L0=21N	A % L0=81N	C14-C15
02	415618	363426		K1	Q0	RT		412	554			25	
02	415618	367440		K1	Q0	RT		413	561			23	
02	415618	377166		K1	Q0	RT		405	558			23	
03	415618	363425		K1	Q0	RT		416	559			25	
03	415618	364016		K1	Q0	RT		421	566			24	
04	415618	363418		K1	Q0	RT		401	550			24	
04	415618	363421		K1	Q0	RT		403	552			22	
05	415618	363419		K1	Q0	RT		417	558			24	
05	415618	363422		K1	Q0	RT		420	560			25	
06	415618	367447		K1	Q0	RT		402	553			25	
06	415618	368176		K1	Q0	RT		403	554			25	
06	415618	368177		K1	Q0	RT		405	553			26	
07	415618	368188		K1	Q0	RT		402	552			25	
07	415618	368189		K1	Q0	RT		403	551			26	
07	415618	368190		K1	Q0	RT		401	555			25	
08	415879	364012		K1	Q0	RT		406	557			26	
08	415879	364013		K1	Q0	RT		412	553			26	
08	415881	368026		K1	Q0	RT		404	545			24	
09	415881	368001		K1	Q0	RT		389	532			28	
09	415881	368002		K1	Q0	RT		397	530			27	
10	415881	366017		K1	Q0	RT		391	532			27	
10	415881	366125		K1	Q0	RT		409	550			25	
10	415881	366126		K1	Q0	RT		391	530			26	

A04	 Manufacturer's mark	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01
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QM-System: Certification as per ISO 9001



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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 7/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C10-C29 Tensile test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/ C01 Temp. GR.F	C03	C10	C11 MPA RP02	C12 RM	C13	A % LO=2IN	A % LO=8IN	C14-C15
10	415881	368027		K1	Q0	RT		390	530			26	
10	415881	368028		K1	Q0	RT		394	533			26	
10	415881	369010		K1	Q0	RT		393	534			27	
11	415881	366121		K1	Q0	RT		393	535			27	
11	415883	366122		K1	Q0	RT		396	542			28	
11	415883	366123		K1	Q0	RT		398	542			27	
12	415883	366089		K1	QV	RT		384	535	38			
12	415883	379171		K1	QV	RT		375	531	38			
13	415111	375109		K1	QV	RT		403	549	37			
13	415879	371380		K1	QV	RT		382	542	34			
13	415879	371381		K1	QV	RT		382	543	37			
14	415879	364025		K1	QV	RT		410	548	37			
14	415879	364026		K1	QV	RT		398	547	35			
14	415879	364027		K1	QV	RT		387	544	36			
14	415879	366124		K1	QV	RT		400	544	37			

C30-C39 Hardness test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/C01	C03 Temp. GR.F	C30 Method of test	C35	C31 Individual values	C32 Mean value
01	415618	363416		K1	Q0		RT HBW 5/750	HB	158	
01	415618	363417		K1	Q0		RT HBW 5/750	HB	156	
01	415618	363420		K1	Q0		RT HBW 5/750	HB	162	
02	415618	363426		K1	Q0		RT HBW 5/750	HB	159	
02	415618	367440		K1	Q0		RT HBW 5/750	HB	161	

A04	201/202/203 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 <p>BROMLEY MECHANICAL SERVICES Checked to ASME</p>	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01
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Sect. IIA 2015 Edd. rein 16501

SA 20 DL 12/12/17
Date

QM-System: Certification as per ISO 9001




DILLINGER HÜTTE

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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No/ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 8/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design.	SAS16-70/SAS16M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C30-C39 Hardness test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.platai Test No.	B05 Reference (heat) treatment	C01	C02/C01	C03 Temp. GR.F	C30 Method of test	C35	C31 Individual values	C32 Mean value
02	415618	377166		K1	Q0	RT	HBW 5/750	HB	163	
03	415618	363425		K1	Q0	RT	HBW 5/750	HB	157	
03	415618	364016		K1	Q0	RT	HBW 5/750	HB	163	
04	415618	363418		K1	Q0	RT	HBW 5/750	HB	156	
04	415618	363421		K1	Q0	RT	HBW 5/750	HB	155	
05	415618	363419		K1	Q0	RT	HBW 5/750	HB	153	
05	415618	363422		K1	Q0	RT	HBW 5/750	HB	158	
06	415618	367447		K1	Q0	RT	HBW 5/750	HB	158	
06	415618	368176		K1	Q0	RT	HBW 5/750	HB	159	
06	415618	368177		K1	Q0	RT	HBW 5/750	HB	159	
07	415618	368188		K1	Q0	RT	HBW 5/750	HB	162	
07	415618	368189		K1	Q0	RT	HBW 5/750	HB	158	
07	415618	368190		K1	Q0	RT	HBW 5/750	HB	153	
08	415879	364012		K1	Q0	RT	HBW 5/750	HB	162	
08	415879	364013		K1	Q0	RT	HBW 5/750	HB	164	
08	415881	368026		K1	Q0	RT	HBW 5/750	HB	155	
09	415881	368001		K1	Q0	RT	HBW 5/750	HB	150	
09	415881	368002		K1	Q0	RT	HBW 5/750	HB	149	
10	415881	366017		K1	Q0	RT	HBW 5/750	HB	155	
10	415881	366125		K1	Q0	RT	HBW 5/750	HB	160	
10	415881	366126		K1	Q0	RT	HBW 5/750	HB	155	
10	415881	368027		K1	Q0	RT	HBW 5/750	HB	149	
10	415881	368028		K1	Q0	RT	HBW 5/750	HB	150	
10	415881	369010		K1	Q0	RT	HBW 5/750	HB	152	

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01
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QM-System: Certification as per ISO 9001



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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 9/...
A05 Established inspecting body DF	A08 Purchaser Final receiver CESSCO FAB., EDMONTON CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C30-C39 Hardness test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/C01	C03 Temp. GRF	C30 Method of test	C35	C31 Individual values	C32 Mean value
11	415881	366121		K1	Q0	RT	HBW 5/750	HB	147	
11	415883	366122		K1	Q0	RT	HBW 5/750	HB	156	
11	415883	366123		K1	Q0	RT	HBW 5/750	HB	147	
12	415883	366089		K1	Q0	RT	HBW 5/750	HB	153	
12	415883	379171		K1	Q0	RT	HBW 5/750	HB	149	
13	415111	375109		K1	Q0	RT	HBW 5/750	HB	165	
13	415879	371380		K1	Q0	RT	HBW 5/750	HB	153	
13	415879	371381		K1	Q0	RT	HBW 5/750	HB	158	
14	415879	364025		K1	Q0	RT	HBW 5/750	HB	157	
14	415879	364026		K1	Q0	RT	HBW 5/750	HB	153	
14	415879	364027		K1	Q0	RT	HBW 5/750	HB	153	
14	415879	366124		K1	Q0	RT	HBW 5/750	HB	156	

C40-C49 Impact test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02/C01	C03 Temp. GRF	C41 Width of test piece	C40 Type of test piece	C44 Testing method	C45 Energy	C45	C42 Individual values AV=FT.LBF	C43 Mean value	
01	415618	363416		K1	LO	-51		CHP-V		AV 8	190	195	170	185
01	415618	363417		K1	LO	-51		CHP-V		AV 8	192	147	159	166
01	415618	363420		K1	LO	-51		CHP-V		AV 8	170	147	200	172
02	415618	363426		K1	LO	-51		CHP-V		AV 8	185	130	192	169
02	415618	367440		K1	LO	-51		CHP-V		AV 8	136	117	129	127
02	415618	377166		K1	LO	-51		CHP-V		AV 8	143	147	194	161
03	415618	363425		K1	LO	-51		CHP-V		AV 8	142	132	134	136
03	415618	364016		K1	LO	-51		CHP-V		AV 8	113	118	135	122

<p>Manufacturer's mark</p>	<p>Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.</p>	<p>POISSONNET Test House Manager</p>	<p>Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais</p>	A01
	<p>Date 11.02.15</p>		<p>ED 1</p>	

QM-System: Certification as per ISO 9001



DILLINGER HÜTTE

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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 10/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C40-C49 Impact test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plata/ Test No.	B05 Reference (heat) treatment	C01	C02/ C01	C03 Temp. GR.F	C41 Width of test piece	C40 Type of test piece	C44 Testing method	C46 Energy	C45	C42 Individual values AV=FT.LBF		C43 Mean value	
04	415618	363418		K1	LO	-51		CHP-V			AV 8	125	108	125	119
04	415618	363421		K1	LO	-51		CHP-V			AV 8	142	197	151	163
05	415618	363419		K1	LO	-51		CHP-V			AV 8	151	139	135	142
05	415618	363422		K1	LO	-51		CHP-V			AV 8	137	119	149	135
06	415618	367447		K1	LO	-51		CHP-V			AV 8	136	119	148	134
06	415618	368176		K1	LO	-51		CHP-V			AV 8	138	120	141	133
06	415618	368177		K1	LO	-51		CHP-V			AV 8	141	134	189	155
07	415618	368188		K1	LO	-51		CHP-V			AV 8	131	120	136	129
07	415618	368189		K1	LO	-51		CHP-V			AV 8	186	129	109	141
07	415618	368190		K1	LO	-51		CHP-V			AV 8	119	116	129	121
08	415879	364012		K1	LO	-51		CHP-V			AV 8	162	156	205	174
08	415879	364013		K1	LO	-51		CHP-V			AV 8	192	191	189	191
08	415881	368026		K1	LO	-51		CHP-V			AV 8	201	201	180	194
09	415881	368001		K1	LV	-51		CHP-V			AV 8	212	188	197	199
09	415881	368002		K1	LV	-51		CHP-V			AV 8	197	184	193	191
10	415881	366017		K1	LV	-51		CHP-V			AV 8	198	193	195	195
10	415881	366125		K1	LV	-51		CHP-V			AV 8	191	187	187	188
10	415881	366126		K1	LV	-51		CHP-V			AV 8	198	197	193	196
10	415881	368027		K1	LV	-51		CHP-V			AV 8	152	197	213	187
10	415881	368028		K1	LV	-51		CHP-V			AV 8	195	207	187	196
10	415881	369010		K1	LV	-51		CHP-V			AV 8	191	145	161	166
11	415881	366121		K1	LV	-51		CHP-V			AV 8	188	165	139	164
11	415883	366122		K1	LV	-51		CHP-V			AV 8	197	198	195	197
11	415883	366123		K1	LV	-51		CHP-V			AV 8	161	149	208	173

A04 Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.



[Signature]

POISSONNET
Test House Manager

Dillinger France
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais

Date 11.02.15

ED 1

QM-System: Certification as per ISO 9001



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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 11/...
A05 Established inspecting body DF	A06 Purchase Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257	B01 Product HEAVY PLATES	
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C40-C49 Impact test

B14 Item No.	B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01	C02 C01	C03 Temp. GRF	C41 Width of test piece	C40 Type of test piece	C44 Testing method	C46 Energy	C45	C42 Individual values AV=FT,LBF		C43 Mean value	
12	415883	366089		K1	LV	-51		CHP-V			AV 8	142	168	202	171
12	415883	379171		K1	LV	-51		CHP-V			AV 8	157	128	125	137
13	415111	375109		K1	LV	-51		CHP-V			AV 8	131	156	134	140
13	415879	371380		K1	LV	-51		CHP-V			AV 8	131	134	135	133
13	415879	371381		K1	LV	-51		CHP-V			AV 8	131	89	125	115
14	415879	364025		K1	LV	-51		CHP-V			AV 8	132	143	195	157
14	415879	364026		K1	LV	-51		CHP-V			AV 8	119	135	131	128
14	415879	364027		K1	LV	-51		CHP-V			AV 8	122	201	116	146
14	415879	366124		K1	LV	-51		CHP-V			AV 8	127	133	157	139

C66-C68 Supplementary tests on test samples

ITEM NO.: 12-13

FERRITE GRAIN SIZE ASTM E112 (SEE APPENDIX)

B07.2	B07.1	RESULT
415618	363422	9,0
415879	364013	9,0
415883	366089	8,5
415881	366125	9,0
415111	375109	9,0

A04



Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.

POISSONNET
Test House Manager

Dillinger France
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais

Date 11.02.15

ED 1

A01

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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 12/...
A05 Established (inspecting body) DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C70-C99 Chemical composition % - Heat analysis

B07.2 Heat	C70	C	SI	MN	P	S	CU	MO	NI	CR	V	NB	TI	B	CA
415111	Y	0,168	0,379	1,17	0,009	0,0007	0,170	0,011	0,371	0,026	0,001	0,016	0,002	0,0001	0,0013
415618	Y	0,180	0,372	1,16	0,007	0,0008	0,098	0,013	0,057	0,040	0,001	0,017	0,002	0,0003	0,0027
415879	Y	0,177	0,369	1,17	0,007	0,0008	0,170	0,028	0,360	0,062	0,001	0,018	0,004	0,0003	0,0023
415881	Y	0,158	0,318	1,18	0,007	0,0009	0,177	0,019	0,362	0,033	0,001	0,016	0,003	0,0003	0,0015
415883	Y	0,163	0,343	1,18	0,007	0,0008	0,168	0,026	0,363	0,043	0,001	0,017	0,003	0,0002	0,0010

B07.2 Heat	C70	AL-T
415111	Y	0,031
415618	Y	0,032
415879	Y	0,042
415881	Y	0,046
415883	Y	0,039

C94 Heat analysis Carbon equivalent / Alloying restrictions

B07.2 Heat	FO-02=	FO-51=	FO-55=	FO-70=	FO-78=
415111 ✓	0,41	0,017	0,58	0,2	0,04
415618 ✓	0,39	0,018	0,21	0,2	0,05
415879 ×	0,43	0,019	0,62	0,3	0,09
415881 ✓	0,40	0,017	0,59	0,2	0,05
415883 ✓	0,41	0,018	0,60	0,3	0,07

C95 Ladle treatment

ITEM NO.: 01-14
HEAT OF THE INDICATED ITEM: VACUUM DEGASSED / SULPHIDE SHAPE CONTROL

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	A01
	BROMLEY MECHANICAL SERVICES Checked to ASME	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15
	Sect. IIA 2015 Edd. Min 1.501" POISSONNET Test House Manager	ED 1

SA 20 08 12/12/17
Date

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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 13/...
A06 Established inspecting body DF	A08 Purchaser Final receiver CESSCO FAB., EDMONTON CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design. SA516-70/SA516M-485/A516-70/A516M-485		B03 Any suppl. requirements ASME- IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014		

C95 Further information about ladle treatment

ITEM NO.: 01-14
 MELTED IN GERMANY BY -AG DER DILLINGER HUETTENWERKE, DILLINGEN/SAAR-

ITEM NO.: 01-14
 FULLY KILLED AND MADE TO FINE GRAIN PRACTICE ✓

C70-C99 Further information about heat analysis

ITEM NO.: 01-14
 OXYGEN MAX. 0,005% ON LADLE AND ON PRODUCT

C70-C99 Chemical composition % - Product analysis

B07.2 Heat	B07.1 Test No.	CM1	C ✓	SI ✓	MN ✓	P ✓	S ✓	CU ✓	MO ✓	NI ✓	CR ✓	V ✓	NB ✓	TI ✓	B ✓	CA ✓
415111	375109	K10	0,166	0,364	1,13	0,009	0,0007	0,168	0,011	0,379	0,028	0,001	0,015	0,002	0,0002	0,0013
415618	363416	K10	0,185	0,375	1,14	0,007	0,0006	0,092	0,012	0,055	0,038	0,001	0,018	0,002	0,0001	0,0022
415618	363417	K10	0,182	0,368	1,12	0,007	0,0006	0,091	0,012	0,054	0,038	0,001	0,016	0,002	0,0002	0,0022
415618	363418	K10	0,181	0,354	1,13	0,007	0,0004	0,093	0,012	0,058	0,041	0,001	0,017	0,003	0,0002	0,0024
415618	363419	K10	0,178	0,362	1,14	0,007	0,0003	0,093	0,012	0,058	0,041	0,001	0,017	0,002	0,0002	0,0022
415618	363420	K10	0,176	0,352	1,13	0,007	0,0003	0,092	0,012	0,058	0,041	0,001	0,017	0,002	0,0001	0,0026
415618	363421	K10	0,166	0,367	1,16	0,008	0,0003	0,095	0,013	0,058	0,041	0,001	0,018	0,003	0,0002	0,0022
415618	363422	K10	0,173	0,359	1,13	0,007	0,0004	0,092	0,012	0,057	0,040	0,001	0,015	0,002	0,0002	0,0027
415618	363425	K10	0,175	0,356	1,13	0,007	0,0004	0,094	0,012	0,058	0,041	0,001	0,016	0,002	0,0002	0,0026
415618	363426	K10	0,180	0,347	1,15	0,007	0,0004	0,097	0,012	0,058	0,041	0,000	0,015	0,002	0,0002	0,0018
415618	364016	K10	0,169	0,342	1,13	0,007	0,0003	0,095	0,012	0,057	0,041	0,001	0,016	0,002	0,0002	0,0026
415618	367440	K10	0,173	0,352	1,14	0,007	0,0005	0,093	0,012	0,058	0,041	0,001	0,016	0,002	0,0002	0,0027
415618	367447	K10	0,181	0,362	1,16	0,008	0,0003	0,094	0,013	0,059	0,041	0,001	0,019	0,003	0,0002	0,0024
415618	368176	K10	0,180	0,349	1,11	0,007	0,0003	0,092	0,012	0,057	0,041	0,001	0,016	0,002	0,0002	0,0025
415618	368177	K10	0,179	0,349	1,12	0,007	0,0003	0,094	0,012	0,058	0,041	0,001	0,016	0,002	0,0002	0,0025

A04 Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.



Manufacturer's mark

POISSONNET
 Test House Manager

Dillinger France
 Port 3032
 3032 rue du Comte Jean - CS 56317
 F-59379 Dunkerque Cedex 1 - FRANCE
 Service Qualité-Essais

Date 11.02.15 ED 1

A01

QM-System: Certification as per ISO 9001





DILLINGER HÜTTE

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A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A06/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 14/...
A05 Established inspecting body DF	A06 Purchaser Final receiver CESSCO FAB., EDMONTON CESSCO FAB., EDMONTON	A07.1 No. K-04257	B01 Product HEAVY PLATES	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C70-C99 Chemical composition % - Product analysis

B07.2 Heat	B07.1 Test No.	C01	C ✓	SI ✓	MN ✓	P ✓	S ✓	CU ✓	MO ✓	NI ✓	CR ✓	V ✓	NB ✓	TI ✓	B ✓	CA ✓
415618	368188	K10	0,137	0,352	1,13	0,007	0,0004	0,094	0,012	0,058	0,041	0,001	0,016	0,002	0,0002	0,0028
415618	368189	K10	0,154	0,349	1,11	0,006	0,0002	0,089	0,012	0,056	0,040	0,001	0,014	0,002	0,0002	0,0027
415618	368190	K10	0,186	0,353	1,13	0,007	0,0003	0,094	0,012	0,058	0,041	0,001	0,017	0,003	0,0002	0,0027
415618	377166	K10	0,181	0,360	1,16	0,008	0,0005	0,097	0,013	0,058	0,041	0,001	0,017	0,002	0,0002	0,0021
415879	364012	K10	0,171	0,360	1,14	0,006	0,0004	0,162	0,027	0,365	0,063	0,001	0,017	0,003	0,0003	0,0022
415879	364013	K10	0,164	0,341	1,15	0,007	0,0006	0,169	0,024	0,368	0,054	0,001	0,017	0,003	0,0002	0,0017
415879	364025	K10	0,170	0,360	1,14	0,006	0,0006	0,169	0,028	0,363	0,061	0,001	0,018	0,003	0,0002	0,0019
415879	364026	K10	0,169	0,364	1,15	0,006	0,0004	0,161	0,027	0,369	0,063	0,001	0,017	0,003	0,0003	0,0022
415879	364027	K10	0,167	0,356	1,14	0,006	0,0004	0,161	0,026	0,364	0,062	0,001	0,017	0,003	0,0002	0,0021
415879	366124	K10	0,166	0,350	1,14	0,006	0,0008	0,169	0,026	0,361	0,056	0,001	0,017	0,003	0,0003	0,0019
415879	371380	K10	0,168	0,346	1,11	0,007	0,0006	0,162	0,027	0,371	0,064	0,001	0,017	0,003	0,0003	0,0023
415879	371381	K10	0,170	0,348	1,11	0,006	0,0004	0,160	0,027	0,369	0,064	0,001	0,017	0,003	0,0003	0,0025
415881	366017	K10	0,153	0,313	1,14	0,007	0,0008	0,172	0,019	0,367	0,035	0,001	0,015	0,002	0,0002	0,0015
415881	366121	K10	0,160	0,322	1,15	0,007	0,0005	0,162	0,025	0,370	0,042	0,001	0,017	0,003	0,0002	0,0011
415881	366125	K10	0,161	0,335	1,14	0,007	0,0005	0,168	0,024	0,368	0,051	0,001	0,016	0,003	0,0002	0,0015
415881	366126	K10	0,151	0,307	1,14	0,007	0,0007	0,175	0,019	0,365	0,033	0,001	0,015	0,002	0,0002	0,0014
415881	368001	K10	0,149	0,304	1,13	0,007	0,0006	0,167	0,019	0,365	0,035	0,001	0,015	0,002	0,0002	0,0014
415881	368002	K10	0,150	0,303	1,15	0,007	0,0005	0,176	0,019	0,367	0,034	0,001	0,015	0,002	0,0002	0,0012
415881	368026	K10	0,155	0,316	1,15	0,007	0,0005	0,173	0,021	0,366	0,044	0,001	0,016	0,003	0,0002	0,0014
415881	368027	K10	0,148	0,308	1,11	0,007	0,0009	0,174	0,018	0,352	0,029	0,001	0,015	0,002	0,0002	0,0013
415881	368028	K10	0,149	0,299	1,11	0,006	0,0005	0,167	0,020	0,362	0,035	0,001	0,014	0,002	0,0002	0,0009
415881	369010	K10	0,160	0,321	1,14	0,007	0,0003	0,169	0,022	0,371	0,046	0,001	0,016	0,003	0,0002	0,0014
415883	366089	K10	0,157	0,334	1,15	0,007	0,0005	0,164	0,026	0,369	0,044	0,001	0,017	0,003	0,0002	0,0011
415883	366122	K10	0,159	0,325	1,14	0,007	0,0001	0,160	0,027	0,367	0,045	0,001	0,018	0,003	0,0002	0,0009
415883	366123	K10	0,154	0,327	1,13	0,007	0,0006	0,158	0,025	0,362	0,043	0,001	0,015	0,003	0,0002	0,0012

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 Manufacturer's mark	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01
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Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 15/...
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES	
B02/ Steel design.	SA516-70/SA516M-485/A516-70/A516M-485			
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014			

C70-C99 Chemical composition % - Product analysis

B07.2 Heat	B07.1 Test No.	C01	C ✓	SI ✓	MN	P ✓	S ✓	CU ✓	MO ✓	NI ✓	CR ✓	V ✓	NB ✓	TI ✓	B	CA ✓
415883	379171	K10	0,163	0,330	1,14	0,007	0,0005	0,162	0,027	0,365	0,045	0,001	0,016	0,003	0,0002	0,0010

C94 Product analysis Carbon equivalent / Alloying restrictions

B07.2 Heat	B07.1 Test No.	C01	FO-02=	FO-51=	FO-55=	FO-70=	FO-78=
415111	375109	K10	0,40	0,016	0,59	0,2	0,04
415618	363416	K10	0,40	0,019	0,20	0,2	0,05
415618	363417	K10	0,39	0,017	0,20	0,2	0,05
415618	363418	K10	0,39	0,018	0,20	0,2	0,05
415618	363419	K10	0,39	0,018	0,20	0,2	0,05
415618	363420	K10	0,39	0,018	0,20	0,2	0,05
415618	363421	K10	0,38	0,019	0,21	0,2	0,05
415618	363422	K10	0,38	0,016	0,20	0,2	0,05
415618	363425	K10	0,38	0,017	0,21	0,2	0,05
415618	363426	K10	0,39	0,015	0,21	0,2	0,05
415618	364016	K10	0,38	0,017	0,21	0,2	0,05
415618	367440	K10	0,38	0,017	0,20	0,2	0,05
415618	367447	K10	0,40	0,020	0,21	0,2	0,05
415618	368176	K10	0,39	0,017	0,20	0,2	0,05
415618	368177	K10	0,39	0,017	0,21	0,2	0,05
415618	368188	K10	0,40	0,017	0,21	0,2	0,05
415618	368189	K10	0,37	0,015	0,20	0,2	0,05
415618	368190	K10	0,40	0,018	0,21	0,2	0,05
415618	377166	K10	0,40	0,018	0,21	0,2	0,05
415879	364012	K10	0,41	0,018	0,62	0,3	0,09
415879	364013	K10	0,41	0,018	0,62	0,3	0,08

A04	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15	A01
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Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)			A10 Advice of dispatch No./ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 16/...
A05 Established inspecting body DF	A06 Purchaser Final receiver CESSCO FAB., EDMONTON CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES		
B02/ Steel design. SA516-70/SA516M-485/A516-70/A516M-485 B03 Any suppl. ASME-IIA: 2013/ASTM-A516:10/ASTM-A516M:10 requirements STKCHEM1001:R05-27.02.2014					

C94 Product analysis Carbon equivalent / Alloying restrictions

B07.2 Heat	B07.1 Test No.	C01										
415879	364025	K10	FO-02=	0,41	FO-51=	0,019	FO-55=	0,62	FO-70=	0,3	FO-78=	0,09
415879	364026	K10	FO-02=	0,41	FO-51=	0,018	FO-55=	0,62	FO-70=	0,3	FO-78=	0,09
415879	364027	K10	FO-02=	0,41	FO-51=	0,018	FO-55=	0,61	FO-70=	0,3	FO-78=	0,09
415879	366124	K10	FO-02=	0,41	FO-51=	0,018	FO-55=	0,61	FO-70=	0,3	FO-78=	0,08
415879	371380	K10	FO-02=	0,41	FO-51=	0,018	FO-55=	0,62	FO-70=	0,3	FO-78=	0,09
415879	371381	K10	FO-02=	0,41	FO-51=	0,018	FO-55=	0,62	FO-70=	0,3	FO-78=	0,09
415881	366017	K10	FO-02=	0,39	FO-51=	0,016	FO-55=	0,59	FO-70=	0,2	FO-78=	0,05
415881	366121	K10	FO-02=	0,40	FO-51=	0,018	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07
415881	366125	K10	FO-02=	0,40	FO-51=	0,017	FO-55=	0,61	FO-70=	0,3	FO-78=	0,08
415881	366126	K10	FO-02=	0,39	FO-51=	0,016	FO-55=	0,59	FO-70=	0,2	FO-78=	0,05
415881	368001	K10	FO-02=	0,38	FO-51=	0,016	FO-55=	0,59	FO-70=	0,2	FO-78=	0,05
415881	368002	K10	FO-02=	0,39	FO-51=	0,016	FO-55=	0,60	FO-70=	0,2	FO-78=	0,05
415881	368026	K10	FO-02=	0,40	FO-51=	0,017	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07
415881	368027	K10	FO-02=	0,38	FO-51=	0,016	FO-55=	0,57	FO-70=	0,2	FO-78=	0,05
415881	368028	K10	FO-02=	0,38	FO-51=	0,015	FO-55=	0,58	FO-70=	0,2	FO-78=	0,06
415881	369010	K10	FO-02=	0,40	FO-51=	0,017	FO-55=	0,61	FO-70=	0,3	FO-78=	0,07
415883	366089	K10	FO-02=	0,40	FO-51=	0,018	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07
415883	366122	K10	FO-02=	0,40	FO-51=	0,019	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07
415883	366123	K10	FO-02=	0,39	FO-51=	0,016	FO-55=	0,59	FO-70=	0,2	FO-78=	0,07
415883	379171	K10	FO-02=	0,40	FO-51=	0,017	FO-55=	0,60	FO-70=	0,3	FO-78=	0,07

A04



Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.



POISSONNET
Test House Manager

Dillinger France
 Port 3032
 3032 rue du Comte Jean - CS 56317
 F-59379 Dunkerque Cedex 1 - FRANCE
 Service Qualité-Essais
 Date 11.02.15

A01



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004 INSPECTION CERTIFICATE 3.1 AS PER ISO 10474:2013 MATERIAL TEST REPORT (MTR)		A10 Advice of dispatch No/ Date of dispatch 6492887-06.02.15	A08/ Manufacturer's order/ A03 Certificate No. 399394-001	Sheet 17	
A05 Established inspecting body DF	A06 Purchaser CESSCO FAB., EDMONTON Final receiver CESSCO FAB., EDMONTON	A07.1 No. K-04257 A07.2 No.	B01 Product HEAVY PLATES		
B02 Steel design.	SA516-70/SA516M-485/A516-70/A516M-485				
B03 Any suppl. requirements	ASME-IIA:2013/ASTM-A516:10/ASTM-A516M:10 STKCHEM1001:R05-27.02.2014				
C94 Carbon equivalent formula / Alloying restrictions					
FO-02 = C+(MN/6)+(CR+MO+V)/5+(NI+CU)/15 FO-51 = V +NB FO-55 = CU+MO+NI+CR FO-70 = CU+MO+CR+NB+V +TI FO-78 = CR+MO					
D01 Marking and identification, surface appearance, shape and dimensional properties					
ITEM NO.: 01-14 EXAMINATION OF MARKING, SURFACE, SHAPE AND DIMENSIONS: THE RESULTS MEET THE REQUIREMENTS. SURFACE AS PER ASME-SA20 (M) THICKNESS AS PER ASTM/ASME-20 (M+US) LENGTH AND WIDTH AS PER ASME-SA20 FLATNESS AS PER ASME-SA20					
D01 Further information about marking and identification, surface appearance, shape and dimensional properties					
ITEM NO.: 01-14 NO WELDING OR WELD REPAIRS HAVE BEEN PERFORMED.					
D02 Non-destructive tests - Ultrasonic testing					
ITEM NO.: 01-14 UT-SPECIFICATION : ASME-SA578 (M) LEVEL C SUPPLEMENTARY REQUIREMENTS S1 ✓ SCANNING PLAN BODY : 100% OF PLATE SURFACE PERSONNEL QUALIFICATION : LEVEL 2 IN ACC. TO EN 473 / ISO 9712 AND SNT-TC-1A THE TEST RESULTS MEET THE REQUIREMENTS OF THE ORDER.					
A04  Manufacturer's mark	Z01/Z02/Z03 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.			 POISSONNET Test House Manager	Dillinger France Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 11.02.15
				Sheet ED 1	



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations

A02 DETERMINING AVERAGE GRAIN SIZE				Appendix 1		A08/ A03 Manufacture's order/ Certificat No. 399394		Sheet 1/1	
A05 Established DILLINGER FRANCE	Inspecting body	B02 Steel designation SA/A516M-485/SA/A516-70	B07.2 Heat No. 415111	B07.1 Rolled plate/ Test No. 375109	B11 Thickness 38.1 mm	C01 K1	C02/ C01 L		

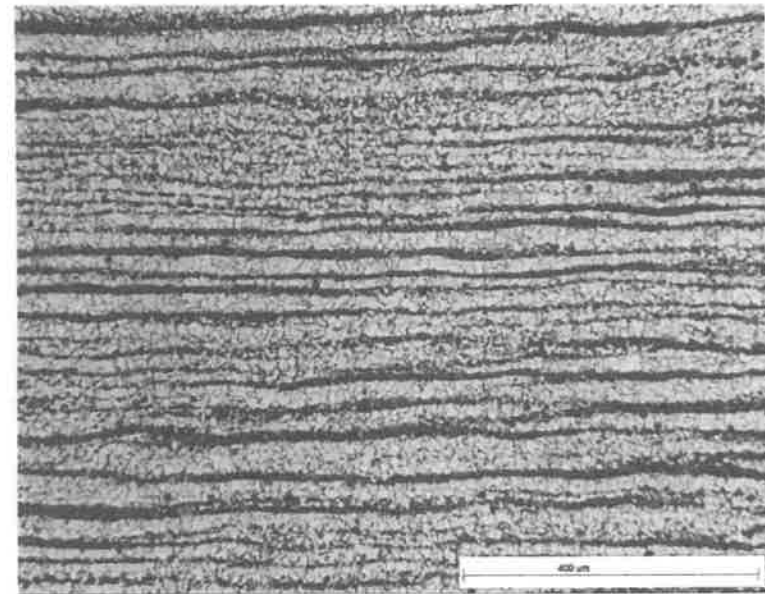
----- C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES -----

**DOCUMENTATION OF THE
MICROSTRUCTURE**

IMAGE No. **375109**

MAGNIFICATION **100:1**

GRAIN SIZE **9**



Metallography

Tester: **MOREL**

Date: **27/01/2015**



Z01/Z02/Z03 We certify, that the results are in accordance with the agreement.

Inspector

DILLINGER FRANCE - Groupe Dillinger Hütte A01
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
 Service Qualité Essais



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations

A02 DETERMINING AVERAGE GRAIN SIZE						Appendix 1	A03: Manufacture's order/ A03: Certificat No. 399394	Sheet 1/1
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A05 Established	Inspecting body	B02 Steel designation	B07.2 Heat No.	B07.1 Rolled plate/ Test No.	B11 Thickness	C01	C02/ C01
	DILLINGER FRANCE	SA/A516M-485/SA/A516-70	415618	363422	15.87 mm	K1	L

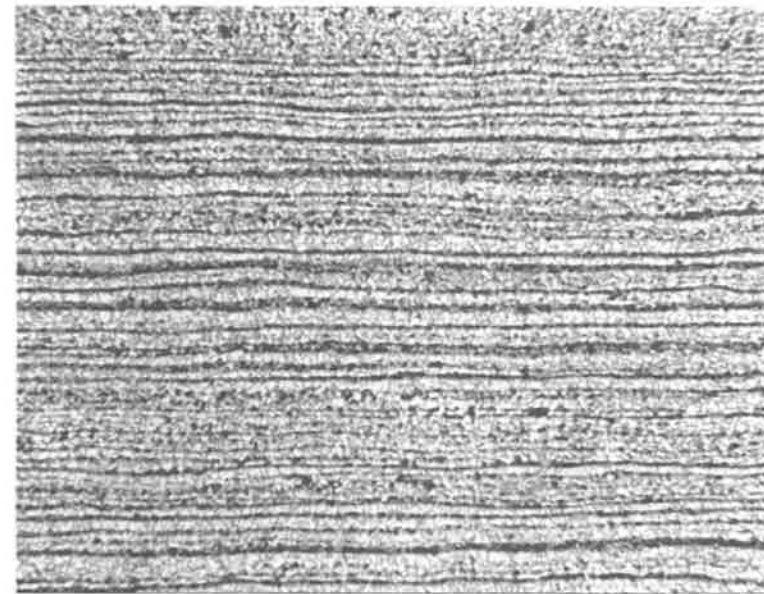
----- C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES -----

**DOCUMENTATION OF THE
MICROSTRUCTURE**

IMAGE No. **363422**

MAGNIFICATION **100:1**

GRAIN SIZE **9**



Metallography

Tester: **MOREL**

Date: **13/01/2015**



Z01/Z02/Z03 We certify, that the results are in accordance with the agreement.

Inspector

DILLINGER FRANCE—Groupe Dillinger Hütte A01
Port 3032
3032 rue du Comte Jean – CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
 Service Qualité Essais



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations

A02 DETERMINING AVERAGE GRAIN SIZE						Appendix 1	A03: Manufacture's order/ A03 Certificat No. 399394	Sheet 1/1
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A05 Established DILLINGER FRANCE	Inspecting body	B02 Steel designation SA/A516M-485/SA/A516-70	B07.2 Heat No. 415881	B07.1 Rolled plate/ Test No. 366125	B11 Thickness 25.40 mm	C01 K1	C02/ C01 L
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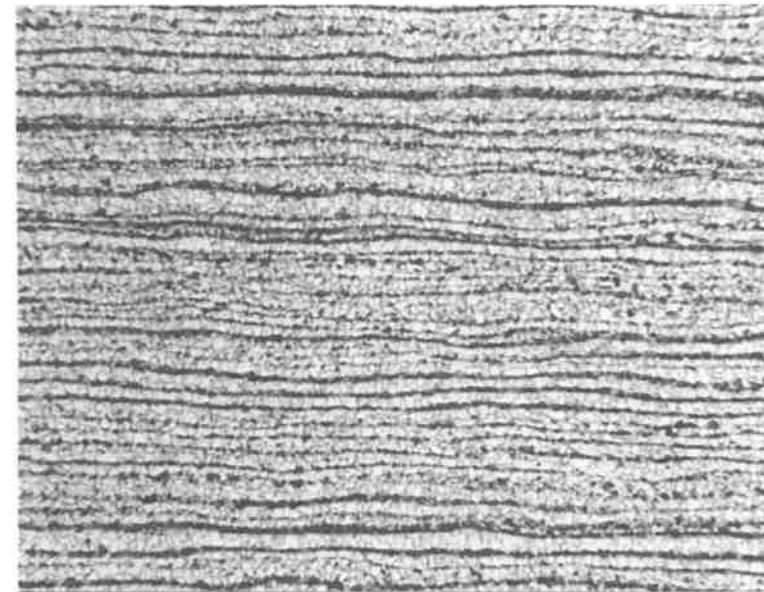
----- C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES -----

DOCUMENTATION OF THE MICROSTRUCTURE

IMAGE No. 366125

MAGNIFICATION 100:1

GRAIN SIZE 9



Metallography

Tester: **MOREL**

Date: **08/01/2015**



Z01/Z02/Z03 We certify, that the results are in accordance with the agreement.

Inspector

DILLINGER FRANCE–Groupe Dillinger Hütte A01
Port 3032
3032 rue du Comte Jean – CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
 Service Qualité Essais



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations

A02						Appendix		A08/AC3	Manufacture's order/ Certificat No.	Sheet
DETERMINING AVERAGE GRAIN SIZE						1		399394		1/1
A05 Established	Inspecting body	B02 Steel designation	B07.2 Heat No.	B07.1 Rolled plate/ Test No.	B11 Thickness	C01	C02/ C01			
	DILLINGER FRANCE	SA/A516M-485/SA/A516-70	415883	366089	38.10 mm	K1	L			

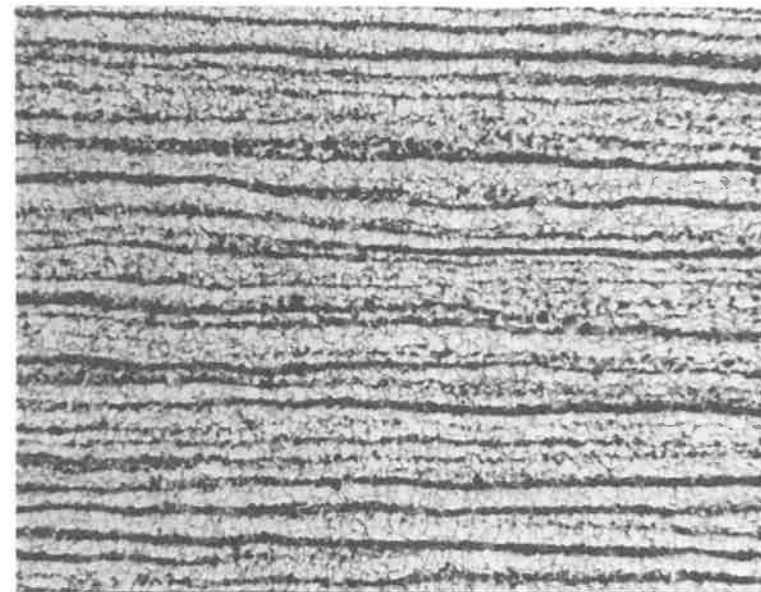
----- C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES -----

DOCUMENTATION OF THE
MICROSTRUCTURE

IMAGE No. 366089

MAGNIFICATION 100:1

GRAIN SIZE 8.5



Metallography

Tester: **MOREL**

Date: **08/01/2015**



Z01/Z02/Z03 We certify, that the results are in accordance with the agreement.

Inspector

DILLINGER FRANCE—Groupe Dillinger Hütte A01
Port 3032
3032 rue du Comte Jean – CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
 Service Qualité Essais



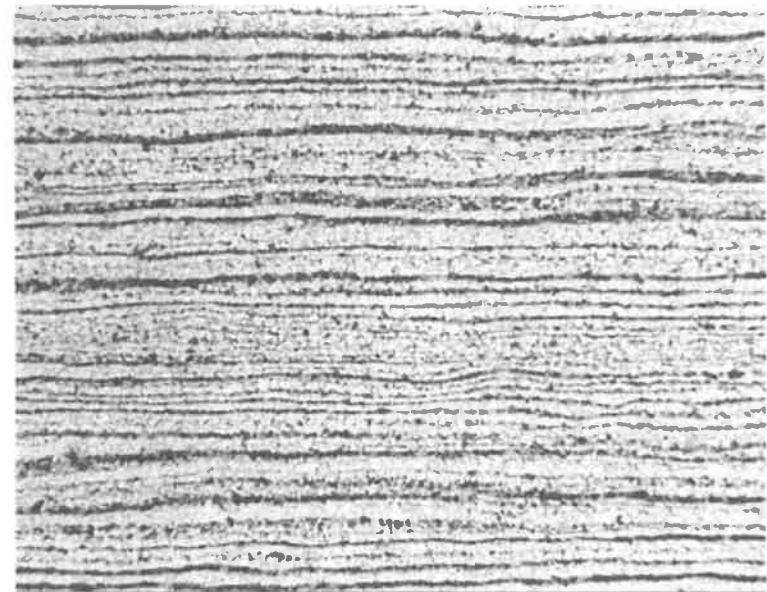
Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations

A02 DETERMINING AVERAGE GRAIN SIZE						Appendix 1		A08/ A03 Manufacture's order/ Certificat No. 399394	Sheet 1/1
A05 Established	Inspecting body	B02 Steel designation	B07.2 Heat No.	B07.1 Rolled plate/ Test No.	B11 Thickness	C01	C02/ C01		
	DILLINGER FRANCE	SA/A516M-485/SA/A516-70	415879	364013	22.22 mm	K1	L		

----- C66-C69 SUPPLEMENTARY TESTS ON TEST SAMPLES -----

**DOCUMENTATION OF THE
MICROSTRUCTURE**

IMAGE No. 364013
MAGNIFICATION 100:1
GRAIN SIZE 9



Metallography

Tester: MOREL

Date: 08/01/2015



Z01/Z02/Z03 We certify, that the results are in accordance with the agreement.

Inspector

DILLINGER FRANCE—Groupe Dillinger Hütte A01
Port 3032
3032 rue du Comte Jean – CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité Essais

BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT

INSPECTED BY: MICHAEL QUINN

GRADE: SA 516-70 MT EE

DIA SIZE OR WITH: 36"
 NPS OD ID

DATE: MARCH 22/2017

HEADS 2:1
 HEMI
 WELD CAP
 OTHER

LENGTH 120"

P.O.#: PO-86241

THICKNESS
 PIPE PUBLISHED NOM
 PLATE NOM 0.3750"

SUPPLIER: EDMONTON EXCHANGERS LTD.

SHELL
 PIPE → NDE BY MANUFACTURER
 PLATE HYDRO YES NDE NO
 REPAD NO YES
 STRUCT. NO NO
 ROLLED YES YES

PART ID#: VES 36375

Weight per foot for pipe over 4"

REQ. MIN TK: 0.3750"

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKING	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35449	94'	SF79167-PC47198902	0.370"	0.377"	0.373"	0.374"	0.370"	ok	ok	ok	mq
VS 35450	94'	SF79167-PC47198502	0.373"	0.378"	0.379"	0.374"	0.373"	ok	ok	ok	mq

W/O#
 CUSTOMER: **BMS STOCK**

RECEIVED & ACCEPTED BY: *MS*
 DATE: JUN 12 2017

REQUIRED CODE MARKINGS:
ALL MARKINGS STAMPED ONTO PLATE BY MANUFACTURE



edmonton exchanger & manufacturing ltd.

CERTIFICATE OF COMPLIANCE

5545-89 Street Edmonton, Alberta Canada T6E 5W9 www.edmontonexchanger.com tel 780.468.6722 • QC fax 780.466.4668 • sales fax 780.466.5155

Customer BROMLEY MECHANICAL SERVICES I.T	PO 86241	Work Order C114219	Date 2017/03/20	Co/C# 63140	Page 1 of 2
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Item#	Description	Qty	Heat#	Brinell Hardn.	Weld Proc.	Form. Proc.
S114219-5-1	SHELL(S) - 1.5000" NOM X 36" OD X 120" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2009 Annex A</i>	1	437045 55062-02	MTR	WP600	4
S114219-5-2	SHELL(S) - 1.5000" NOM X 36" OD X 120" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2009 Annex A</i>	1	437373 74682-02	MTR	WP600	4
S114219-5-3	SHELL(S) - 1.5000" NOM X 36" OD X 120" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2009 Annex A</i>	1	437373 74682-02	MTR	WP600	4
S114219-5-4	SHELL(S) - 1.5000" NOM X 36" OD X 120" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2009 Annex A</i>	1	437373 74682-02	MTR	WP600	4
S114219-5-5	SHELL(S) - 1.5000" NOM X 36" OD X 120" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2009 Annex A</i>	1	437373 74682-02	MTR	WP600	4
S114219-5-6	SHELL(S) - 1.5000" NOM X 36" OD X 120" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2009 Annex A</i>	1	437373 74683-02	MTR	WP600	4
S114219-5-7	SHELL(S) - 1.5000" NOM X 36" OD X 120" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2009 Annex A</i>	1	437373 74683-02	MTR	WP600	4
S114219-5-8	SHELL(S) - 1.5000" NOM X 36" OD X 120" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2009 Annex A</i>	1	437373 74683-02	MTR	WP600	4
S114219-6	COUPON(S) - 1.5000" NOM X 24" X 6" (Material Spec: SA 516-70 Normalized)	1	437045 55062-02	-	-	-
S114219-8-1	SKIRT(S) - 0.3750" NOM X 36" OD X 120" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2009 Annex A</i>	1	SF79167 PC47198902	MTR	WP600	4
S114219-8-2	SKIRT(S) - 0.3750" NOM X 36" OD X 120" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2009 Annex A</i>	1	SF79167 PC47198502	MTR	WP600	4
S114219-10	COUPON(S) - 1.5000" NOM X 24" X 6" (Material Spec: SA 516-70 Normalized)	1	437045 55090-01	-	-	-

Forming Procedure:

4. Cold Formed With no additional Heat Treatment(s)

NOTE: All items which were heat treated during or after forming shall be documented as a forming procedure per UG-79(c) and UCS-79(f).

Brinell Equipment: Newage Calibrated Pin
Brinell Hardness Tester

Supplementary Requirements

Normalized Material Identification Marking:

'MT' indicates normalized by the mill per ASME Code Section II, Part A, SA 20, Paragraph 13.1.1.

'GMT' indicates normalized by Edmonton Exchanger per ASME Code Section II, Part A, SA 20, Paragraph 13.1.2.

'GT' indicates normalized by Edmonton Exchanger per ASME Code Section VIII Division 1, UG-85 or ASME Code Section I, PG-77.4.

The item(s) listed above comply with the requirements of ASME Code Section I, PG-80 and ASME Code Section VIII, Division 1, UCS-79(d), UG-79 & UG-80. All welders and procedures are qualified to ASME Code Section IX. For tacking carbon steel items, roundbar used is 1018 Cold Rolled. Material being supplied conforms to the latest ASME Code Section II, Part A, 2015 Edition.

Steve Zubryckyj (QAM)



edmonton exchanger
& manufacturing ltd.

CERTIFICATE OF COMPLIANCE

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Customer BROMLEY MECHANICAL
SERVICES I.T

PO 86241

Work Order C114219 Date 2017/03/20 CoC# 63140

Page 2 of 2

Supplementary Examination - Items

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edmonton exchanger
& manufacturing ltd.

CERTIFICATE OF COMPLIANCE

MTR List

5545-89 Street Edmonton, Alberta Canada T6E 5W9 www.edmontonexchanger.com tel 780.468.6722 • QC fax 780.466.4668 • sales fax 780.466.5155

Customer BROMLEY MECHANICAL	Po 86241	Work Order C114219	Date 2017/03/20	CoC# 63140	Page 1 of 2
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Email to barbh@argosales.com

Email to michaelq@argosales.com

Email to kolsen@edmontonexchanger.com

MTR ID	Pages	Heat#	Thickness	Material Grades
19049	2	N21114-FA47467602	1.5"	SA 516-70 N
19072	14	N21114-FA47393202	1.5"	SA 516-70 N
19092	14	SB14589-PC21961301	1.5"	SA 516-70 N
		SB14589-PC22020101	1.5"	SA 516-70 N
19220	14	SB17945-PB62239401	1.5"	SA 516-70 N
19664	8	416909-31200-01	1.5"	SA 516-70 N
		416909-31201-01	1.5"	SA 516-70 N
20454	4	437373-74682-02	1.5"	SA 516-70 N
20469	6	437373-74683-02	1.5"	SA 516-70 N
20478	7	437045-55062-02	1.5"	SA 516-70 N
		437045-55090-01	1.5"	SA 516-70 N
20487	7	SF79167-PC47198502	.375"	SA 516-70 N
		SF79167-PC47198902	.375"	SA 516-70 N

Heat#	Material Grades	MTR ID	Item#
416909 31200-01	SA 516-70 N	19664	H114219-7
416909 31201-01	SA 516-70 N	19664	H114219-7
437045 55062-02	SA 516-70 N	20478	S114219-5 S114219-6
437045 55090-01	SA 516-70 N	20478	S114219-10
437373 74682-02	SA 516-70 N	20454	S114219-5
437373 74683-02	SA 516-70 N	20469	S114219-5
N21114 FA47393202	SA 516-70 N	19072	H114219-7
N21114 FA47467602	SA 516-70 N	19049	H114219-7
SB14589 PC21961301	SA 516-70 N	19092	H114219-7
SB14589 PC22020101	SA 516-70 N	19092	H114219-7
SB17945 PB62239401	SA 516-70 N	19220	H114219-7
SF79167 PC47198502	SA 516-70 N	20487	S114219-8
SF79167 PC47198902	SA 516-70 N	20487	S114219-8

SERVICES LT

Heat#	Thickness	Grade	HIC Report Filename
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Order No. : 01S2427210

PO No. : E11123J1010ER

Supplier : POSCO DAEWOO CORPORATION

Commodity : PLATE

Customer : EDMONTON EXCHANGER

Spec & Type : SA516-70 ASME 2015ED

Size	Product No.	Quantity	Weight (lb)	Heat No.	Position	Tensile Test			Impact Test		Hardness HB	A.G.S	Division	Chemical Composition										
						YP (ksi)	TS (%)	EL (%)	V Notch -51°F Energy (ft-lbs)	C (%)				Si (%)	Mn (%)	P (%)	S (%)	Cr (%)	Ni (%)	B (ppm)	Cu (%)	Mo (%)	Nb (%)	
9.53x3060x12192	PC47198801-8802	2	12.306	SF79167	T	58.0	79.5	26	1: 139	A: 152.6	9.5	L	0.1730	0.351	1.159	0.0066	0.0005	0.019	0.212	2	0.145	0.003	0.007	
									2: 101				P	0.1719	0.349	1.158	0.0067	0.0005	0.018	0.202	2	0.131	0.003	0.006
9.53x3060x12192	PC47198701-8702	2	12.306	SF79167	T	56.4	78.9	28	1: 96	A: 152.6	9.5	L	0.1730	0.351	1.159	0.0066	0.0005	0.019	0.212	2	0.145	0.003	0.007	
									2: 142				P	0.1719	0.349	1.158	0.0067	0.0005	0.018	0.202	2	0.131	0.003	0.006
9.53x3060x12192	PC47202101-2102	2	12.306	SF79167	T	57.6	79.3	26	1: 117	A: 152.6	9.5	L	0.1730	0.351	1.159	0.0066	0.0005	0.019	0.212	2	0.145	0.003	0.007	
									2: 97				P	0.1719	0.349	1.158	0.0067	0.0005	0.018	0.202	2	0.131	0.003	0.006
9.53x3060x12192	PC47202301-2302	2	12.306	SF79167	T	55.3	79.2	28	1: 121	A: 152.6	9.5	L	0.1730	0.351	1.159	0.0066	0.0005	0.019	0.212	2	0.145	0.003	0.007	
									2: 108				P	0.1719	0.349	1.158	0.0067	0.0005	0.018	0.202	2	0.131	0.003	0.006
9.53x3060x12192	PC47202201-2202	2	12.306	SF79167	T	56.7	78.8	26	1: 145	A: 152.6	9.5	L	0.1730	0.351	1.159	0.0066	0.0005	0.019	0.212	2	0.145	0.003	0.007	
									2: 100				P	0.1719	0.349	1.158	0.0067	0.0005	0.018	0.202	2	0.131	0.003	0.006
9.53x3060x12192	PC47202401-2402	2	12.306	SF79167	T	56.1	78.6	29	1: 143	A: 152.6	9.5	L	0.1730	0.351	1.159	0.0066	0.0005	0.019	0.212	2	0.145	0.003	0.007	
									2: 87				P	0.1719	0.349	1.158	0.0067	0.0005	0.018	0.202	2	0.131	0.003	0.006
9.53x3060x12192	PC47198601-8602	2	12.306	SF79167	T	54.7	78.9	25	1: 140	A: 152.6	9.5	L	0.1730	0.351	1.159	0.0066	0.0005	0.019	0.212	2	0.145	0.003	0.007	
									2: 137				P	0.1719	0.349	1.158	0.0067	0.0005	0.018	0.202	2	0.131	0.003	0.006
									3: 98															
									A: 125															

* Position - T : Top, M : Middle, B : Bottom
 * Tensile Test. Direction : Transversal, Gauge Length : 200mm(Rectangular), YP Method : 0.2% off-set
 * Impact Test. Direction : 1/4T Longitudinal, Sub-Size : 10mmX7.5mm
 * A.G.S : Austenite Grain Size.
 * Division - L : Ladle Analysis, P : Products Analysis
 * Supply Condition : As-Rolled unless otherwise Heat Treated.



We hereby certify that the material herein has been made in accordance with the order and above specification. This material has been fully killed and made by basic oxygen process. This material is fine grained steel. This material has been made by vacuum degassing and calcium treated process. No repair welding was performed to the products. Test Certificate is issued according to EN10204 3.1. Melted and Manufactured in Republic of Korea

Legal sanction can be imposed on forging. Improper use of product can cause safety issues.

Surveyor To :

H.J. Yoo



Mill Test Certificate

Certificate No. : 161226-FP01PS-0007A1-0001
Date of Issue : Jan., 03, 2017

Order No. : 01S2427210

PO No. : E11123J1010ER

Supplier : POSCO DAEWOO CORPORATION

Commodity : PLATE

Customer : EDMONTON EXCHANGER

Spec & Type : SA516-70 ASME 2015ED

Product No.	Division	Ti	V	Sol-Al	CEQ
		(%)	(%)	(%)	(%)
PC47198801-8802	L	0.0020	0.002	0.025	0.395
	P	0.0020	0.002	0.024	0.392
PC47198701-8702	L	0.0020	0.002	0.025	0.395
	P	0.0020	0.002	0.024	0.392
PC47202101-2102	L	0.0020	0.002	0.025	0.395
	P	0.0020	0.002	0.024	0.392
PC47202301-2302	L	0.0020	0.002	0.025	0.395
	P	0.0020	0.002	0.024	0.392
PC47202201-2202	L	0.0020	0.002	0.025	0.395
	P	0.0020	0.002	0.024	0.392
PC47202401-2402	L	0.0020	0.002	0.025	0.395
	P	0.0020	0.002	0.024	0.392
PC47198601-8602	L	0.0020	0.002	0.025	0.395
	P	0.0020	0.002	0.024	0.392

We hereby certify that the material herein has been made in accordance with the order and above specification. This material has been fully killed and made by basic oxygen process. This material is fine grained steel. This material has been made by vacuum degassing and calcium treated process. No repair welding was performed to the products. Test Certificate is issued according to EN10204 3.1. Melted and Manufactured in Republic of Korea

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Surveyor To :

H.J. Yoo



Mill Test Certificate

Certificate No. : 161226-FP01PS-0007A1-0002

Date of Issue : Jan., 03, 2017

Order No. : 01S2427210

PO No. : E11123J1010ER

Supplier : POSCO DAEWOO CORPORATION

Commodity : PLATE

Customer : EDMONTON EXCHANGER

Spec & Type : SA516-70 ASME 2015ED

Size	Product No.	Quantity	Weight (lb)	Heat No.	Position	Tensile Test			Impact Test		Hardness	A.G.S	Division	Chemical Composition									
						YP (ksi)	TS (%)	EL (%)	V Notch -51°F Energy (ft-lbs)	HB				C (%)	Si (%)	Mn (%)	P (%)	S (%)	Cr (%)	Ni (%)	B (ppm)	Cu (%)	Mo (%)
9.53x3060x12192	PC47199101-9102	2	12,306	SF79167	T	56.7	78.6	27	1: 95 2: 91 3: 107 A: 98	A: 152.6	9.5	L P	0.1730 0.1719	0.351 0.349	1.159 1.158	0.0066 0.0067	0.0005 0.0005	0.019 0.018	0.212 0.202	2 2	0.145 0.131	0.003 0.003	0.007 0.006
9.53x3060x12192	PC47198901-8902	2	12,306	SF79167	T	56.9	78.3	26	1: 114 2: 144 3: 98 A: 119	A: 152.6	9.5	L P	0.1730 0.1719	0.351 0.349	1.159 1.158	0.0066 0.0067	0.0005 0.0005	0.019 0.018	0.212 0.202	2 2	0.145 0.131	0.003 0.003	0.007 0.006
9.53x3060x12192	PC47198501-8502	2	12,306	SF79167	T	56.4	78.5	27	1: 104 2: 100 3: 145 A: 119	A: 152.6	9.5	L P	0.1730 0.1719	0.351 0.349	1.159 1.158	0.0066 0.0067	0.0005 0.0005	0.019 0.018	0.212 0.202	2 2	0.145 0.131	0.003 0.003	0.007 0.006
9.53x3060x12192	PC47198401-8402	2	12,306	SF79167	T	56.1	78.5	25	1: 105 2: 100 3: 108 A: 105	A: 152.6	9.5	L P	0.1730 0.1719	0.351 0.349	1.159 1.158	0.0066 0.0067	0.0005 0.0005	0.019 0.018	0.212 0.202	2 2	0.145 0.131	0.003 0.003	0.007 0.006
9.53x3060x12192	PC47199001-9002	2	12,306	SF79167	T	56.1	78.5	27	1: 142 2: 94 3: 97 A: 111	A: 152.6	9.5	L P	0.1730 0.1719	0.351 0.349	1.159 1.158	0.0066 0.0067	0.0005 0.0005	0.019 0.018	0.212 0.202	2 2	0.145 0.131	0.003 0.003	0.007 0.006
*** Sub Total (010) ***		24	147,672 (lb)																				
*** Heat Treatment ==> Normalized : 1634°F 20min; ***													CEQ (G) = C + Mn/6 + (Ni + Cu)/15 + (Cr + Mo + V)/5										

min 0.370"
min 0.373"

- * Position - T : Top, M : Middle, B : Bottom
- * Tensile Test, Direction : Transversal, Gauge Length : 200mm(Rectangular), YP Method : 0.2% off-set
- * Impact Test, Direction : 1/4T Longitudinal, Sub-Size : 1CmmX7.5mm
- * A.G.S : Austenite Grain Size.
- * Division - L : Ladle Analysis, P : Products Analysis
- * Supply Condition : As-Rolled unless otherwise Heat Treated.

We hereby certify that the material herein has been made in accordance with the order and above specification. This material has been fully killed and made by basic oxygen process. This material is fine grained steel. This material has been made by vacuum degassing and calcium treated process. No repair welding was performed to the products. Test Certificate is issued according to EN10204 3.1. Melted and Manufactured in Republic of Korea

Legal sanction can be imposed on forging. Improper use of product can cause safety issues.

Surveyor To :

BROMLEY MECHANICAL SERVICES

H.J. Yoo

POSCO Pohang Works, 6262, Dorghaean-ro, Nam-gu, Pohang-si, Gyeongsangbuk-do, 37877, Korea

Checked to ASME

Chief of material testing section

Hyun Jae, Yoo

VS 35 449
VS 35 450

Sect. IIA 2015 Edd. min see above

SA 20 *08* 6/12/17



Mill Test Certificate

Certificate No. : 161226-FP01PS-0007A1-0002

Date of Issue : Jan., 03, 2017

Order No. : 01S2427210

PO No. : E11123J1010ER

Supplier : POSCO DAEWOO CORPORATION

Commodity : PLATE

Customer : EDMONTON EXCHANGER

Spec & Type : SA516-70 ASME 2015ED

Product No.	Division	Ti	V	So-Al	CEQ
		(%)	(%)	(%)	(%)
PC47199101-9102	L	0.0020	0.002	0.025	0.395
	P	0.0020	0.002	0.024	0.392
PC47198901-8902	L	0.0020	0.002	0.025	0.395
	P	0.0020	0.002	0.024	0.392
PC47198501-8502	L	0.0020	0.002	0.025	0.395
	P	0.0020	0.002	0.024	0.392
PC47198401-8402	L	0.0020	0.002	0.025	0.395
	P	0.0020	0.002	0.024	0.392
PC47199001-9002	L	0.0020	0.002	0.025	0.395
	P	0.0020	0.002	0.024	0.392
*** Sub Total (010) ***				24	147,672 (lb)

VS 35449

VS 35450



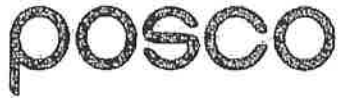
$$CEQ(G) = C + Mn/6 + (Ni + Cu)/15 + (Cr + Mo + V)/5$$

We hereby certify that the material herein has been made in accordance with the order and above specification. This material has been fully killed and made by basic oxygen process. This material is fine grained steel. This material has been made by vacuum degassing and calcium treated process. No repair welding was performed to the products. Test Certificate is issued according to EN10204 3.1. Melted and Manufactured in Republic of Korea

Legal sanction can be imposed on forging. Improper use of product can cause safety issues.

Surveyor To :

H.J. Yoo



(135-777) POSCO Center, 892, Daechi 4-Dong, Gangnam-gu, Seoul, Korea, Gangnam P.O.Box 777
Tel (82-2) 3457 -1094 / Fax (82-2) 3457 - 1980

Edmonton Exchanger Group of Companies
5545-89 Street
Edmonton, Alberta, Canada T6E 5W9

TO WHOMSOEVER IT MAY CONCERN

SUBJECT : CONFIRMATION LETTER

REFERENCE: SUPPLY OF STEEL PLATES FOR EDMONTON EXCHANGER

MTC NO : 161226-FP01PS-0007A1-0001~161226-FP01PS-0007A1-0006

POSCO confirms the size dimensions of the steel plate as per attachment shown in imperial units

Sincerely yours,

Ms. Kim, Eunji

Manager

Steel Solution Marketing Dept. Quality Design Group

POSCO

(Attachment)

Product No.	Certifi. No.	Specification	THK IN	WIDTH IN	Length IN	Weight LB	Charge No.
PC47198601	161226-FP01PS-0007A1-0001	SA516-70	0.375	120	480	6153	SF79167
PC47198602	161226-FP01PS-0007A1-0001	SA516-70	0.375	120	480	6153	SF79167
PC47198701	161226-FP01PS-0007A1-0001	SA516-70	0.375	120	480	6153	SF79167
PC47198702	161226-FP01PS-0007A1-0001	SA516-70	0.375	120	480	6153	SF79167
PC47198801	161226-FP01PS-0007A1-0001	SA516-70	0.375	120	480	6153	SF79167
PC47198802	161226-FP01PS-0007A1-0001	SA516-70	0.375	120	480	6153	SF79167
PC47202101	161226-FP01PS-0007A1-0001	SA516-70	0.375	120	480	6153	SF79167
PC47202102	161226-FP01PS-0007A1-0001	SA516-70	0.375	120	480	6153	SF79167
PC47202201	161226-FP01PS-0007A1-0001	SA516-70	0.375	120	480	6153	SF79167
PC47202202	161226-FP01PS-0007A1-0001	SA516-70	0.375	120	480	6153	SF79167
PC47202301	161226-FP01PS-0007A1-0001	SA516-70	0.375	120	480	6153	SF79167
PC47202302	161226-FP01PS-0007A1-0001	SA516-70	0.375	120	480	6153	SF79167
PC47202401	161226-FP01PS-0007A1-0001	SA516-70	0.375	120	480	6153	SF79167
PC47202402	161226-FP01PS-0007A1-0001	SA516-70	0.375	120	480	6153	SF79167
PC47198401	161226-FP01PS-0007A1-0002	SA516-70	0.375	120	480	6153	SF79167
PC47198402	161226-FP01PS-0007A1-0002	SA516-70	0.375	120	480	6153	SF79167
PC47198501	161226-FP01PS-0007A1-0002	SA516-70	0.375	120	480	6153	SF79167
PC47198502	161226-FP01PS-0007A1-0002	SA516-70	0.375	120	480	6153	SF79167
PC47198901	161226-FP01PS-0007A1-0002	SA516-70	0.375	120	480	6153	SF79167
PC47198902	161226-FP01PS-0007A1-0002	SA516-70	0.375	120	480	6153	SF79167
PC47199001	161226-FP01PS-0007A1-0002	SA516-70	0.375	120	480	6153	SF79167
PC47199002	161226-FP01PS-0007A1-0002	SA516-70	0.375	120	480	6153	SF79167
PC47199101	161226-FP01PS-0007A1-0002	SA516-70	0.375	120	480	6153	SF79167
PC47199102	161226-FP01PS-0007A1-0002	SA516-70	0.375	120	480	6153	SF79167
PC47236701	161226-FP01PS-0007A1-0003	SA516-70	0.5	96	480	6568	SF79167
PC47236702	161226-FP01PS-0007A1-0003	SA516-70	0.5	96	480	6568	SF79167
PC47236801	161226-FP01PS-0007A1-0003	SA516-70	0.5	96	480	6568	SF79167
PC47236802	161226-FP01PS-0007A1-0003	SA516-70	0.5	96	480	6568	SF79167
PC47236901	161226-FP01PS-0007A1-0003	SA516-70	0.5	96	480	6568	SF79167
PC47236902	161226-FP01PS-0007A1-0003	SA516-70	0.5	96	480	6568	SF79167
PC47237001	161226-FP01PS-0007A1-0003	SA516-70	0.5	96	480	6568	SF79167
PC47237002	161226-FP01PS-0007A1-0003	SA516-70	0.5	96	480	6568	SF79167
PC47237101	161226-FP01PS-0007A1-0003	SA516-70	0.5	96	480	6568	SF79167
PC47237102	161226-FP01PS-0007A1-0003	SA516-70	0.5	96	480	6568	SF79167
PC47237201	161226-FP01PS-0007A1-0003	SA516-70	0.5	96	480	6568	SF79167

PC47237202	161226-FP01PS-0007A1-0003	SA516-70	0.5	96	480	6568	SF79167
PC47186001	161226-FP01PS-0007A1-0004	SA516-70	0.5	120	480	8201	SF79167
PC47186002	161226-FP01PS-0007A1-0004	SA516-70	0.5	120	480	8201	SF79167
PC47186003	161226-FP01PS-0007A1-0004	SA516-70	0.5	120	480	8201	SF79167
PC47186101	161226-FP01PS-0007A1-0004	SA516-70	0.5	120	480	8201	SF79167
PC47186102	161226-FP01PS-0007A1-0004	SA516-70	0.5	120	480	8201	SF79167
PC47186103	161226-FP01PS-0007A1-0004	SA516-70	0.5	120	480	8201	SF79167
PC47186201	161226-FP01PS-0007A1-0004	SA516-70	0.5	120	480	8201	SF79167
PC47186202	161226-FP01PS-0007A1-0004	SA516-70	0.5	120	480	8201	SF79167
PC47186203	161226-FP01PS-0007A1-0004	SA516-70	0.5	120	480	8201	SF79167
PC47243401	161226-FP01PS-0007A1-0004	SA516-70	0.5	120	480	8201	SF79167
PC47243402	161226-FP01PS-0007A1-0004	SA516-70	0.5	120	480	8201	SF79167
PC47243403	161226-FP01PS-0007A1-0004	SA516-70	0.5	120	480	8201	SF79167
PC47109701	161226-FP01PS-0007A1-0004	SA516-70	0.625	96	480	8214	SF79167
PC47109702	161226-FP01PS-0007A1-0004	SA516-70	0.625	96	480	8214	SF79167
PC47109703	161226-FP01PS-0007A1-0004	SA516-70	0.625	96	480	8214	SF79167
PC47109801	161226-FP01PS-0007A1-0004	SA516-70	0.625	96	480	8214	SF79167
PC47109802	161226-FP01PS-0007A1-0004	SA516-70	0.625	96	480	8214	SF79167
PC47109803	161226-FP01PS-0007A1-0004	SA516-70	0.625	96	480	8214	SF79167
PC47186901	161226-FP01PS-0007A1-0005	SA516-70	0.625	120	480	10258	SF79167
PC47186902	161226-FP01PS-0007A1-0005	SA516-70	0.625	120	480	10258	SF79167
PC47186903	161226-FP01PS-0007A1-0005	SA516-70	0.625	120	480	10258	SF79167
PC47187001	161226-FP01PS-0007A1-0005	SA516-70	0.625	120	480	10258	SF79167
PC47187002	161226-FP01PS-0007A1-0005	SA516-70	0.625	120	480	10258	SF79167
PC47187003	161226-FP01PS-0007A1-0005	SA516-70	0.625	120	480	10258	SF79167
PC47187101	161226-FP01PS-0007A1-0005	SA516-70	0.625	120	480	10258	SF79167
PC47187102	161226-FP01PS-0007A1-0005	SA516-70	0.625	120	480	10258	SF79167
PC47187103	161226-FP01PS-0007A1-0005	SA516-70	0.625	120	480	10258	SF79167
PC47187201	161226-FP01PS-0007A1-0005	SA516-70	0.625	120	480	10258	SF79167
PC47187202	161226-FP01PS-0007A1-0005	SA516-70	0.625	120	480	10258	SF79167
PC47187203	161226-FP01PS-0007A1-0005	SA516-70	0.625	120	480	10258	SF79167
PC47109301	161226-FP01PS-0007A1-0005	SA516-70	1	96	480	13135	SF79167
PC47109302	161226-FP01PS-0007A1-0005	SA516-70	1	96	480	13135	SF79167
PC47109201	161226-FP01PS-0007A1-0006	SA516-70	1	96	480	13135	SF79167
PC47109202	161226-FP01PS-0007A1-0006	SA516-70	1	96	480	13135	SF79167
PC47137401	161226-FP01PS-0007A1-0006	SA516-70	1	96	480	13135	SF79167
PC47137402	161226-FP01PS-0007A1-0006	SA516-70	1	96	480	13135	SF79167

BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT

DIA SIZE OR WITH: 36" X 120"
 NPS OD ID

INSPECTED BY: MICHAEL QUINN
 DATE: JUNE 28/2017
 P.O.#: PO-86907
 SUPPLIER: EDMONTON EXCHANGERS LTD.
 PART ID#: VES 36120
 REQ. MIN TK: 0.3750"

GRADE: SA 516-70 MT EE

HEADS 2:1
 HEMI
 WELD CAP
 OTHER
 SHELL
 PIPE → NDE BY MANUFACTURER
 PLATE HYDRO YES NDE NO
 REPAD NO YES
 STRUCT. NO NO
 ROLLED YES YES

LENGTH _____
 THICKNESS _____
 PIPE PUBLISHED NOM _____
 PLATE NOM 0.3750"

Weight per foot for pipe over 4"

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKING	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35658	282'	N28440-FA49878301	0.395"	0.399"	0.402"	0.399"	0.395"*	ok	ok	ok	MJ
				0.397"	0.396"	0.397"	0.396"	ok	ok	ok	MJ
				0.399"	0.399"	0.397"	0.399"	ok	ok	ok	MJ

W/O# _____ RECEIVED & ACCEPTED BY: [Signature] REQUIRED CODE MARKINGS: _____
 CUSTOMER: BMS STOCK DATE: 8/2/17 ALL MARKINGS STAMPED ONTO PLATE BY MANUFACTURE



edmonton exchanger
& manufacturing ltd.

CERTIFICATE OF COMPLIANCE

5545-89 Street Edmonton, Alberta Canada T6E 5W9 www.edmontonexchanger.com tel 780.468.6722 • QC fax 780.466.4668 • sales fax 780.466.5155

Customer **BROMLEY MECHANICAL SERVICES LT**

PO 86907

Work Order C115201 Date 2017/06/27 CofC# 64439

Page 1 of 2

Item#	Description	Qty	Heat#	Brinell Hardn.	Weld Proc.	Form. Proc.
S115201-1-1	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48881-02	MTR	WP600	4
S115201-1-2	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48881-02	MTR	WP600	4
S115201-1-3	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48881-02	MTR	WP600	4
S115201-1-4	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48888-02	MTR	WP600	4
S115201-1-5	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48888-02	MTR	WP600	4
S115201-1-6	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48888-02	MTR	WP600	4
S115201-1-7	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48888-02	MTR	WP600	4
S115201-1-8	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48894-02	MTR	WP600	4
S115201-1-9	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48894-02	MTR	WP600	4
S115201-1-10	SHELL(S) - 1.5000" NOM X 36" OD X 112" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	442036 48894-02	MTR	WP600	4
S115201-2	COUPON(S) - 1.5000" NOM X 24" X 6" (Material Spec: SA 516-70 Normalized)	1	442036 48881-02	-	-	-
S115201-4-1	SKIRT(S) - 0.3750" NOM X 36" OD X 120" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	N28440 FA49878301	MTR	WP600	4
S115201-4-2	SKIRT(S) - 0.3750" NOM X 36" OD X 120" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	N28440 FA49878301	MTR	WP600	4
S115201-4-3	SKIRT(S) - 0.3750" NOM X 36" OD X 120" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2015 Annex A</i>	1	N28440 FA49878301	MTR	WP600	4

Forming Procedure:

4. Cold Formed **With no additional Heat Treatment(s)**

NOTE: All items which were heat treated during or after forming shall be documented as a forming procedure per UG-79(c) and UCS-79(f).

Brinell Equipment: Newage Calibrated Pin
Brinell Hardness Tester

Supplementary Requirements



CERTIFICATE OF COMPLIANCE

edmonton exchanger
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5545-89 Street Edmonton, Alberta Canada T6E 5W9 www.edmontonexchanger.com tel 780.468.6722 • QC fax 780.466.4668 • sales fax 780.466.5155

Customer **BROMLEY MECHANICAL SERVICES LT** PO **86907** Work Order **C115201** Date **2017/06/27** CofC# **64439** Page **2 of 2**

Item S115201-1-2, S115201-1-7 had cosmetic surface repairs done in accordance with ASME Sec.VIII, Div.1 and ASME Sec.IX. Repairs were done per approved Weld Procedure WP-2 (as welded) or WP-63 (PWHT). All repaired areas were MT examined.

Normalized Material Identification Marking:

- 'MT' indicates normalized by the mill per ASME Code Section II, Part A, SA 20, Paragraph 13.1.1.
- 'GMT' indicates normalized by Edmonton Exchanger per ASME Code Section II, Part A, SA 20, Paragraph 13.1.2.
- 'GT' indicates normalized by Edmonton Exchanger per ASME Code Section VIII Division 1, UG-85 or ASME Code Section I, PG-77.4.

The item(s) listed above comply with the requirements of ASME Code Section I, PG-80 and ASME Code Section VIII, Division 1, UCS-79(d), UG-79 & UG-80. All welders and procedures are qualified to ASME Code Section IX. For tacking carbon steel items, roundbar used is 1018 Cold Rolled. Material being supplied conforms to the latest ASME Code Section II, Part A, 2015 Edition.

Steve Zubryckyj (QAM)

Supplementary Examination - Items

Edmonton Exchanger

MPI - Dry MPI

(for -1-2, -1-7)

Acceptable to ASME Code

X SEC. VIII, DIV.1	SEC. IV
_ SEC. VIII, DIV.2	B31.1
_ SEC. I	B31.3
_ Bevelled Edge	Backgouge
_ Completed Welds	
X Surface Repair Area	

EE Procedure: MPI-001 REV.16
 Material: SA 516-70 N
 Thickness: 1.5"
 Parker B300 Yoke
 Magnaflux 8A-Red (Dry)
 AC Continuous
 Light: Natural
 Tech: Tracy Enman (#11226)
 CGSB / SNT: Level II
 Date: 2017/06/17
 Time: Day Shift



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& manufacturing ltd.

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MTR List

5545-89 Street Edmonton, Alberta Canada T6E 5W9 www.edmontonexchanger.com tel 780.468.6722 • QC fax 780.466.4668 • sales fax 780.466.5155

Customer BROMLEY MECHANICAL	PO 86907	Work Order C115201	Date 2017/06/27	CofC# 64439	Page 1 of 1
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Email to barbh@argosales.com

Email to michaelq@argosales.com

Email to kolsen@edmontonexchanger.com

MTR ID	Pages	Heat#	Thickness	Material Grades
17636	6	380618-99903-01	1.5"	SA 516-70 N
19032	9	396636-26385-01	1.5"	SA 516-70 N
		396636-26385-02	1.5"	SA 516-70 N
19398	14	N28440-FA49878301	.375"	SA 516-70 N
19668	5	415939-08727-02	1.5"	SA 516-70 N
20641	7	442036-48881-02	1.5"	SA 516-70 N
		442036-48898-02	1.5"	SA 516-70 N
20643	6	442036-48880-01	1.5"	SA 516-70 N
		442036-48888-02	1.5"	SA 516-70 N
		442036-48894-02	1.5"	SA 516-70 N

Heat#	Material Grades	MTR ID	Item#
380618 99903-01	SA 516-70 N	17636	H115201-3
396636 26385-01	SA 516-70 N	19032	H115201-3
396636 26385-02	SA 516-70 N	19032	H115201-3
415939 08727-02	SA 516-70 N	19668	H115201-3
442036 48880-01	SA 516-70 N	20643	H115201-3
442036 48881-02	SA 516-70 N	20641	S115201-1
			S115201-2
442036 48888-02	SA 516-70 N	20643	S115201-1
442036 48894-02	SA 516-70 N	20643	S115201-1
442036 48898-02	SA 516-70 N	20641	H115201-3
N28440 FA49878301	SA 516-70 N	19398	S115201-4

Heat#	Thickness	Grade	HIC Report Filename
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검사증명서

MILL TEST CERTIFICATE



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukbussanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea

주문번호 Order No. : F141000167
 품명 Commodity : Hot Rolled Steel Plate 고객사 Customer : EDMONTON STEEL PLATE
 제품규격 Specification : ASME SA516-70 MT 주문자 Contractor : 현대중합상사(주) 증명서 번호 Certificate No. : 20141128-PS-092-001
 발행일자 Date of Issue : 2014-11-28

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hard- ness Test HB	화학성분 Chemical Compositor (%)														단위 Unit 2 : x 100 3 : x 1,000 4 : x 10,000 5 : x 100,000			
						YP	TS	EL	YP-EL	RA	YR	YP Mtd			Division	C	Si	Mn	P	S	Cr	Ni	B	Ca	Cu	Mo	N	Nb	Ti	V	Sol -Al	CEO
						(KSI)	(%)	(%)	(%)	(%)	(%)	(%)				4	3	3	4	4	2	2	4	4	3	2	4	3	3	3	3	3
0.375" x 96.5" x 480"	1	4,925	N2844C	FA49851301	T	56.0	79.3	40				2	Good	153.7	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
															C	1,507	349	1,168	136	14	18	17	2	13	132	0	29	14	2	1	36	402
0.375" x 96.5" x 480"	1	4,925	N2844C	FA49851302	T	56.0	79.3	40				2	Good	153.7	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
															C	1,507	349	1,168	136	14	18	17	2	13	132	0	29	14	2	1	36	402
0.375" x 96.5" x 480"	1	4,925	N29440	FA49851303	T	56.0	79.3	40				2	Good	153.7	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
															C	1,507	349	1,168	136	14	18	17	2	13	132	0	29	14	2	1	36	402
0.375" x 96.5" x 480"	1	4,925	N28440	FA49851401	T	54.3	78.5	39				2	Good	153.0	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
															C	1,534	348	1,152	131	15	18	17	2	14	132	0	32	13	2	1	35	422

BROOKLYN MECHANICAL SERVICES
Checked to ASME

NOTE

- Position - T: Top, M: Middle, B: Bottom
- Tensile test - Direction: Transverse, Gauge length: 50.8mm (Rectangular), YP Mtd : 2 (0.2% off-set), 5 (0.5% underload), U (Upper yield point), L (Lower yield point)
- U.S.T - Ultrasonic test
- Impact test - Direction: Longitudinal, Size 10mm X 7.5mm, SF: Shear fracture, LE: Lateral Expansion
- Division - C: Check analysis, L: Ladle analysis

ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION, SULPHIDE SHAPE CONTROL
 The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

Sect. IIIA 2015 Ed. MIN 0.395"
 SA 20 8/2/17
 US 35658 Date

상기의 제품은 검사 결과 지정된 규격에 합격한 것을 증명합니다.
 WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature: **S. B. Park**
 SURVEYOR TC: Chief Of Quality Assurance Team

* 본 검사증명서는 원본인 전자문서(전자서명 정보 포함)로부터 출력된 사본입니다. 전자문서의 내용은 현대제철 고객포탈에서 확인하실 수 있습니다.(http://sm.hyundai-steel.com/cs/cm/login.jsp)
 * This Mill Test Certificate is a copy that has been printed from original electronic document(with digital signing).
 You are able to check an original electronic document at hyundaisteel's customer portal.(http://sm.hyundai-steel.com/cs/cm/login.jsp) * QRcode scanner App : 'QReal'

검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Eukbusanuo-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호
Order No. : F141000167

품명
Commodity : HSI Rolled Steel Plate

제품규격
Specification : ASME SA516-70 MT

고객사
Customer : EDMONTON STEEL PLATE

주문자
Contractor : 현대중합상사(주)

증명서 번호
Certificate No. : 20141128-PS-092-001

발행일자
Date of Issue : 2014-11-28

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50.8°F		
		Energy	SF	LE
		(Ft-Lbs)	(%)	(mm)
FA49851301	T	1: 145		
		2: 145		
		3: 174		
		A: 155		
FA49851302	T	1: 145		
		2: 145		
		3: 174		
		A: 155		
FA49851303	T	1: 145		
		2: 145		
		3: 174		
		A: 155		
FA49851401	T	1: 142		
		2: 142		
		3: 128		
		A: 137		

NOTE

- ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION. SULPHIDE SHAPE CONTROL
- The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2C04) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature
S. B. Park
SURVEYOR TO : Chief Of Quality Assurance Team

* 본 검사증명서는 원본인 전자문서(전자서명 정보 포함)로부터 출력된 사본입니다. 전자문서의 내용은 현대제철 고객포탈에서 확인하실 수 있습니다.(<http://sm.hyundai-steel.com/cs/cm/login.jsp>)
* This Mill Test Certificate is a copy that has been printed from original electronic document(with digital signing).
You are able to check an original electronic document at hyundasteel's customer portal.(<http://sm.hyundai-steel.com/cs/cm/login.jsp>) * QRcode scanner App : 'QReal'

검사증명서
MILL TEST CERTIFICATE



당진제철소 : 흥남 당진시 송악읍 북부산업로 1480
1480 Bukbusanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea

주문번호 : F141000167
Order No.
품명 : Hot Rolled Steel Plate
Commodity
제품규격 : ASME SA516-70 MT
Specification
고객사 : EDMONTON STEEL PLATE
Customer
주문자 : 현대중합상사(주)
Contractor
증명서 번호 : 20141128-PS-092-002
Certificate No.
발행일자 : 2014-11-28
Date of Issue

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test						U.S.T	경도 시험 Hard- ness Test HB	화학성분 Chemical Composition(%)																				
						YP	TS	EL	YP-EL	RA	YR			YP Mtd	Division	C	S	Mn	P	S	Cr	Ni	B	Ca	Cu	Mo	N	Nb	Ti	V	Sol -Al	CEQ		
						(KSI)	(%)	(%)	(%)	(%)	2: x100 3: x1,000 4: x10,000 5: x100,000																							
0.375" x 96.5" x 480"	1	4,925	N28440	FA49851402	T	54.3	78.5	39				2	Good	153.0	L	1,509	336	1,130	125	19	18	17	2	4	4	3	2	4	3	3	3	3	28	396
															C	1,534	348	1,152	131	15	18	17	2	14	132	0	32	13	2	1	35	402		
0.375" x 96.5" x 480"	1	4,925	N28440	FA49851403	T	54.3	78.5	39				2	Good	153.0	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396		
															C	1,534	348	1,152	131	15	18	17	2	14	132	0	32	13	2	1	35	402		
0.375" x 96.5" x 480"	1	4,925	N28444	FA49851501	T	54.9	79.6	39				2	Good	153.7	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411		
															C	1,583	354	1,167	150	14	18	17	1	13	129	1	34	13	2	1	43	411		
0.375" x 96.5" x 480"	1	4,925	N28444	FA49851502	T	54.9	79.6	39				2	Good	153.7	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411		
															C	1,583	354	1,167	150	14	18	17	1	13	129	1	34	13	2	1	43	411		

NOTE

- Position - T:Top, M:Middle, B:Bottom
- Tensile test - Direction:Transverse, Gauge length:50.8mm (Rectangular), YP Mtd : 2 (0.2% off-set),5 (0.5% underload), U (Upper yield point), L (Lower yield point)
- U.S.T - Ultrasonic test
- Impact test - Direction:Longitudinal, Size:10mmX7.5mm, SF:Shear fracture, LE:Lateral Expansion
- Division - C:Check analysis, L:Ladle analysis

ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION, SULPHIDE SHAPE CONTROL

The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature: **S. B. Park**
SURVEYOR TO : Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1430 Bukbusanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호
Order No. : F141000167

품명
Commodity : Hot Rolled Steel Plate

제품규격
Specification : ASME SA516-70 MT

고객사
Customer : EDMONTON STEEL PLATE

주문자
Contractor : 현대중합상사(주)

증명서 번호
Certificate No. : 20141128-PS-092-002

발행일자
Date of Issue : 2014-11-28

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50.8 °F		
		Energy	SF	LE
		(Ft-Lbs)	(%)	(mm)
FA49851402	T	1: 142		
		2: 142		
		3: 128		
		A: 137		
FA49851403	T	1: 142		
		2: 142		
		3: 128		
		A: 137		
FA49851501	T	1: 153		
		2: 145		
		3: 150		
		A: 150		
FA49851502	T	1: 153		
		2: 145		
		3: 150		
		A: 150		

NOTE

- ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION. SULPHIDE SHAPE CONTROL
- The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature

S. B. Park

SURVEYOR TC : Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukbuseonup-Ro, Songak-Eup, Dengjin-Si, Chungnam, Korea

주문번호 : F141000167
Order No.

품명 : Hot Rolled Steel Plate
Commodity

제품규격 : ASME SA516-70 MT
Specification

고객사 : EDMONTON STEEL PLATE
Customer

주문자 : 현대중합상사(주)
Contractor

증명서 번호 : 20141128-PS-092-003
Certificate No.

발행일자 : 2014-11-28
Date of Issue

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hardness Test HB	화학성분 Chemical Composition(%)														단위 Unit							
						YP	TS	EL	YF-EL	RA	YR	YP Mtd			C	Si	Mn	P	S	Cr	N	B	Ca	Cu	Mo	Ni	Nb	Ti	V	Sol -Al	CEO	2 : x100	3 : x1,000	4 : x 10,000	5 : x 100,000	
																																(KSI)	(%)	(%)	(%)	(%)
0.375" x 96.5" x 480"	1	4,925	N28444	FA49851503	T	54.9	79.6	39				2	Good	153.7	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411				
															C	1,568	354	1,167	150	14	18	17	1	13	129	1	34	13	2	1	43	411				
0.375" x 96.5" x 480"	1	4,925	N28444	FA49851601	T	54.8	79.5	39				2	Good	153.7	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411				
															C	1,568	354	1,157	140	14	17	17	1	12	132	0	33	14	2	1	40	404				
0.375" x 96.5" x 480"	1	4,925	N28444	FA49851602	T	54.8	79.5	39				2	Good	153.7	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411				
															C	1,568	354	1,157	140	14	17	17	1	12	132	0	33	14	2	1	40	404				
0.375" x 96.5" x 480"	1	4,925	N28444	FA49851603	T	54.8	79.5	39				2	Good	153.7	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411				
															C	1,568	354	1,157	140	14	17	17	1	12	132	0	33	14	2	1	40	404				

*** Sub Total(001) *** 12 59,100(Lbs)

- NOTE**
- Position - T:Top, M:Middle, B:Bottom
 - Tensile test - Direction:Transverse, Gauge length:50.8mm (Rectangular), YP Mtd : 2 (0.2% off-set),5 (0.5% underload), U (Upper yield point), L (Lower yield point)
 - U.S.T - Ultrasonic test
 - Impact test - Direction:Longitudinal, Size:10mmX7.5mm, SF:Shear fracture, LE:Lateral Expansion
 - Division - C:Check analysis, L:Ladle analysis

• ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION. SULPHIDE SHAPE CON' FOL
• The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
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Signature

S. B. Park

SURVEYOR TO : Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukbusanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호
Order No. : F141000167

품명
Commodity : Hot Rolled Steel Plate

제품규격
Specification : ASME SA516-70 MT

고객사
Customer : EDMONTON STEEL PLATE

주문자
Contractor : 현대중합상사(주)

증명서 번호
Certificate No. : 20141128-PS-092-003

발행일자
Date of Issue : 2014-11-28

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50.8°F		
		Energy	SF	LE
		(Ft-Lbs)	(%)	(mm)
FA49851503	T	1: 153 2: 145 3: 150 A: 150		
FA49851601	T	1: 142 2: 108 3: 107 A: 119		
FA49851602	T	1: 142 2: 108 3: 107 A: 119		
FA49851603	T	1: 142 2: 108 3: 107 A: 119		

*** Sub Total(Q01) *** 12 59,100(Lbs)

NOTE

• ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION. SULPHIDE SHAPE CONTROL
• The plate is fully killed and line grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
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Signature

S. B. Park

SURVEYOR TO Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukbusanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호 Order No. : F141000167
 품명 Commodity : Hot Rolled Steel Plate 고객사 Customer : EDMONTON STEEL PLATE
 제품규격 Specification : ASME SA516-70 MT 주문자 Contractor : 현대중합상사(주)
 증명서 번호 Certificate No. : 20141128-PS-092-004
 발행일자 Date of Issue : 2014-11-28

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hard- ness Test HB	화학성분 Chemical Composition(%)														단위 Unit							
						YP	TS	EL	YP-EL	RA	YR	YP Mid			Division	C	Si	Mn	P	S	Cr	Ni	B	Ca	Cu	Mo	N	Nb	Ti	V	SoI -Al	CEO	2 : x 100	3 : x 1,000	4 : x 10,000	5 : x 100,000
						(KSI)	(%)	(%)	(%)	(%)	(%)					4	3	3	4	4	2	2	4	4	3	2	4	3	3	3	3	3	3			
*** Heat Treatment : Normalized : 1634.0°F 23 Min.																																				
*** UST Application Spec. => ASME SA578(LEVEL B)																																				
0.375" x 120.5" x 480"	1	6,151	N28444	FA49822801	T	55.8	79.5	37				2	Good	148.0	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411				
															C	1,568	348	1,155	139	14	17	17	2	12	132	0	28	13	2	1	38	404				
0.375" x 120.5" x 480"	1	6,151	N28444	FA49822802	T	55.8	79.5	37				2	Good	148.0	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411				
															C	1,568	348	1,155	139	14	17	17	2	12	132	0	28	13	2	1	38	404				
0.375" x 120.5" x 480"	1	6,151	N28444	FA49822803	T	55.8	79.5	37				2	Good	148.0	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411				
															C	1,568	348	1,155	139	14	17	17	2	12	132	0	28	13	2	1	38	404				

NOTE

- Position - T:Top, M:Middle, B:Bottom
- Tensile test - Direction:Transverse, Gauge length:50.8mm (Rectangular), YP Mid : 2 (0.2% of t-set), 5 (0.5% underload), U (Upper yield point), L (Lower yield point)
- U.S.T - Ultrasonic test
- Impact test - Direction:Longitudinal, Size:10mmX7.5mm, SF:Shear fracture, LE:Lateral Expansion
- Division - C:Check analysis, L:Ladle analysis

ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION, SULPHIDE SHAPE CONTROL
 The plate is fully killed and fine grained steel, Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
 WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature **S. B. Park**
 SURVEYOR TO : Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 B.Jkbusanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호
Order No. : F141000167

품명
Commodity : Hot Rolled Steel Plate

제품규격
Specification : ASME SA516-70 MT

고객사
Customer : EDMONTON STEEL PLATE

주문자
Contractor : 현대중합상사(주)

증명서 번호
Certificate No. : 20141128-PS-092-004

발행일자
Date of Issue : 2014-11-28

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50.8 °F		
		Energy	SF	LE
		(Ft-Lbs)	(%)	(mm)
*** Heat Treatment : Normalized : 1634.0°F 23 Min.				
*** UST Application Spec. => ASME SA578(LEVEL B)				
FA49822801	T	1: 170 2: 144 3: 150 A: 155		
FA49822802	T	1: 170 2: 144 3: 150 A: 155		
FA49822803	T	1: 170 2: 144 3: 150 A: 155		
NOTE	* ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION, SULPHIDE SHAPE CONTROL * The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.			
	상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다. WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS			
				Signature SURVEYOR TO : Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukusanup-Ro, Songak-Eup, Dengjin-Si, Chungnam, Korea



주문번호 : F141000167
Order No.

품명 : Hot Rolled Steel Plate
Commodity

제품규격 : ASME SA516-70 MT
Specification

고객사 : EDMONTON STEEL PLATE
Customer

주문자 : 현대중합상사(주)
Contractor

증명서 번호 : 20141128-PS-092-005
Certificate No.

발행일자 : 2014-11-28
Date of Issue

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hardness Test HB	화합성분 Chemical Composition(%)																	
						YP	TS	EL	YP-EL	RA	YR	YP Mid			단위 Unit 2 : x 100 3 : x 1,000 4 : x 10,000 5 : x 100,000																	
						(KSI)	(%)	(%)	(%)	(%)	(%)	Division			C	Si	Mn	P	S	Cr	Ni	B	Ca	Ou	Mo	N	Nb	Ti	V	Sc -Al	CEQ	
0.375" x 120.5" x 480"	1	6,151	N28440	FA49878201	T	54.2	78.0	40				2	Good	150.6	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
						C	1,546	329	1,153	129	12	18	17	1	17	136	0	33	14	1	1	29	403									
0.375" x 120.5" x 480"	1	6,151	N28440	FA49878202	T	54.2	78.0	40				2	Good	150.6	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
						C	1,546	329	1,153	129	12	18	17	1	17	136	0	33	14	1	1	29	403									
0.375" x 120.5" x 480"	1	6,151	N28440	FA49878203	T	54.2	78.0	40				2	Good	150.6	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
						C	1,546	329	1,153	129	12	18	17	1	17	136	0	33	14	1	1	29	403									
0.375" x 120.5" x 480"	1	6,151	N28440	FA49878301	T	54.8	78.2	38				2	Good	149.7	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
						C	1,553	329	1,152	130	13	18	17	1	17	135	0	34	13	1	1	29	404									

NOTE

- Position - T:Top, M:Middle, B:Bottom
- Tensile test - Direction:Transverse, Gauge length:50.8mm (Rectangular), YP Mtd : 2 (0.2% off-set), 5 (0.5% underload), U (Upper yield point), L (Lower yield point)
- U.S.T - Ultrasonic test
- Impact test - Direction:Longitudinal, Size:10mmX7.5mm, SF:Shear fracture, LE:Lateral Expansion
- Division - C:Check analysis, L:Ladle analysis

ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION, SULPHIDE SHAPE CONTROL
The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature
S. B. Park
SURVEYOR TO : Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukbusanup-Ro, Songek-Eup, Dangjin-Si, Chungnam, Korea



주문번호 Order No. : F141000167	고객사 Customer : EDMONTON STEEL PLATE	증명서 번호 Certificate No. : 20141128-PS-092-005
품명 Commodity : Hot Rolled Steel Plate	주문자 Contractor : 현대중합상사(주)	발행일자 Date of Issue : 2014-11-28
제품규격 Specification : ASME SA516-70 MT		

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50.6°F		
		Energy	SF	LE
		(Ft-Lbs)	(%)	(mm)
FA49878201	T	1: 144 2: 145 3: 143 A: 144		
FA49878202	T	1: 144 2: 145 3: 143 A: 144		
FA49878203	T	1: 144 2: 145 3: 143 A: 144		
FA49878301	T	1: 150 2: 144 3: 153 A: 150		

NOTE

• ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION, SULPHIDE SHAPE CONTROL
• The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature: **S. B. Park**
SURVEYOR TO : Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukbusanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea

주문번호 Order No. : F141000167

품명 Commodity : Hot Rolled Steel Plate

제품규격 Specification : ASME SA516-7C MT

고객사 Customer : EDMONTON STEEL PLATE

주문자 Contractor : 현대중합상사(주)

증명서 번호 Certificate No. : 20141128-PS-092-006

발행일자 Date of Issue : 2014-11-28

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hard- ness Test HB	화학성분 Chemical Composition(%)														단위 Unit			
						YP	TS	EL	YP-EL	RA	YR	YP Mtd			Division	C	Si	Mn	P	S	Cr	Ni	3	Ca	Cu	Mo	N	Nb	Ti	V	Sol -Al	CEO
						(KSI)		(%)	(%)	(%)	(%)					4	3	3	4	4	2	2	4	4	3	2	4	3	3	3	3	3
0.375" x 120.5" x 480"	1	6,151	N28440	FA49878302	T	54.8	78.2	38				2	Good	149.7	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
															C	1,553	329	1,152	130	13	18	17	1	17	135	0	34	13	1	1	29	404
0.375" x 120.5" x 480"	1	6,151	N28440	FA49878303	T	54.8	78.2	38				2	Good	149.7	L	1,509	336	1,130	125	19	18	17	2	15	133	0	28	14	2	1	28	396
															C	1,553	329	1,152	130	13	18	17	1	17	135	0	34	13	1	1	29	404
0.375" x 120.5" x 480"	1	6,151	N28444	FA49878401	T	53.9	79.0	39				2	Good	154.6	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411
															C	1,621	347	1,148	142	12	18	17	1	14	134	0	35	13	1	1	42	410
0.375" x 120.5" x 480"	1	6,151	N28444	FA49878402	T	53.9	79.0	39				2	Good	154.6	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411
															C	1,621	347	1,148	142	12	18	17	1	14	134	0	35	13	1	1	42	410

NOTE

- Position - T:Top, M:Middle, B:Bottom
- Tensile test - Direction:Transverse, Gauge length:50.8mm (Rectangular), YP Mtd : 2 (0.2% off-set), 5 (0.5% underload), U (Upper yield point), L (Lower yield point)
- U.S.T - Ultrasonic test
- Impact test - Direction:Longitudinal, Size:10mmX7.5mm, SF:Shear fracture, LE:Lateral Expansion
- Division - C:Check analysis, L:Ladle analysis

• ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION, SULPHIDE SHAPE CONTROL
• The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
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Signature
S. B. Park
SURVEYOR TC : Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진제철소 충남 당진시 송악읍 북부산업로 1480
1460 Bukbuseanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호 Order No. : F141000167	고객사 Customer : EDMONTON STEEL PLATE	증명서 번호 Certificate No. : 20141128-PS-092-006
품명 Commodity : Hot Rolled Steel Plate	주문자 Contractor : 현대중합상사(주)	발행일자 Date of Issue : 2014-11-28
제품규격 Specification : ASME SA516-70 MT		

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50.8 °F		
		Energy	SF	LE
		(Ft-Lbs)	(%)	(mm)
FA49878302	T	1: 150		
		2: 144		
		3: 153		
		A: 150		
FA49878303	T	1: 150		
		2: 144		
		3: 153		
		A: 150		
FA49878401	T	1: 149		
		2: 101		
		3: 165		
		A: 139		
FA49878402	T	1: 149		
		2: 101		
		3: 165		
		A: 139		

NOTE

• ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION, SULPHIDE SHAPE CONTROL
• The plate is fully killed and fine grained steel, Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

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Signature **S. B. Park**
SURVEYOR TO : Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE



당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukbusanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호 Order No.	: F141000167	고객사 Customer	: EDMONTON STEEL PLATE	증명서 번호 Certificate No.	: 20141128-PS-092-007
품명 Commodity	: Hot Rolled Steel Plate	주문자 Contractor	: 현대중합상사(주)	발행일자 Date of Issue	: 2014-11-28
제품규격 Specification	: ASME SA516-70 MT				

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	재검번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hardness Test HB	화학성분 Chemical Composition(%)																	
						YP	TS	EL	YP-EL	RA	YR	YP Mtd			단위 Unit 2 : x 100 3 : x 1,000 4 : x 10,000 5 : x 100,000																	
						(KSI)	(%)	(%)	(%)	(%)	(%)	Division			C	Si	Mn	P	S	Cr	Ni	B	Ca	Al	Mo	N	Nb	Ti	V	Se -A1	CEO	
0.375" x 120.5" x 480"	1	6,151	N28444	FA49878403	T	53.9	79.0	39				2	Good	154.6	L	1,617	360	1,160	147	17	18	17	3	14	132	0	33	14	2	1	39	411
															C	1,621	347	1,148	142	12	18	17	1	14	134	0	35	13	1	1	42	410

--- Sub Total(Q02) --- 12 73,812(Lbs)
 --- Heat Treatment : Normalized : 1634.0°F 23 Min.
 --- UST Application Spec. => ASME SA578(LEVEL B)

NOTE

- Position - T:Top, M:Middle, B:Bottom
- Tensile test - Direction:Transverse, Gauge length:50.8mm (Rectangular), YP Mtd : 2 (0.2% off-set), 5 (0.5% underload), U (Upper yield point), L (Lower yield point)
- U.S.T - Ultrasonic test
- Impact test - Direction:Longitudinal, Size:10mmX7.5mm, SF:Shear fracture, LE:Lateral Expansion
- Division - C:Check analysis, L:Ladle analysis

ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION. SULPHIDE SHAPE CONTROL
 The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2304) 3.1.

싱기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
 WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature

 SURVEYOR TO : Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE



(Attached Sheet)



당진지 철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukbusenup-Ro, Songek-Eup, Dangjin-Si, Chungnam, Korea



주문번호 Order No.	: F141000167		
품명 Commodity	: Hot Rolled Steel Plate	고객사 Customer	: EDMONTON STEEL PLATE
제품규격 Specification	: ASME SA516-70 MT	주문자 Contractor	: 현대중합상사(주)
		증명서 번호 Certificate No.	: 20141128-PS-092-007
		발행일자 Date of Issue	: 2014-11-28

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50.3 °F		
		Energy	SF	LE
		(Ft-Lbs)	(%)	(mm)
FA49878403	T	1: 149		
		2: 101		
		3: 165		
		A: 139		
		*** Sub Total(002) *** 12 73.612(Lbs)		
*** Heat Treatment : Normalized : 1634.0°F 23 Min.				
*** UST Application Spec. => ASME SA578(LABEL B)				
				
NOTE	* ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2013 EDITION, SULPHIDE SHAPE CONTROL. * The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.			
	상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다. WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS			Signature  SURVEYOR TO : Chief Of Quality Assurance Team

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W03528

Material Test Report

FVC Canada Ltd.

FVC
an AFGlobal Company

FVC Heat Nbr: **C1017BN**

An AFGlobal Company

7410A-5 Street, S.E. Calgary, Alberta T2H 2L9

ISO 9001:2008 Certified

Sales: (403) 255-9011 Fax: (403) 255-7239

BROMLEY MECHANICAL 00011652	PO: 88128	Sales Order: C15999	Line: 1
A Division of Argo Sales Ltd	Item Code: LWN040600100A004A1		Qty: 8
T1A 8R1 MEDICINE HAT, AB	Item Desc: LWN, SA350LF2, 600#, 4"x10", RF		
CA	Mill Heat: A14760		
Spec: ASTM A350(17)/ASME SA350(17)Section II Part A, - LF2 CL1			

Element	(%wt)	Ladle	Product	EPCRA	CAS#	Element	(%wt)	Ladle	Product	EPCRA	CAS#
C	Carbon	0.18				V	Vanadium	0.033			
Mn	Manganese	1.09		ü	7439-96-5	Cb	Columbium	0.000			
P	Phosphorous	0.006				B	Boron	0.0002			
S	Sulphur	0.003				Ti	Titanium	0.001		ü	7440-02-0
Si	Silicon	0.24				Al	Aluminum	0.030			
Cu	Copper	0.14		ü	7440-50-8	C.E.		0.41			
Ni	Nickel	0.07		ü	7440-02-0	CuNiCrMoV		0.39			
Cr	Chromium	0.11		ü	7440-47-3	CrMo		0.15			
Mo	Molybdenum	0.04									

Mechanical Testing				Heat Treat			
Test Lab	AFG	Norm. Temp. (F)	1675				
HBW	141 - 144	Norm. (Hrs)	6				
Elg (%)	40	Norm. Cooling Type	AIR				
RA (%)	71	Norm. Location	FVC 094-17				
Tensile Specimen Size (in)	.492						
Tensile (ksi)	73.1	Other					
Yield (ksi)	48.2	VD	Y				
Gauge Length (in)	2	EF	Y				
Charpy Temp (F)	-50	Made to Fine Grain Practice	Y				
Charpy (ft lbs)	83 - 112 - 94						
Avg Energy 3 Specimens (ft-lbs)	96						
Min Energy 1 Specimens (ft-lbs)	83						
% Shear	40 - 50 - 50						
Lat. Exp. (in)	.069 - .076 - .065						

The recording of false, fictitious, or fraudulent statement or entries on this document may be punishable as a felony under federal statute.

EPCRA Supplier Notification: This product may contain one or more toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (Title III of the Superfund Amendments and Reauthorization Act of 1986) and 40 C.F.R. Part 372. Potentially reportable chemicals are indicated with a checkmark in the "EPCRA" column and a Chemical Abstract Services (CAS) registry number is provided for each such chemical in addition to the percent by weight of the chemical present in this product. It is your responsibility alone to determine whether your facility is required to submit a Toxic Release Inventory Report under EPCRA Section 313.

Certification No.: 1309166
 Certification Date: 12/14/2017
 Issued By: Bryun Jantzen

This report is issued in compliance with the requirements of EN10204 3.1 / ISO 10474 3.1.b

Material Test Report

FVC Heat Nbr: C1017BN

FVC Canada Ltd.

An AFGlobal Company

7410A-5 Street, S.E. Calgary, Alberta T2H 2L9

ISO 9001:2008 Certified

Sales: (403) 255-9011 Fax: (403) 255-7239

BROMLEY MECHANICAL 00011652	PO: 88128	Sales Order: C15999	Line: 1
A Division of Argo Sales Ltd	Item Code: LWN040600100A004A1		Qty: 8
T1A 8R1 MEDICINE HAT, AB	Item Desc: LWN, SA350LF2, 600#, 4"x10", RF		
CA	Mill Heat: A14760		
Spec: ASTM A350(17)/ASME SA350(17) Section II Part A, - LF2 CL1			

Product compliant with NACE MR0175/ISO 15156-2:2015, Annex A (A.2.1.2, A2.1.3).
Product compliant with NACE MR0103/ISO 17945:2015, Section 13.1.1 and 13.1.3.

YIELD STRENGTH CALCULATED AT 0.2% OFFSET.

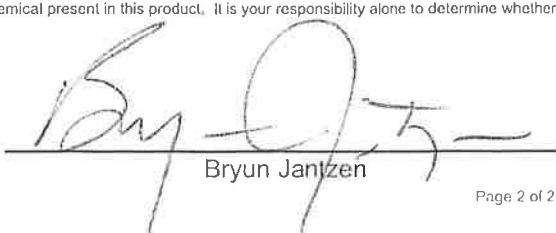
FVC STANDARD MANUFACTURING PRACTICES:

- 1) FLANGE DIMENSIONS & BOLTING COMPLY - ASME B16.5
- 2) SELF-REINFORCING NOZZLES COMPLY WITH SPECIFICATION OF SECTION VIII DIV. 1 OR DIV. 2 PER CUSTOMER DESIGN/FVC DESIGN
- 3) MATERIAL SPECIFICATION COMPLIES WITH ASME SECT. II PART A
- 4) ALL FVC MATERIAL MANUFACTURED PER FINE GRAIN PRACTICE
- 5) ALL FVC MATERIAL CERTIFIED PER EN 10204 TYPE 3.1 UNLESS OTHERWISE SPECIFIED
- 6) CERTIFICATE OF INSURANCE AVAILABLE UPON REQUEST

The recording of false, fictitious, or fraudulent statement or entries on this document may be punishable as a felony under federal statute.

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Certification No.: 1309166
Certification Date: 12/14/2017
Issued By: Bryun Jantzen


Bryun Jantzen

This report is issued in compliance with the requirements of EN10204 3.1 / ISO 10474 3.1.b

wo # 35528

FVC
an AFGlobal Company

Material Test Report

FVC Heat Nbr: CTD

FVC Canada Ltd.

An AFGlobal Company

7410A-5 Street, S.E. Calgary, Alberta T2H 2L9

ISO 9001:2008 Certified

Sales: (403) 255-9011 Fax: (403) 255-7239

BROMLEY MECHANICAL 00011652	PO: 88128	Sales Order: C15999	Line: 2
A Division of Argo Sales Ltd	Item Code: LWN030600090A004A1		Qty: 8
T1A 8R1 MEDICINE HAT, AB	Item Desc: LWN, SA350LF2, 600#, 3"x9", RF		
CA	Mill Heat: CB137093		
Spec: ASTM A350 (17) / ASME SA350 (17) - LF2 CL1 & ASTM A105/A105M (14) / ASME SA105/SA105M (15)			

Element	(%wt)	Ladle	Product	EPCRA	CAS#	Element	(%wt)	Ladle	Product	EPCRA	CAS#
C	Carbon	0.19				Cr	Chromium	0.06		ü	7440-47-3
Mn	Manganese	1.10		ü	7439-96-5	Mo	Molybdenum	0.02			
P	Phosphorous	0.010				V	Vanadium	0.04			
S	Sulphur	0.003				Cb	Columbium	0.001			
Si	Silicon	0.26				Al	Aluminum	0.021			
Cu	Copper	0.15		ü	7440-50-8	C.E.		0.42			
Ni	Nickel	0.22		ü	7440-02-0						

Mechanical Testing				Heat Treat			
Test Lab		AFG		Norm. Temp. (F)			1675
HBW		143 - 145		Norm. (Hrs)			3:34
Elg (%)		37		Norm. Cooling Type			AIR
RA (%)		66		Norm. Location			FVC 462-17
Tensile Specimen Size (in)		.495					
Tensile (ksi)		77.2				Other	
Yield (ksi)		51.4		VD			YES
Gauge Length (in)		2		EF			Y
Charpy Temp (F)		-50		Fully Killed			YES
Charpy (ft lbs)		56 - 54 - 55		Made to Fine Grain Practice			YES
Avg Energy 3 Specimens (ft-lbs)		55					
Min Energy 1 Specimens (ft-lbs)		54					
% Shear		10 - 10 - 10					
Lat. Exp. (in)		.047 - .051 - .054					

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Certification No.: 1309167
 Certification Date: 12/14/2017
 Issued By: Bryun Jantzen

Material Test Report

FVC Heat Nbr: CTD

FVC Canada Ltd.

An AFGlobal Company

7410A-5 Street, S.E. Calgary, Alberta T2H 2L9

ISO 9001:2008 Certified

Sales: (403) 255-9011 Fax: (403) 255-7239

BROMLEY MECHANICAL 00011652	PO: 88128	Sales Order: C15999	Line: 2
A Division of Argo Sales Ltd	Item Code: LWN030600090A004A1	Qty: 8	
T1A 8R1 MEDICINE HAT, AB	Item Desc: LWN, SA350LF2, 600#, 3"x9", RF		
CA	Mill Heat: CB137093		
Spec: ASTM A350 (17)/ASME SA350 (17) - LF2 CL1 & ASTM A105/A105M(14)/ASME SA105/SA105M(15)			

Product compliant with NACE MR0175/ISO 15156-2:2015, Annex A (A.2.1.2, A2.1.3).
Product compliant with NACE MR0103/ISO 17945:2015, Section 13.1.1 and 13.1.3.

We hereby certify that the material represented by this document has been tested and is in conformance with the Purchase Order and Specification Requirements.

YIELD STRENGTH CALCULATED AT 0.2% OFFSET.

FVC STANDARD MANUFACTURING PRACTICES:

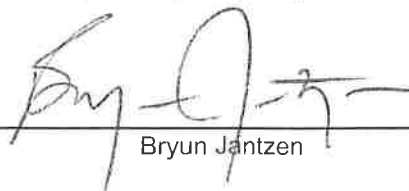
- 1) FLANGE DIMENSIONS & BOLTING COMPLY - ASME B16.5
- 2) SELF-REINFORCING NOZZLES COMPLY WITH SPECIFICATION OF SECTION VIII DIV. 1 OR DIV. 2 PER CUSTOMER DESIGN/FVC DESIGN
- 3) MATERIAL SPECIFICATION COMPLIES WITH ASME SECT. II PART A
- 4) ALL FVC MATERIAL MANUFACTURED PER FINE GRAIN PRACTICE
- 5) ALL FVC MATERIAL CERTIFIED PER EN 10204 TYPE 3.1 UNLESS OTHERWISE SPECIFIED
- 6) CERTIFICATE OF INSURANCE AVAILABLE UPON REQUEST

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Certification No.: 1309167
Certification Date: 12/14/2017
Issued By: Bryun Jantzen

This report is issued in compliance with the requirements of EN10204 3.1 / ISO 10474 3.1.b


Bryun Jantzen



SAN ENG STEEL FORGING CO LTD
 311, Jen Hsin Road, Jen Wu District
 Kaohsiung, Taiwan, R.O.C
 TEL:07-3724249 FAX:07-3712923
 URL: www.saneng.com.tw
 e-mail: saneng@ksts.seed.net.tw

MILL TEST CERTIFICATE

EN10204-3.1 B(DIN50049/3.1.B)
 Customer: SEYBOLD INTERNATIONAL CORP.
 Order No.: 7010155(1)-CCTF

Certificate No.: SE10155A
 Date: 06/03/2015
 Page: 1 OF 1

PO# 4897077

PRODUCT		MATERIAL SPECIFICATIONS						DIMENSIONAL SPECIFICATIONS										
FORGED CARBON STEEL FLANGES		ASTM A105-14/ASME SA-105-14						ASME B16.5-13 CSA Z245.12										
Item No.	CODE NO	DESCRIPTION	QUANTITY	CHEMICAL COMPOSITION (%)														
				Min	C	Si	Mn	P	S	Cu	Cr	Ni	Mo	V	Nb	N	CE(*3)	
1	7534442	150 WNRF XS 18" A1CEN	15 PCE	0.350	0.210	0.190	1.020	0.014	0.007	0.080	0.090	0.040	0.120	0.080	0.001	0.001	0.008	0.408
2	7535732	150 BLRF 4" A105N	400 PCE	0.350	0.220	0.220	1.150	0.018	0.004	0.006	0.020	0.010	0.002	0.006	0.001	0.007	0.418	
3	7535848	150 BLRF 24" A105N	8 PCE	0.350	0.220	0.200	1.020	0.015	0.007	0.080	0.120	0.070	0.020	0.001	0.001	0.009	0.428	
4	7535848	150 BLRF 24" A105N	1 PCE	0.350	0.200	0.180	1.020	0.013	0.011	0.100	0.110	0.040	0.010	0.001	0.001	0.009	0.404	
5	7535848	150 BLRF 24" A105N	1 PCE	0.350	0.210	0.190	1.020	0.014	0.007	0.080	0.090	0.040	0.010	0.001	0.001	0.008	0.408	
6	7534728	300 WNRF STD 16" A-Q5N	5 PCE	0.350	0.200	0.190	1.030	0.019	0.009	0.110	0.130	0.050	0.020	0.002	0.001	0.008	0.413	
7	7530560	600 WNRF S160 2" A1C5N	300 PCE	0.350	0.211	0.230	1.070	0.010	0.007	0.007	0.034	0.047	0.005	0.008	0.305	0.007	0.402	

Item No.	Heat No.	Min	T.S.(*) (MPA)	Y.S.(*) (MPA)	E.L.(*) (%)	Hardness (HB)	R.A.(*) (%)	Impact Test			Material Supplier	HEAT TREATMENT(*2) <input checked="" type="checkbox"/> N	REMARKS
								Temp:	1	2			
		Max	485.0	250.0	22.0	187	30.0	Minimum:	Joule				
1	Y402355		520.0	362.0	35.4	153/151	69.5				KOTOBUKI	880°CX4HRS CONFORMS WITH NACE MRO103-12 AND NACE MRO175/ISO15156 2-09 CLAUSE 7.2.1.4 REGION 3 AND ANNEX A. CONFORMS WITH Z245.12 CAT I GR248 SOUR SERVICE-09(FOR USE AS WELDING NECK AND BLIND FLANGES ONLY) MN TO C RATIO IS GREATER THAN 3.0"	
2	4723468		531.0	360.0	36.2	154/151	71.3				ACOMINAS		
3	Y402268		531.0	383.0	33.2	154/152	70.4				KOTOBUKI		
4	Y402256		524.0	383.0	36.4	153/151	69.5				KOTOBUKI		
5	Y402355		520.0	362.0	35.4	153/151	69.5				KOTOBUKI		
6	Y402255		525.0	364.0	31.8	154/151	68.6				KOTOBUKI		
7	522176		514.0	345.0	35.4	152/150	71.3				NTMK		

*1: T.S.=Tensile Strength, Y.S.=Yield Strength, E.L.=Elongation, R.A.=Reduction of Area.
 *2: N=Normalized, A=Annealed, Q=Quenched, T=Tempered, S.T=Solution Treated, S.R=Stress Relieved, A.C=Air Cooled, F.C=Furnace Cooled, W.C=Water Cooled, O.C=Oil Cooled.
 *3: C.E. Value = C + (Mn /6) + (Cr + Mo +V) / 5 + (Ni + Cu) / 15

We hereby certify that the material has been tested in accordance with the above specification and also with the requirements called for by the above order.

Manager of Quality Assurance Dept

BROMLEY MECHANICAL SERVICES MATERIAL INSPECTION REPORT

DIA SIZE OR WITH: 2"
 NPS OD ID

INSPECTED BY: MICHAEL QUINN

GRADE: SA 106B

DATE: OCTOBER 12/2017

HEADS 2:1
 HEMI
 WELD CAP
 OTHER

LENGTH: 20'

P.O.#: PO-87541

THICKNESS: 160

PIPE PUBLISHED NO: 0.344"

SUPPLIER: APEX DISTRIBUTION INC.

SHELL
 PIPE → NDE BY MANUFACTURER

PLATE NOM

PART ID#: SPI 46449

PLATE HYDRO YES NDE NO
 REPAD NO YES
 STRUCT. NO NO
 OTHER YES YES

Weight per foot for pipe over 4"

7.44

REQ. MIN TK:

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35802	504'	A6643	0.326"	0.342"	0.337"	0.345"	0.342"	OK	OK	OK	ML
				0.342"	0.342"	0.344"	0.340"	OK	OK	OK	ML
				0.345"	0.346"	0.330"	0.331"	OK	OK	OK	ML
				0.326"	0.338"	0.342"	0.346"	OK	OK	OK	ML
				0.345"	0.345"	0.344"	0.345"	OK	OK	OK	ML
				0.345"	0.342"	0.341"	0.337"	OK	OK	OK	ML
				0.340"	0.345"	0.346"	0.340"	OK	OK	OK	ML

W/O#	RECEIVED & ACCEPTED BY: <i>ML</i>	REQUIRED CODE MARKINGS:
CUSTOMER:	DATE: <u>OCT 26 2017</u>	MAHARASHTRA SEAMLESS LIMITED-MADE IN INDIA ALL MARKING STENCILED ONTO PIPE BY MANUFACTURE
BMS STOCK		



MAHARASHTRA SEAMLESS LIMITED
WORKS (MILL) TEST CERTIFICATE
 DIN:50049:3.1. B/EN:10204:3.1

QCF.20A

Tc No : MSL-14/QC/ 3096E/2016 Customer : NORTH AMERICAN PIPE & STEEL
 Date : 20-DEC-16
 Specification : ASTM/ASME A/SA 106 B (15), CSA Z245.1 GR.290
 CAT1(14), ASTM A 53B, API 5L B/X-42 PSL-1(12) P.O. No : 405742 Dt. 20-OCT-16
 Process/Product : HOT FINISH SEAMLESS Carbon Steel Pipes W.O. No : 6160163

Inv-398

DESCRIPTION

Sl No	Material/Item Code	SIZE (Inch)	Length Range (Feet/Mtr)	Heat No.	No Of PCS	Length (Feet/Mtr)	End Finish	Hydro Test Pressure at 5 Sec	Bend Test	Flattening Test	Flaring Test	Drift Test	Crushing Test
1		2 3/8 X 0.344	21	A6643	154	3234	BEVEL	2970 PSI	OK	NA	NA	NA	NA

PHYSICAL PROPERTIES

CHEMICAL COMPOSITION (%)

Sl No	Heat No	YST (PSI)	UTS (PSI)	El (%)	Hardness HRB	Impact Test Charpy v-notch	LA/PA	C	Mn	Si	P	S	Cr	Mo	Ni	V	Cu	Al	Ti	Nb	CE			
G.L. = 2". G.W. 3/4" - L at room temp								.28	1.06		.03	.03	.4	.15	.4	.08	.4							
Required (Max)																								
Required (Min)								42100	60200			.29	.1											
1	A6643	53359	73813	19.00	74 - 76		LA PA PA	.170 .174 .162	1.050 1.020 1.030	.230 .220 .211	.015 .013 .011	.004 .006 .006	.012 .018 .017	.002 .002 .002	.004 .022 .023	.002 .011 .002	.005 .011 .011	.025 .024 .025	.002 .002 .001	.002 .000 .000	.002 .000 .000	.349 .351 .340		

BROMLEY MECHANICAL SERVICES
 Checked to ASME

Sect. II A 2015 min 0.326"
SA 530 15 10/26/17
VS 35802 Date

Dimensions : Outside diameter, thickness, weight, length conforms to above specification.
 Coating : All Pipes are coated with rust preventive from outside surface only.
 N.D.T. : Not Applicable
 Heat Treatment : Not applicable
 Raw material : Fully killed
 Marking/Stencilling : MAHA (MSL) API SPEC 5L 0135.1 (API LOGO) H/Y ASTM A 106 GR.B/ASME SA 106 GR.B ACTM A 53 GR.B API 5L GR.B/X-42 PSL-1 CSA Z245.1 GR.290 CAT-1 OD 2.375 INCH (SCH 160) X WT 0.344 INCH SMLS HEAT NO.2970 PSI+MADE IN INDIA+PIPE NO.

Remarks : Material conforms to NACE MR-0175 restricted to Sulphur contents 0.01% max and Hardness 22 HRC max.

CERTIFY THAT THE MATERIAL CONFORMS TO ABOVE SPECIFICATION.

FOR MAHARASHTRA SEAMLESS LIMITED
 R.K. SRIVASTAVA - SENIOR ENGINEER



BROMLEY MECHANICAL SERVICES

MATERIAL INSPECTION REPORT

INSPECTED BY: MICHAEL QUINN

GRADE: SA 106B

DIA SIZE OR WITH: 2"
 NPS OD ID

DATE: MAY 9/2017

HEADS 2:1
 HEMI
 WELD CAP
 OTHER

LENGTH: 20'

P.O.#: PO-86718

THICKNESS: 160

PIPE PUBLISHED NO: 0.344"

SUPPLIER: BHD TUBULAR LIMITED

SHELL
 PIPE → NDE BY MANUFACTURER

PLATE NOM

PART ID#: SPI 46449

PLATE HYDRO YES NDE NO
 REPAD NO YES
 STRUCT. NO NO
 OTHER YES YES

Weight per foot for pipe over 4"

7.44

REQ. MIN TK:

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35556	145'	352145	0.339"	0.351"	0.348"	0.347"	0.350"	OK	OK	OK	ML
				0.349"	0.349"	0.348"	0.349"	OK	OK	OK	ML
				0.350"	0.344"	0.350"	0.347"	OK	OK	OK	ML
				0.343"	0.344"	0.339"	0.340"	OK	OK	OK	ML
				0.344"	0.345"	0.350"	0.353"	OK	OK	OK	ML
				0.356"	0.350"	0.345"	0.356"	OK	OK	OK	ML
				0.345"	0.356"	0.357"	0.344"	OK	OK	OK	ML

W/O#	RECEIVED & ACCEPTED BY: <i>[Signature]</i>	REQUIRED CODE MARKINGS:
CUSTOMER: BMS STOCK	DATE: <u>6/12/17</u> <u>10/16/17</u>	TIANJIN PIPE(GROUP) CORPORATION-MADE IN CHINA ALL MARKING STENCILED ONTO PIPE BY MANUFACTURE



MANUFACTURER: TIANJIN PIPE (GROUP) CORPORATION
 ADD: JINTANG ROAD DONGLI DISTRICT, TIANJIN, CHINA
 TEL.: 86-22-24801073
 FAX: 86-22-24801291

QR-11-8.2.4-19

QUALITY CERTIFICATE

Licence No.:

No.: THM1510200014001

Contract No. TPCO-15255E L/C No. O.D.*W.T. 21N SCH160(60.30mm*8.74mm) Packing IN BUNDLES
 Order Product SEAMLESS STEEL LINE PIPE Steel grade Cat I Gr.290 SS /B/X42/Gr.B Total pieces 212
 P.O. No. Port of desti. Man. Method HOT ROLLING SEAMLESS Total metres
 Standard CSA Z245.1-14 /API SPEC 5L 45th/ASTM A106 -2014/ASME SA106 -2013 Length range 38-44FT Total Tons 30.177

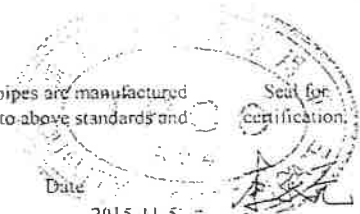
Heat No.	Lot No.	Pieces	Quantity			Delivery condition	Sample No.	J* Tem. °C	Tensile test(MPa)				Shrink %	2* Tem. °C	Size	Impact test(J)			Shear AVE %
			Meters	Bundles	Tons				T.S.	Type	Y.S.	Elong.%				AK1 %	AK2 %	AK3 %	
352145	71	212			30.177	As rolled	71-09-1086	A	25	515	Rt0.5	360	37.0						

BROMLEY MECHANICAL SERVICES
 Checked to ASME
 2012 09/11/18
 Sect. IIA 2015 MIN 0.339"
 SA 530 US 35556 Date 6/12/19
 NDE test(1) test(2)

Heat No.	Lot No.	Sample No.	HV10	Hardness test (inside)				Hardness test (middle)				Hardness test (outside)				Fla. test(1)	Fla. test(2)			
				1	2	3	4	AVE	1	2	3	4	AVE	1	2			3	4	AVE
352145	71	71-09-1086		172.0	172.0	173.0	172.0	172.0	167.0	166.0	166.0	166.0	166.0	167.0	168.0	169.0	168.0	168.0	ET+UT/Ø1.8+/-1.3	

Heat No.	Material	Chemical composition % (L: Ladle analysis P: Product analysis)																Hydro. Test			
		C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Al	V	Nb	Ti	B	Ca	N		O	CE(PCM)	CE(IW)
352145	L	0.14	0.25	1.04	0.010	0.003	0.04	0.07	0.03	0.06	0.029	0.04	<0.01	<0.01	<0.0005	0.0011			0.33	0.35	3010PSI/8S
	P	0.14	0.26	1.08	0.010	0.002	0.03	0.07	0.04	0.04	0.031	0.04	<0.01	<0.01	<0.0005	0.0013			0.34	0.35	
14Mn5V	P	0.14	0.26	1.08	0.010	0.002	0.03	0.07	0.04	0.04	0.031	0.04	<0.01	<0.01	<0.0005	0.0012			0.34	0.35	

NDE (100%) Visual and Dimension Hydro. Test Pipe End NDE Pipe End Beveling Residual Mag. Test SSC HIC We hereby state that all pipes are manufactured and inspected according to above standards and order. Seal for certification.
 G G G G G G
 Note: NACE MR 0103-2010/NACE MR 0175-2009/ISO 15156-2:2009/CE (CSA) C-F-1 Mn+5w/24+Cu/15+Ni20-1Cr+Mo+V+Nb /3+5B /CE /IW
 Note: C+Mn+Si+Cr+Mo+V+Ni+(Cu+Ni)15; ALUMINUM KILLED STEEL. EAF-LF-CONTINUOUS CASTING;ISO16474/EN13204-3-1;Silicon and calcium treated for inclusion morphology control in Steel
 Melting: Visual inspection and Dimensional inspection & dimensions controls as per ASME B36.10M
 Remark: desti.=destination; Tem.=Temperature; speci.= specification; Man.=Manufacture; Fla.=Flattening; G=Good; Hydro.=Hydrostatic; Mag=Magnetic



(FOR EXPORT ONLY)

BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT

DIA SIZE OR WITH: 96.5" X 48"

NPS OD ID

INSPECTED BY: MICHAEL QUINN

GRADE: SA 516-70 MTEE

DATE: DECEMBER 10/2014

HEADS 2:1

LENGTH

P.O.# PO-82429

HEMI

THICKNESS

SUPPLIER: EDMONTON EXCHANGERS LTD.

WELD CAP

PIPE PUBLISHED NOM

PART ID#: STL 95730

OTHER

PLATE NOM 1.0000"

REQ. MIN TK: 1.0000"

SHELL

PIPE → NDE BY MANUFACTURER

PLATE HYDRO YES NDE NO

Weight per foot for pipe over 4"

REPAD NO YES

STRUCT. NO NO

OTHER YES YES

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKING	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 33732	32'	N19328-FA47146301	0.999"	1.008"	1.001"	1.001"	0.999"	ok	ok	ok	MQ

W/O# _____
 CUSTOMER: BMS STOCK

RECEIVED & ACCEPTED BY: [Signature]
 DATE: 11/16/18

REQUIRED CODE MARKINGS:
ALL MARKINGS STAMPED INTO PLATE BY MANUFACTURE



edmonton exchanger
& manufacturing ltd.

CERTIFICATE OF COMPLIANCE

5545-89 Street Edmonton, Alberta Canada T6E 5W9 www.edmontonexchanger.com tel 780.468.6722 • QC fax 780.466.4668 • sales fax 780.466.5155

Customer **BROMLEY MECHANICAL SERVICES LT** PO 82429 Work Order C106685 Date 2014/12/08 CofC# 53669 Page 1 of 1

Item#	Description	Qty	Heat#	Brinell Hardn.
P106685-1	PLATE(S) 1.0000" NOM X 96.5" X 48" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2009 Annex A</i>	1	N19328-FA47146301	MTR
P106685-2	PLATE(S) - 0.5000" NOM X 96.5" X 48" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2009 Annex A</i>	2	M13160-PA08436002	151
P106685-3	PLATE(S) - 0.2500" NOM X 96.5" X 48" (Material Spec: SA 516-70 Normalized) <i>Conforms to NACE MR0175 / ISO 15156-2 2009 Annex A</i>	2	0399A3-AM0777	151

Brinell Equipment: Newage Calibrated Pin
Brinell Hardness Tester

Material being supplied conforms to the latest ASME Code Section II, Part A, 2013 Edition. All welders and procedures are qualified to ASME Code Section IX.

Steve Zubryckyj (QAM)

Supplementary Examination - Items

--



edmonton exchanger
& manufacturing ltd.

CERTIFICATE OF COMPLIANCE

MTR List

5545-89 Street Edmonton, Alberta Canada T6E 5W9 www.edmontonexchanger.com tel 780.468.6722 • QC fax 780.466.4668 • sales fax 780.466.5155

Customer **BROMLEY MECHANICAL** PO 82429 Work Order C106685 Date 2014/12/08 CofC# 53669 Page 1 of 1

Email to barbh@argosales.com

Email to michaelq@argosales.com

Email to kolsen@edmontonexchanger.com

MTR ID	Pages	Heat#	Thickness	Material Grades
15930	1	M13160-PA08436002	.5"	SA 516-70 N
19061	8	N19328-FA47146301	1"	SA 516-70 N
19066	4	0399A3-AM0777	.25"	SA 516-70 N

Heat#	Material Grades	MTR ID
0399A3-AM0777	SA 516-70 N	19066
M13160-PA08436002	SA 516-70 N	15930
N19328-FA47146301	SA 516-70 N	19061

Heat#	Thickness	Grade	HIC Report Filename



검사증명서

MILL TEST CERTIFICATE



당진개점소 : 충남 당진시 송악읍 북부산업로 1483
1483 Bukbuan-ro, Songsk-Eup, Dangjin-Si Chyngnam, Korea



주문번호 : E140700097

품명 : Hot Rolled Steel Plate

제품규격 : ASME SA516-70 MT LTV

고객사 : EDMONTON STEEL PLATE

주문자 : HYUNDAI CANADA INC.

증명서 번호 : 20140821-PS-002-018

발행일자 : 2014-09-21

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hardness Test HB	화학성분 Chemical Composition(%)														단위 Unit			
						YP	TS	EL	YP-EL	RA	YR	YP Mtd			Division	C	S	Mn	P	S	Cr	N	3	Ca	Cu	Mo	N	Nb	Ti	V	Sol-AI	CEQ
						(KSI)	(%)	(%)	(%)	(%)	(%)					4	3	3	4	4	2	2	4	4	3	2	4	3	3	3	3	3
1" x 120.5" x 480"	1	16,407	N19331	FA47011101	T	51.7	76.1	50				2	Good	151.1	L	1,546	350	1,163	12E	14	18	18	2	17	132	1	34	14	2	1	30	407
															C	1,474	345	1,143	114	13	17	18	1	15	131	0	31	13	2	1	27	383
1" x 120.5" x 480"	1	16,407	N19331	FA47145001	T	50.8	75.6	51				2	Good	158.0	L	1,546	350	1,163	12E	14	18	18	2	17	132	1	34	14	2	1	30	407
															C	1,486	349	1,164	124	12	18	18	1	17	131	0	30	14	2	1	30	400
1" x 120.5" x 480"	1	16,407	N19331	FA47145002	T	50.6	75.6	51				2	Good	156.0	L	1,546	350	1,163	12E	14	18	18	2	17	132	1	34	14	2	1	30	407
															C	1,486	349	1,164	124	12	18	18	1	17	131	0	30	14	2	1	30	400
1" x 120.5" x 480"	1	16,407	N19331	FA47145102	T	51.6	75.6	52				2	Good	146.1	L	1,546	350	1,163	12E	14	18	18	2	17	132	1	34	14	2	1	30	407
															C	1,505	354	1,171	11E	16	18	18	1	15	132	0	31	14	2	2	27	403

NOTE

- Position - T:Top, M:Middle, B:Bottom
- Tensile test - Direction:Transverse, Gauge length:50.8mm (Rectangular), YP Mtd : 2 (0.2% off-set), 5 (0.5% underload), U (Upper yield point), L (Lower yield point)
- U.S.T - Ultrasonic test
- Impact test - Direction:Longitudinal, Size:10mmX10mm, SF:Shear fracture, LE:Lateral Expansion
- Division - C:Check analysis, L:Ladle analysis

ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2010 EDITION. SULPHIDE SHAPE CONTROL
The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied.
Applicable Code is ASME Section II Part A 2010 Edition. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature: **S. B. Park**
SURVEYOR TO: Chief Of Quality Assurance Team

* 본 검사증명서는 원본인 전자문서(전자서명 정보 포함)로부터 출력된 사본입니다. 전자문서의 내용은 해당제품 고객포탈에서 확인하실 수 있습니다.(http://sm.hyundai-steel.com/cs/cm/login.jsp)
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검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진제철소 · 충남 당진시 송악읍 북부산업로 1463
1463 Bukbusanuis-Ro, Songsk-Exp, Dangin-Si, Chungnam, Korea



주문번호 Order No. : E140700097

품명 Commodity : Hot Rolled Steel Plate

제품규격 Specification : ASME SA516-70 MT LTV

고객사 Customer : EDMONTON STEEL PLATE

주문자 Contractor : HYUNDAI CANADA INC.

증명서 번호 Certificate No. : 2014C921-PS-002-018

발행일자 Date of Issue : 2014-09-21

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50.8 °F		
		Energy	SF	LE
		(R-Lbs) (%)	(%)	(mm)
FA47011101	T	1: 272 2: 212 3: 210 A: 232		
FA47145001	T	1: 237 2: 175 3: 221 A: 211		
FA47145002	T	1: 237 2: 175 3: 221 A: 211		
FA47145102	T	1: 266 2: 249 3: 228 A: 247		

NOTE

* ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2010 EDITION. SULPHIDE SHAPE CONTROL
 * The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied.
 Applicable Code is ASME Section II Part A 2010 Edition. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
 WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature

S. B. Park

SURVEYOR TC : Chief Of Quality Assurance Team

* 본 검사증명서는 원본인 전자문서(전자서명 정보 포함)로부터 출력된 사본입니다. 전자문서의 내용은 현대제철 고객포털에서 확인하실 수 있습니다.(<http://sm.hyundai-steel.com/cs/cm/login.jsp>)
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검사증명서

MILL TEST CERTIFICATE



당진제철소 · 충남 당진시 중앙읍 북부산업로 1483
1483 Bukbuanup-Ro, Songnag-Eup, Dangjin-Si, Chungnam, Korea



주문번호
Order No. : E140700097

품명
Commodity : Hot Rolled Steel Plate

제품규격
Specification : ASME SA516-70 MT LTV

고객사
Customer : EDMONTON STEEL PLATE

주문자
Contractor : HYUNDAI CANADA INC.

증명서 번호
Certificate No. : 20140921-PS-002-019

발행일자
Date of Issue : 2014-09-21

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hard- ness Test HB	화학성분 Chemical Composition(%)														단위 Unit							
						YP	TS	EL	YP-EL	RA	YR	YP Mtd			C	Si	Mn	P	S	Cr	Ni	B	Ca	Cu	Mo	N	Nb	Ti	V	Sol- Al	CEO	2 : x100	3 : x1,000	4 : x10,000	5 : x100,000	
						(KSI)	(%)	(%)	(%)	(%)	(%)				4	3	3	4	4	2	4	4	3	2	4	3	3	3	3	3						
1" x 120.5" x 480"	1	16,407	N19331	FA47145201	T	51.9	75.9	52				2	Good	150.2	L	1,546	350	1,163	125	14	18	18	2	17	132	1	34	14	2	1	30	407				
															C	1,553	346	1,173	130	13	18	18	1	19	137	0	26	14	2	2	29	408				
1" x 120.5" x 480"	1	16,407	N19331	FA47145202	T	51.9	75.9	52				2	Good	150.2	L	1,546	350	1,163	125	14	18	18	2	17	132	1	34	14	2	1	30	407				
															C	1,553	346	1,173	130	13	18	18	1	19	137	0	26	14	2	2	29	408				
1" x 120.5" x 480"	1	16,407	N19328	FA47145301	T	53.1	77.0	52				2	Good	152.4	L	1,538	348	1,172	132	13	18	18	2	15	130	0	38	14	2	2	26	406				
															C	1,522	343	1,162	123	12	17	18	1	13	128	0	32	13	2	1	25	401				
1" x 120.5" x 480"	1	16,407	N19328	FA47145302	T	53.1	77.0	52				2	Good	152.4	L	1,538	348	1,172	132	13	18	18	2	15	130	0	38	14	2	2	26	406				
															C	1,522	343	1,162	123	12	17	18	1	13	128	0	32	13	2	1	25	401				

NOTE
 * Position - T:Top, M:Middle, B:Bottom
 * Tensile test - Direction:Transverse, Gauge length:50,8mm (Rectangular), YP Mtd : 2 (0.2% off-set), 5 (0.5% underload), U (Upper yield point), L (Lower yield point)
 * U.S.T - Ultrasonic test
 * Impact test - Direction:Longitudinal, Size:10mmX10mm, SF:Shear fracture, LE:Lateral Expansion
 * Division - C:Check analysis, L:Ladle analysis

* ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2010 EDITION, SULPHIDE SHAPE CONTROL
 * The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied.
 Applicable Code is ASME Section II Part A 2010 Edition. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature
S. B. Park
 SURVEYOR TO : Chief Of Quality Assurance Team

* 본 검사증명서는 원본인 전자문서(전자서명 정보 포함)로부터 출력된 사본입니다. 전자문서의 내용은 현대제철 고객포탈에서 확인하실 수 있습니다.(http://sm.hyundai-steel.com/cs/cm/login.jsp)
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검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진제철소 : 충남 당진시 송악읍 북부산업로 1489
1489 Bukbuanup-Ro, Songak-Eup, Dangin-Si, Chungnam, Korea



주문번호 : E140700097
Order No.

품명 : Hot Rolled Steel Plate
Commodity

제품규격 : ASME SA516-70 MT LTV
Specification

고객사 : EDMONTON STEEL PLATE
Customer

주문자 : HYUNDAI CANADA INC.
Contractor

증명서 번호 : 20140921-PS-002-019
Certificate No.

발행일자 : 2014-09-21
Date of Issue

ORIGINAL

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50.8 °F		
		Energy	SF	LE
		(Ft-Lbs)	(%)	(mm)
FA47145201	T	1: 228 2: 250 3: 195 A: 224		
FA47145202	T	1: 228 2: 250 3: 195 A: 224		
FA47145301	T	1: 245 2: 224 3: 234 A: 235		
FA47145302	T	1: 245 2: 224 3: 234 A: 235		

NOTE

- ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2010 EDITION. SULPHIDE SHAPE CONTROL
- The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied.
- Applicable Code is ASME Section II Part A 2010 Edition. The Certificate has been Issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature

S. B. Park

SURVEYOR TO : Chief Of Quality Assurance Team

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검사증명서

MILL TEST CERTIFICATE



당진제철소 · 충남 당진시 송악읍 북부산업로 1483
1483 Bukbuan-eup, Songak-eup, Dangjin-si, Chungnam, Korea



주문번호 : E140700097
Order No.

품명 : Hot Rolled Steel Plate
Commodity

제품규격 : ASME SA516-70 MT LTV
Specification

고객사 : EDMONTON STEEL PLATE
Customer

주문자 : HYUNDAI CANADA INC.
Contractor

증명서 번호 : 2014C921-PS-002-020
Certificate No.

발행일자 : 2014-09-21
Date of Issue

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	재간번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hard- ness Test HB	화학성분 Chemical Composition(%)																	
						YP	TS	EL	YP-EL	RA	YR	YP Mid			C	Si	Mn	P	S	Cr	Ni	B	Ca	Cu	Mo	N	Nb	Ti	V	S _{AI}	O _{EQ}	
						(KSI)	(%)	(%)	(%)	(%)	(%)	4																				3
1" x 120.5" x 480"	1	16,407	N19328	FA47146101	T	53.3	78.2	51				2	Good	151.5	L	1,538	348	1,172	132	13	18	18	2	15	130	0	38	14	2	2	26	406
															C	1,626	331	1,137	130	13	17	18	1	14	129	0	30	13	2	1	25	407
1" x 120.5" x 480"	1	16,407	N19328	FA47146102	T	53.3	78.2	51				2	Good	151.5	L	1,538	348	1,172	132	13	18	18	2	15	130	0	38	14	2	2	26	406
															C	1,626	331	1,137	130	13	17	18	1	14	129	0	30	13	2	1	25	407
1" x 120.5" x 480"	1	16,407	N19328	FA47146202	T	53.3	76.6	51				2	Good	152.9	L	1,538	348	1,172	132	13	18	18	2	15	130	0	38	14	2	2	26	406
															C	1,554	343	1,157	125	12	17	18	1	15	127	0	33	13	2	1	24	403
1" x 120.5" x 480"	1	16,407	N19328	FA47146301	T	52.0	76.6	52				2	Good	149.6	L	1,538	348	1,172	132	13	18	18	2	15	130	0	38	14	2	2	26	406
															C	1,588	343	1,150	126	15	17	18	1	15	127	0	32	14	2	1	26	406

NOTE
 * Position - T:Top, M:Middle, B:Bottom
 * Tensile test - Direction:Transverse, Gauge length:50.8mm (Rectangular), YP Mid : 2 (0.2% off-set), 5 (0.5% underload), U (Upper yield point), L (Lower yield point)
 * U.S.T - Ultrasonic test
 * Impact test - Direction:Longitudinal, Size:10mmX10mm, SF:Shear fracture, LE:Lateral Expansion
 * Division - C:Check analysis, L:Ladle analysis
 * ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2010 EDITION. SULPHIDE SHAPE CONTROL.
 * The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied.
 * Applicable Code is ASME Section II Part A 2010 Edition. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

BROWLEY MECHANICAL SERVICES
 Checked to ASME
 2017 08 11/16/18
 Sect. IIA 2013 Edd. min 0.999"
 SA 20
 Signature: **S. B. Park** Date: 11/8/15
 SURVEYOR TO: Chief Of Quality Assurance Team

WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

US 33782

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검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진제철소 · 흥남 당진시 송악읍 북부산업로 1480
1480 Bukhuseon-ro, Songak-Eup, Dangjin-Si, Chungnam, Korea



주문번호 : E140700097
Order No.

품명 : Hot Rolled Steel Plate
Commodity

제품규격 : ASME SA516-70 MT LTV
Specification

고객사 : EDMONTON STEEL PLATE
Customer

주문자 : HYUNDAI CANADA INC.
Contractor

증명서 번호 : 20140921-PS-002-020
Certificate No.

발행일자 : 2014-09-21
Date of Issue

ORIGINAL

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50,8 °F		
		Energy	SF	LE
		(Ft-Lbs)	(%)	(mm)
FA47146101	T	1: 240		
		2: 209		
		3: 232		
		A: 226		
FA47146102	T	1: 240		
		2: 209		
		3: 232		
		A: 226		
FA47146202	T	1: 249		
		2: 246		
		3: 245		
		A: 246		
FA47146301	T	1: 237		
		2: 235		
		3: 119		
		A: 198		

NOTE

• ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2010 EDITION. SULPHIDE SHAPE CONTROL
 • The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied.
 Applicable Code is ASME Section II Part A 2010 Edition. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
 WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature: **S. B. Park**
 SURVEYOR TO : Chief Of Quality Assurance Team

* 본 검사증명서는 원본인 전자문서(전자서명 정보 포함)로부터 출력된 사본입니다. 전자문서의 내용은 현대제철 고객포탈에서 확인하실 수 있습니다.(<http://sm.hyundai-steel.com/cs/cm/login.jsp>)
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검사증명서

MILL TEST CERTIFICATE



당진제철소 · 충남 당진시 송악읍 북부산업로 1483
1483 Bukhusanu-ro, Songak-eup, Dangjin-si, Chungnam, Korea



주문번호 : E140700097
Order No.

품명 : Hot Rolled Steel Plate
Commodity

제품규격 : ASME SA516-70 MT LTV
Specification

고객사 : EDMONTON STEEL PLATE
Customer

주요자 : HYUNDAI CANADA INC.
Contractor

증명서 번호 : 20140921-PS-002-021
Certificate No.

발행일자 : 2014-09-21
Date of Issue

제품치수 Dimension	수량 Quantity	중량 Weight (Lbs)	제강번호 Heat No.	제품번호 Product No.	Position	인장시험 Tensile Test							U.S.T	경도 시험 Hard- ness Test HB	화학성분 Chemical Composition(%)														단위 Unit							
						YP	TS	EL	YP-EL	RA	YR	YP Mtd			C	Si	Mn	P	S	Cr	Ni	B	Ca	Cu	Mo	N	Nb	Ti	V	Sn -Al	CEQ	2 : x100	3 : x1,000	4 : x10,000	5 : x100,000	
																																(KSI)	(%)	(%)	(%)	(%)
																				Dial S																
1' x 120.5" x 480"	1	16,407	N1932B	FA47146302	T	52.0	76.6	52				2	Good	149.6	L	1,538	348	1,172	132	13	18	18	2	15	130	0	38	14	2	2	26	406				
															C	1,588	343	1,158	125	15	17	18	1	15	127	0	32	14	2	1	25	406				
1' x 120.5" x 480"	1	16,407	N19331	FA47146401	T	53.5	76.8	51				2	Good	151.3	L	1,546	350	1,163	125	14	18	18	2	17	132	1	34	14	2	1	30	407				
															C	1,595	329	1,141	119	13	17	18	1	18	132	0	29	13	2	1	28	405				
1' x 120.5" x 480"	1	16,407	N19331	FA47146402	T	53.5	76.8	51				2	Good	151.3	L	1,546	350	1,163	125	14	18	18	2	17	132	1	34	14	2	1	30	407				
															C	1,595	329	1,141	119	13	17	18	1	13	132	0	29	13	2	1	28	405				

*** Sub Total(007) *** 15 246,105(Lbs)

*** Heat Treatment : Normalized : 1634,0° F 46 Min.

*** UST Application Spec. => ASME SA578(LLEVEL B)

NOTE

- * Position - T:Top, M:Middle, B:Bottom
- * Tensile test - Direction:Transverse, Gauge length:50.8mm (Rectangular), YP Mtd : 2 (0.2% off-set), 5 (0.5% underload), U (Upper yield point), L (Lower yield point)
- * U.S.T - Ultrasonic test
- * Impact test - Direction:Longitudinal, Size:10mmX10mm, SF:Shear fracture, LE:Lateral Expansion
- * Division - C:Check analysis, L:Ladle analysis

* ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2010 EDITION. SULPHIDE SHAPE CONTROL
* The plate is fully killed and fine grained steel, Basic oxygen process and Vacuum degassing process were applied.
Applicable Code is ASME Section II Part A 2010 Edition. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature

S. B. Park

SURVEYOR TO : Chief Of Quality Assurance Team

* 본 검사증명서는 원본인 전자문서(전자서명 정보 포함)로부터 출력된 사본입니다. 전자문서의 내용은 현대제철 고객포탈에서 확인하실 수 있습니다.(<http://sm.hyundai-steel.com/cs/cm/login.jsp>)
* This Mill Test Certificate is a copy that has been printed from original electronic document(with digital signing).
You are able to check an original electronic document at hyundai-steel's customer portal.(<http://sm.hyundai-steel.com/cs/cm/login.jsp>) * QRcode scanner App : 'QReal'

검사증명서

MILL TEST CERTIFICATE

(Attached Sheet)



당진제철소 : 충남 당진시 중앙읍 북부산업로 1483
1483 Bukbueon-ro, Songuk-Eup, Dangjin-Si Chungnam, Korea

주문번호 Order No. : E140700097	고객사 Customer : EDMONTON STEEL PLATE	증명서 번호 Certificate No. : 20140921-PS-002-021
품명 Commodity : Hot Rolled Steel Plate	주문자 Contractor : HYUNDAI CANADA INC.	발행일자 Date of Issue : 2014-09-21
제품규격 Specification : ASME SA516-70 MT LTV		

제품번호 Product No.	Position	충격시험 Impact Test V Notch -50.8°F		
		Energy	SF	LE
		(Ft-Lbs)	(%)	(mm)
FA47146302	T	1: 237		
		2: 235		
		3: 119		
		A: 198		
FA47146401	T	1: 250		
		2: 225		
		3: 230		
		A: 235		
FA47146402	T	1: 250		
		2: 225		
		3: 230		
		A: 235		
*** Sub Total(007) *** 15 246,105(Lbs)				
*** Heat Treatment : Normalized : 1634,0°F 46 Min.				
*** UST Application Spec. => ASME SA578(LEVEL B)				
NOTE	* ALL MATERIALS HAVE BEEN PRODUCED AS PER ASME SECTION II PART A SA 516-70 MT LTV + SA20 AS WELL AS SECTION VIII DIV.1 - 2010 EDITION. SULPHIDE SHAPE CONTROL. * The plate is fully killed and fine grained steel. Basic oxygen process and Vacuum degassing process were applied. * Applicable Code is ASME Section II Part A 2010 Edition. The Certificate has been issued in compliance with EN 10204 (2004) 3.1.			
	WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS. 상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.			



* 본 검사증명서는 원본인 전자문서(전자서명 정보 포함)로부터 출력된 사본입니다. 전자문서의 내용은 현대제철 고객포탈에서 확인하실 수 있습니다.(<http://sm.hyundai-steel.com/cs/cm/login.jsp>)
 * This Mill Test Certificate is a copy that has been printed from original electronic document(with digital signing).
 You are able to check an original electronic document at hyundaisteel's customer portal.(<http://sm.hyundai-steel.com/cs/cm/login.jsp>) * QRcode scanner App : 'QReal'

ALBERTA MUNICIPAL AFFAIRS

ABSA, the pressure equipment safety authority
9410 – 20th Avenue
Edmonton, AB T6N 0A4

**MANUFACTURER'S DATA REPORT
FOR MINIATURE PRESSURE VESSEL
DÉCLARATION DE CONFORMITÉ DU CONSTRUCTEUR
D'APPAREILS SOUS PRESSION**

Upon shipment of a pressure vessel, this form fully and correctly filled in must be mailed to the office of the Chief Inspector in the province of installation in accordance with the regulations under the Act, governing the construction and installation of pressure vessels.

Au moment de l'expédition d'un appareil sous pression, ce formulaire correctement complété, doit être envoyé au bureau de l'inspecteur en chef de la province d'installation tel que prévu selon les règlements de la loi sur les appareils sous pression.

Manufactured by Construit par	Name and address of Manufacturer/Nom et adresse du constructeur Bromley Mechanical Services, A Division of Argo Sales Inc, 925 - 23rd Street SW, Medicine Hat, AB T1A 8R1
Manufactured for Construit pour	Name and address of Purchaser or Consignee/Nom et adresse du client ou de son représentant Arc Resources General Ptnrs, 1200, 308 - 4th Avenue SW, Calgary, Alberta T2P 0H7
Ultimate owner Utilisateur	Name and address/Nom et adresse Arc Resources General Ptnrs, 1200, 308 - 4th Avenue SW, Calgary, Alberta T2P 0H7
Location of installation Lieu d'installation	Name and address/Nom et adresse LSD: 03-18-080-14 W6M

Pressure vessel/Appareil

Type/Genre Bridle	Overall Length/Longueur totale 88"	Serial No./N° de série 35528-F05 to 35528-F08	Year Built/Année de fabrication 20183
Provincial Registration No. -- C.R.N./N° d'enregistrement provincial - N.E.C. 0H18137.2			Drawing No./N° de dessin 35527-BRIDLE-REG Rev.0

The chemical and physical properties of all parts meet the requirements of material specifications of the A.S.M.E. Code.

Les propriétés chimiques et physiques de toutes les composantes respectent les exigences des spécifications de matériaux de code ASME.

The design, construction and workmanship conform to CSA B51. <i>La conception, la construction et la façon sont conformes à ACNOR B51.</i>	ASME Section VIII	Division 1	Edition/édition 2015	Code case No. N° de cas N/A
Manufacturer's partial data reports properly identified and signed by authorized inspectors have been furnished for the following items of the report, and attached to this report: <i>Les rapports partiels du constructeur adéquatement identifiés et signés par les inspecteurs autorisés ont été produits pour les items suivants du rapport, et attachés à ce rapport:</i>				
Names of parts/ Nom de la composante	Manufacturer's Name/ Nom du constructeur	Identifying Stamp/ Estampe d'identification		

Shell/Virole

Material Matériau	Thickness Épaisseur	Corr. Allow. Surépais. de corr.	Diameter Diamètre	Longitudinal Joints Joints longitudinaux			P.W.H.T. Traitement therm		Girth Joints Joints de circonférence			Number of courses Nombre de sections
				Type	R.T. Radiog.	Efficiency Efficacité	Temp. Température	Time Durée	Type	R.T. Radiog	Efficiency Efficacité	
SA106B	0.531"	0.125"	4" NPS		NONE	1.00	1150°F	1Hr	1	FULL	1.00	3

Body Flanges on Shells/Brides de corps sur les coquilles

No.	Type	ID	OD	Flange Thk l'épaisseur de la bride	Min Hub Thk l'épaisseur minimum de moyeu	Material Matériau	How Attached l'attachement de	Location Emplacement	Bolting/boulonnage Spec. & Gr.	
									Num & Size Nombre et la taille	Bolting Material Matériel de boulonnage
N/A										

Heads/Tetes

Location Top, Bottom, Ends Emplacement Haut, Bas, Extrémités	Material Matériau	Min. Thckn. Épals minim.	Corr. Allow Surép. Corr.	Crown. Radius Rayon couron.	Knuckle Radius Petit rayon	Ellipse Ratio Rapp. ellipse	Conical Apex Angle Angle conique	Hemisph. Radius Ray. Hémisph	Flat Diameter Diam. plat	Side to pressure Côte sous pression
a TOP	SA105N	0.531"	0.125"	-----	-----	-----	-----	-----	4" 600#	-----
b BOTTOM	SA105N	0.531"	0.125"	-----	-----	-----	-----	-----	4" 600#	-----

Body Flanges on Heads/Brides de corps sur les chefs

Location Emplacement	Type	ID	OD	Flange Thk l'épaisseur de la bride	Min Hub Thk l'épaisseur minimum de moyeu	Material Matériau	How Attached l'attachement de	Bolting/boulonnage Spec. & Gr.	
								Num & Size Nombre et la taille	Bolting Material Matériel de boulonnage
a N/A									
b									

Pressure - Temperature/Pression - température

Constructed for max. allowable working pressure <i>Construit pour une pression maximale de marche permise</i> Internal: 1440 Psi External:	At max. temp. <i>A une temp. max.</i> Internal: 130°F External:	Minimum design metal temp. <i>Temp. min.</i> -20°F	Test pressure (hydro-pneumatic or combination) <i>Pression d'épreuve (hydro-pneumatique ou combinaison)</i> 1872 Psi	Proof Test <i>test de résistance</i> N/A
---	--	--	--	--

Impact Tests/Tests d'impact

Material/Matériau		Welds/Soudures	
_____ @ _____ Components/composants	_____ @ _____ Test Temp/essai Température	_____ @ _____ Production Test/test de production	_____ @ _____ Test Temp/Test de Température
_____ Exempt PFR UG20(f)(1-5) Components/composants	_____ Paragraph(s)/paragraphe (s)	_____ Exempt PER UG20(f)(1-5)	_____ Paragraph(s)/paragraphe (s)
Indicate Components Impact Tested or Exempted/Indiquer Composants Impact Testé ou exclus			

Tube Section/Faisceau tubulaire

Tube sheet/Plaque tubulaire	Material/Matériau	Diameter/Diamètre	Nominal Thickness Épaisseur nominale	Corr. Allow. Surépais. corrosion	Attachment Mode d'attachement
_____	_____	_____	_____	_____	_____
Tube material/Matériau des tubes	Diameter/Diamètre	Nominal Thickness (gauge) Épaisseur nominale (calibre)	Number/Numéro	Type (Straight or U) Type (Droit ou U)	Heating Surface Surface de chauffage
_____	_____	_____	_____	_____	_____

Jacket/Chemise

Type of Jacket/Genre de chemise	Jacket Closure Fermeture de chemise	Proof Test Épreuve de Pression	Heating Surface Surface de chauffe	Sketch/Schéma
_____	_____	_____	_____	_____

Safety Valve Outlets/Soupapes de sûreté

Number/Nombre	Dimension	Location/Endroit
_____	_____	_____

Nozzles and Openings/Tubulures et ouvertures

Purpose/But (Inlet, Outlet, Drain Etc.)	Number Nombre	Dimension	Type	Material Matériau		Nozzle Thickness Épaisseur nominale		Reinforcement material Matériau de renfort	Attachment Details Genre d'attaches		Location Endroit
				Nozzle/bec	Flange/bride	Nom.	Corr.		Nozzle/bec	Flange/bride	
Heads	2	4"	600W N	SA105N	0.531"	0.125"			Type 1	Inspection	
Vessel Conn.	3	2"	600W N	234WPB SA105N	0.344"	0.125"			Type 1	Shell	

Supports/Supports

Skirt/Jupe Yes/Oui No/Non	Lugs/Oreilles No./Nbre	Legs/Pieds No./Nbre	Other/Autres (Description)	Attached/Attaches (Where and How/Méthode et endroit)
<input type="checkbox"/> <input checked="" type="checkbox"/>	0	0	N/A	N/A

Remarks/Observations (Cubical Capacity/Volume/Capacité cubique/volume de)

Volume: 0.53 cu ft or 0.02 cu m CA: 0.125" Construction drawing cad. no. 35528-Bridle Rev.0 BMS WO: 35528
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Certificate of Compliance/Certificat de conformité

We certify that the statements made in this data report are correct and that the said vessel has been constructed in accordance with the Provincial Registered design below and the requirements of standard CSA B51.

Nous certifions que les données de la déclaration de conformité sont correctes et que l'appareil a été construit en accord avec l'enregistrement provincial ci-dessous et les exigences de la norme ACNOR B51.

Provincial Registered Design
Enregistrement provincial **0H18137.2**

Manufacturer
Constructeur **Bromley Mechanical Svcs, A Division of Argo Sales Inc**

Signature  Date Jan 23, 2018

Signature _____ Date _____

(Representative/représentant)

(Certified Individual/personne certifiée)

BROMLEY MECHANICAL SERVICES

Pressure Vessel Travel Sheet

Travel Sheet AI Review/Date :	Travel Sheet Initiation :Merle K	Travel Sheet Revision Number :
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Customer : Arc Resources Ltd.

DRAWING/CAD#: 35528-BRIDLE	DRAWING/CAD REVISION #: 0	WO-35528	SERIAL # : 35528-F05
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W/O DESIGNATION : 4" x 1440 Psi Bridle

Seq.	Item	Comments	Q.C.I.	Date	A.I. Hold Points	A.I.	Date	Owner	Date
1.	Calculations in File		<i>lu</i>	1/23/18	R			<i>D. Hoop</i>	AUG 0 2 2018
2.	Release of App'd Dwg.		<i>lu</i>	12/11/17	R			<i>D. Hoop</i>	AUG 0 2 2018
3.	Heat Numbers Recorded		<i>os</i>	JAN 0 5 2018	W			<i>D. Hoop</i>	AUG 0 2 2018
4.	Material Examination		<i>os</i>	JAN 0 5 2018				<i>D. Hoop</i>	AUG 0 2 2018
5.	MTRs Checked		<i>os</i>	JAN 0 5 2018	W			<i>D. Hoop</i>	AUG 0 2 2018
6.	WPS(s) Checked		<i>lu</i>	12/11/17	R			<i>D. Hoop</i>	AUG 0 2 2018
7.	Welder(s) Qualified		<i>os</i>	12/12/17	W			<i>D. Hoop</i>	AUG 0 2 2018
8.	Thicknesses Verified & Recorded		<i>os</i>	JAN 0 5 2018				<i>D. Hoop</i>	AUG 0 2 2018
9.	Shell(s) & Head(s) Fit-up Inspection		<i>os</i>	JAN 0 5 2018	W			<i>D. Hoop</i>	AUG 0 2 2018
10.	Nozzles & Fittings Fit-up Inspection		<i>os</i>	JAN 0 5 2018				<i>D. Hoop</i>	AUG 0 2 2018
11.	Nozzle Orientation		<i>os</i>	JAN 0 5 2018				<i>D. Hoop</i>	AUG 0 2 2018
12.	Nozzle & Flange Rating Checked		<i>os</i>	JAN 0 5 2018				<i>D. Hoop</i>	AUG 0 2 2018
13.	Impact Tests	Exempt						<i>D. Hoop</i>	AUG 0 2 2018
14.	Internals Checked	Per UG-76(C)	<i>os</i>	JAN 0 5 2018	W			<i>D. Hoop</i>	AUG 0 2 2018
15.	Final Internal Inspection		<i>os</i>	JAN 0 5 2018	H			<i>D. Hoop</i>	AUG 0 2 2018
16.	Weld Size Checked		<i>os</i>	JAN 0 5 2018				<i>D. Hoop</i>	AUG 0 2 2018
17.	Welder I.D. Checked		<i>os</i>	12/12/17	R			<i>D. Hoop</i>	AUG 0 2 2018
18.	Final External Inspection		<i>os</i>	JAN 0 5 2018	W			<i>D. Hoop</i>	AUG 0 2 2018
19.	Radiography	RT - 1	<i>os</i>	JAN 1 9 2017	W			<i>D. Hoop</i>	AUG 0 2 2018
20.	Other N.D.E. MPI							<i>D. Hoop</i>	AUG 0 2 2018
21.	Final Ext. Prior to P.W.H.T.	1150F for 60 minutes	<i>os</i>	JAN 0 5 2018	W			<i>D. Hoop</i>	AUG 0 2 2018
22.	PWHT Details		<i>lu</i>	1/23/18				<i>D. Hoop</i>	AUG 0 2 2018
23.	PWHT Chart Checked		<i>lu</i>	1/23/18	R			<i>D. Hoop</i>	AUG 0 2 2018
24.	Hydrostatic Test 1872 Psig	Shell Side	<i>lu</i>	1/23/18	H			<i>D. Hoop</i>	AUG 0 2 2018
		Gauge # <i>F44-10; -9</i>							
25.	CRN Drawing	0H18137.2	<i>lu</i>	12/11/17	R			<i>D. Hoop</i>	AUG 0 2 2018
26.	N.C.R. #							<i>D. Hoop</i>	AUG 0 2 2018
27.	Nameplate Stamping		<i>lu</i>	1/23/18	W			<i>D. Hoop</i>	AUG 0 2 2018
28.	Manuf. Data Report Completed & Verified		<i>lu</i>	1/23/18	R			<i>D. Hoop</i>	AUG 0 2 2018
29.	Nameplate Installation							<i>D. Hoop</i>	AUG 0 2 2018

The Authorized Inspector shall be presented with the Travel Sheet prior to construction so that he can designate additional inspection points and/or Hold Points. Any revisions shall be marked with a delta symbol with revision number and described at the bottom of this page.

I/R Denotes Inspection/Review Point W/H Denotes Witness/Hold Point

Z:\BMSDOCS\travel sheet.doc

VESSEL SERIAL NUMBER: 35528-F05; MATERIAL THICKNESS VERIFICATION AND IDENTIFICATION				WPS / WELD I.D. / WELDER SYMBOLS / FIT-UP					
Designation	Thickness	Material Spec. & Grade	Heat & Slab Number or I.D. Number	WPS	Weld I.D.	Welder Symbol	Verify Fit Up & Type 1 Joint	Date	ABSA USE
Pipe	0.531"	SA106B S.A.S336R6	VS 35908	BA-2 Or BM-19	L-				
					L-				
					L-				
Flange	0.531"	SA105N	536937		C-1	KH	OK	JAN 5 2018	
Flange	0.531"	SA105N	536937		C-7				
)					C-				
Welding Consumable Heat Number			HI # 3897 8435T	C-					

ATTACHMENT AND / OR NOZZLE MATERIAL THICKNESS VERIFICATION AND IDENTIFICATION						WELDER ID / WPS & ABSA USE			
Mark	Mat. I.D.	Neck	Fitting	Flange	Repad or Attachment	Cat. B, C	Cat D	WPS	ABSA USE
N2A N2B N2C	Spec.-Grd.		234WPB	SA105N					
	Thk./Rating		4x4x3's160T	3" CL 600 2" CL	RFWN	KH			
	Heat# or ID		17611822	522176					
	Spec.-Grd.								
	Thk./Rating								
	Heat# or ID								
	Spec.-Grd.								
	Thk./Rating								
	Heat# or ID								
	Spec.-Grd.								
	Thk./Rating								
	Heat# or ID								
	Spec.-Grd.								
	Thk./Rating								
	Heat# or ID								
	Spec.-Grd.								
	Thk./Rating								
	Heat# or ID								

Used for recording miscellaneous information (Skirt/ Lift Lug Heat numbers, Another shell etc...)			
Material	Heat Number	WPS	Remarks

Shells & Heads			Final		
Task	Name/Welder symbol	Date	Task	Name/Welder symbol	Date
Layout / Checked by			Weld ID/ Material code/ Vessel Serial number stamped	KH	JAN 05 2018
Shell cut by			Vessel completed by	KH	JAN 05 2018
Internals by			Final Quality Control check	DS	JAN 05 2018

BROMLEY MECHANICAL SERVICES

Pressure Vessel Travel Sheet

Travel Sheet AI Review/Date :	Travel Sheet Initiation :Merle K	Travel Sheet Revision Number :
-------------------------------	----------------------------------	--------------------------------

Customer : Arc Resources Ltd.

DRAWING/CAD#: 35528-BRIDLE	DRAWING/CAD REVISION #: 0	WO-35528	SERIAL # : 35528-F06
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W/O DESIGNATION : 4" x 1440 Psi Bridle

Seq.	Item	Comments	Q.C.I.	Date	A.I. Hold Points	A.I.	Date	Owner	Date
1.	Calculations in File		lu	1/23/18	R			D Hoge	AUG 0 2 2018
2.	Release of App'd Dwg.		lu	12/11/17	R			D Hoge	AUG 0 2 2018
3.	Heat Numbers Recorded		os	JAN 0 5 2018	W			D Hoge	AUG 0 2 2018
4.	Material Examination		os	JAN 0 5 2018				D Hoge	AUG 0 2 2018
5.	MTRs Checked		os	JAN 0 5 2018	W			D Hoge	AUG 0 2 2018
6.	WPS(s) Checked		lu	12/11/17	R			D Hoge	AUG 0 2 2018
7.	Welder(s) Qualified		os	12/12/17	W			D Hoge	AUG 0 2 2018
8.	Thicknesses Verified & Recorded		os	JAN 0 5 2018				D Hoge	AUG 0 2 2018
9.	Shell(s) & Head(s) Fit-up Inspection		os	JAN 0 5 2018	W			D Hoge	AUG 0 2 2018
10.	Nozzles & Fittings Fit-up Inspection		os	JAN 0 5 2018				D Hoge	AUG 0 2 2018
11.	Nozzle Orientation		os	JAN 0 5 2018				D Hoge	AUG 0 2 2018
12.	Nozzle & Flange Rating Checked		os	JAN 0 5 2018				D Hoge	AUG 0 2 2018
13.	Impact Tests	Exempt						D Hoge	AUG 0 2 2018
14.	Internals Checked	Per UG-76(C)	os	JAN 0 5 2018	W			D Hoge	AUG 0 2 2018
15.	Final Internal Inspection		os	JAN 0 5 2018	H			D Hoge	AUG 0 2 2018
16.	Weld Size Checked		os	JAN 0 5 2018				D Hoge	AUG 0 2 2018
17.	Welder I.D. Checked		os	12/12/17	R			D Hoge	AUG 0 2 2018
18.	Final External Inspection		os	JAN 0 5 2018	W			D Hoge	AUG 0 2 2018
19.	Radiography	RT - 1	os	JAN 1 9 2017	W			D Hoge	AUG 0 2 2018
20.	Other N.D.E. MPI							D Hoge	AUG 0 2 2018
21.	Final Ext. Prior to P.W.H.T.	1150F for 60 minutes	os	JAN 0 5 2018	W			D Hoge	AUG 0 2 2018
22.	PWHT Details		lu	1/23/18				D Hoge	AUG 0 2 2018
23.	PWHT Chart Checked		lu	1/23/18	R			D Hoge	AUG 0 2 2018
24.	Hydrostatic Test 1872 Psig	Shell Side Gauge #	lu	1/23/18	H			D Hoge	AUG 0 2 2018
25.	CRN Drawing	Full 10/09 OH18137.2	lu	12/11/17	R			D Hoge	AUG 0 2 2018
26.	N.C.R. #							D Hoge	AUG 0 2 2018
27.	Nameplate Stamping		lu	1/23/18	W			D Hoge	AUG 0 2 2018
28.	Manuf. Data Report Completed & Verified		lu	1/23/18	R			D Hoge	AUG 0 2 2018
29.	Nameplate Installation							D Hoge	AUG 0 2 2018

Authorized Inspector shall be presented with the Travel Sheet prior to construction so that he can designate addition inspection points and/or Hold Points. Any revisions shall be marked with a delta symbol with revision number and described at the bottom of this page.

I/R Denotes Inspection/Review Point W/H Denotes Witness/Hold Point

VESSEL SERIAL NUMBER: 35528-F06 MATERIAL THICKNESS VERIFICATION AND IDENTIFICATION				WPS / WELD I.D. / WELDER SYMBOLS / FIT-UP					
Designation	Thickness	Material Spec. & Grade	Heat & Slab Number or I.D. Number	WPS	Weld I.D.	Welder Symbol	Verify Fit Up & Type 1 Joint	Date	ABSA USE
Pipe	0.531"	SA106B SA333626	VS 35908	BA-2 Or BM-19	L-				
					L-				
					L-				
Flange	0.531"	SA105N	536937		C-1	KH	DS	Jan 5 2018	
Flange	0.531"	SA105N	536937		C-7				
Welding Consumable Heat Number			HI # 3897 8435T	C-					

ATTACHMENT AND / OR NOZZLE MATERIAL THICKNESS VERIFICATION AND IDENTIFICATION						WELDER ID / WPS & ABSA USE			
Mark	Mat. I.D.	Neck	Filling	Flange	Repad or Attachment	Cat. B, C	Cat D	WPS	ABSA USE
N2A	Spec.-Grd.		234WPB	SA105N					
N2B	Thk./Rating		4x4x3 s160T	8" CL 600	RFWN	KH			
N2C	Heat# or ID	17F11821 -	17G11822	522176					
	Spec.-Grd.								
	Thk./Rating								
	Heat# or ID								
	Spec.-Grd.								
	Thk./Rating								
	Heat# or ID								
	Spec.-Grd.								
	Thk./Rating								
	Heat# or ID								
	Spec.-Grd.								
	Thk./Rating								
	Heat# or ID								
	Spec.-Grd.								
	Thk./Rating								
	Heat# or ID								

Used for recording miscellaneous information (Skirt/ Lift Lug Heat numbers, Another shell etc...)

Material	Heat Number	WPS	Remarks

Shells & Heads			Final		
Task	Name/Welder symbol	Date	Task	Name/Welder symbol	Date
Layout / Checked by			Weld ID/ Material code/ Vessel Serial number stamped	KH	JAN 05 2018
Shell cut by			Vessel completed by	KH	JAN 05 2018
Internals by			Final Quality Control check	DS	JAN 05 2018

CERTIFIED BY:

BROMLEY
MECHANICAL SERVICES
A DIVISION OF ARGO SALES INC.

Medicine Hat, Alberta
(800) 215 - 9806
(403) 526 - 3142

W
RT-1
HT

M.A.W.P. 1440 PSI AT 130 °F

M.D.M.T. -20 °F AT 1440 PSI

MFR'S SER. NO. 35528-F05 YR. BUILT 2018

VESSEL TYPE BRIDLE

TAG ARC RESOURCES LTD.

M.A.W.P. 9929 KPA AT 64 °C

SHELL NOM. 0.531" MATERIAL SA106B

HEAD MIN. 0.531" MATERIAL SA105N

C.A. 0.125" CRN OH18137.2

CERTIFIED BY:

BROMLEY
MECHANICAL SERVICES
A DIVISION OF ARGO SALES INC.

Medicine Hat, Alberta
(800) 215 - 9806
(403) 526 - 3142

W
RT-1
HT

M.A.W.P. 1440 PSI AT 130 °F

M.D.M.T. -20 °F AT 1440 PSI

MFR'S SER. NO. 35528-F06 YR. BUILT 2018

VESSEL TYPE BRIDLE

TAG ARC RESOURCES LTD.

M.A.W.P. 9929 KPA AT 34 °C

SHELL NOM. 0.531" MATERIAL SA106B

HEAD MIN. 0.531" MATERIAL SA105N

C.A. 0.125" CRN OH18137.2

CERTIFIED BY:



Medicine Hat, Alberta

(800) 215 - 9806

(403) 526 - 3142

W
RT-1
HT

M.A.W.P. 1440 PSI AT 130 °F

M.D.M.T. -20 °F AT 1440 PSI

MFR'S SER. NO. [] YR. BUILT 2018

VESSEL TYPE BRIDLE

TAG ARC RESOURCES LTD.

M.A.W.P. 9929 KPA AT 54 °C

SHELL NOM. 0.531" MATERIAL SA106B

HEAD MIN. 0.531" MATERIAL SA105N

C.A. 0.125" CRN OH18137.2

35528-F05
↓
35528-F08
(4)

wo # 35528

[Handwritten signature]

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100118

587-353-6630

1-800-442-8721

DATE: Jan 18 2018

PAGE 1 of 1


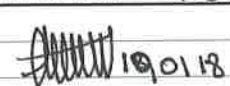

CLIENT ADDRESS	Bromley Mechanical	VIE JOB NO.	BMS-110	Total Hrs	3	KM'S	
		P.O. NO.	88241	IN	18:30	DAILY SUBS	
		AFE NO.		OUT	21:30	ROOMS	
JOB LOCATION	ARC	WORK ORDER #	35528	IN		DAILY MEALS	
CONTRACTOR	BMS	PROJECT NO.		OUT		LATE MEAL	

TECHNIQUE NO.	RT001 tech03	WT	WALL THICKNESS	WELD DEFECTS 1. SLIGHT 2. MEDIUM 3. REJECT					
MAX SOURCE SIZE	3.64mm	WS	WELDER SYMBOL	AB	ARC BURN	C	CRACK	S	SLAG
TYPE OF MATERIAL	C.S	EX	NUMBER OF EXPOSURES	EP	EXCESSIVE PENETRATION		HL	HIGH LOW	
LEAD SCREENS FRONT	0.010	SO	SOURCE TO OBJECT	IP	INCOMPLETE PENETRATION		P	POROSITY	
LEAD SCREENS BACK	0.010	DISTANCE OR C FOR CONTACT		IC	INTERNAL CONCAVITY		LC	LOW COVER	
FILM PER CASSETTE	1	SSF	MAXIMUM DISTANCE FROM	IU	INTERNAL UNDERCUT		CR	CONCAVE ROOT	
FILM BRAND	agfa	SOURCE SIDE OF OBJECT TO FILM		EU	EXTERNAL UNDERCUT		LF	LACK OF FUSION	
FILM DENSITY	2.5 - 2.8	EW	ASTM ESSENTIAL WIRE #	BT	BURN THROUGH		HB	HOLLOW BEAD	

Weld			No.	EX	SO	SSF	EW #	film type	CODE	LIST ACCEPTABLE DEFECTS	OK	SHOW LOCATION OF UNACCEPTABLE DEFECTS	REJECT
No.	Size	WT											
WO#35528 SN#35528 F05													
C1	4"	160	KH	4	C	0.72	8	D3	4				
C2	4"	160	KH								✓		
C3	4"	160	KH								✓		
C4	4"	160	KH								✓		
C5	4"	160	KH								✓		
C6	4"	160	KH								✓		
C7	4"	160	KH								✓		
C8	2"	160	KH	4	C	0.54	7	D3	4		✓		
C9	2"	160	KH								✓		
C10	2"	160	KH								✓		

WO#35528 SN#35528 - 06													
C1	4"	160	KH	4	C	0.72	8	D3	4			✓	
C2	4"	160	KH								✓		
C3	4"	160	KH								✓		
C4	4"	160	KH								✓		
C5	4"	160	KH								✓		
C6	4"	160	KH								✓		
C7	4"	160	KH								✓		
C8	2"	160	KH	4	C	0.54	7	D3	4		✓		
C9	2"	160	KH								✓		
C10	2"	160	KH								✓		

SNT#5335 Level 2 RT, MT, PT

AUTHORIZED BY: (signature)	WELDING CODES:	TECHNICIANS SIGNATURE	 Kevin Hayward RT, MT, PT Level II CGSB/SNT-TC-1A # 5335 Interpreted by: (stamp)
	UW51-15	 CEDO Jessie Marshall	

Heat Treatment Instructions

Customer:	Seven Generations / Arc Resources	Date:	1/19/2018
WO No.(s):	WO-35550, 35528		

COMPONENT DESCRIPTION:

Dwg No. / Line No. / Serial No.	Diameter	Thk. (in.)	Material	Length	Weight (lbs)
SN:35550-01	60"	0.500	P1	60"	4200
SN:35528-F05, 35528-F06	4"	0.531	P1	96-1/2"	570

TYPE OF HEAT TREATMENT: **PRESSURE VESSEL STRESS RELIEF P-No. 1**

HEATING

Temperature to be raised from 800°F (427°C) to 1150°F (621°C) at a maximum rate of

400 °F/hr, (**204** °C /hr)

NOTE: THIS VALUE MUST NEVER EXCEED 400°F (222°C) PER HOUR.

[Calculated rate = 400 degrees F /hr. (222 degrees C/hr) divided by the maximum metal thickness of the shell or head plate in inches.]

HOLDING

Temperature to be held at a minimum of 1150°F (621°C) for: **60** minutes

[Holding time to be determined by Table UCS-56 for Nominal Thickness as specified in UW-40(f)]

COOLING

Temperature to be lowered from 1150°F (621°C) to 800°F (427°C) at a maximum rate of

500 °F/hr, (**260** °C /hr)

NOTE: THIS VALUE MUST NEVER EXCEED 500°F (278°C) PER HOUR.

[Calculated rate = 500 degrees F /hr. (278 degrees C/hr) divided by the maximum metal thickness of the shell or head plate in inches.]

From 800°F (427°C) items may be cooled in still air

ADDITIONAL REQUIREMENTS

1. Job Number and description required on heat treatment charts along with the operator's signature and date.
2. Reporting of thermocouple attachment method and location and verification of furnace thermocouple calibration is required.
3. A sufficient number of thermocouples shall be located to control and maintain uniform distribution of temperature on all vessels and parts. Thermocouples shall be directly attached to the item or provision shall be made for thermocouple placement at bottom, centre and top of the furnace charge in accordance with the ASME Code
4. During the heating period, there shall not be a greater variation in temperature throughout the portion of the vessel being heated than 250°F (139°C) within any 15 ft. (4.6m) interval of length. An adequate number of thermocouples must be used to ensure this Code requirement is met. This limitation is also applicable to the temperature variations between the different thicknesses of various vessel components
5. During the holding period, there shall not be a greater difference than 150°F (83°C) between the highest and lowest temperature throughout the portion of the vessel being heat treated, except where the range is further limited by these instructions.
6. If Capacitor Discharge welding is used to attach thermocouples an ASME Code Section IX Welding Procedure Specification is required (WPS qualification is not required), and the energy output must be limited to 125 W-Seconds
7. The method of thermocouple removal shall not damage the heat treated item.

APPROVALS

Quality Control Inspector Signature  Date Jan 22, 2018
 Thermocouple Attachment Method/Locations Capacitor Discharge/per UW 40
 Furnace Heat Number: #1-19-JAN-2018
 Furnace Operator Signature:  Date: 1/19/18



925 23 Street S.W. Medicine Hat, AB T1A 8R1
HEAT TREATMENT SERVICES

Date Started:	19-Jan-18	Date Finished:	19-Jan-18
Customer/Work Order:	Seven Generations / Arc Resources		
	WO-35550, 35528		
Furnace S/N	23600		
Furnace Cal Date	9/1/2017		
Procedure:	Internal PWHT Instructions/Cust. Supplied		
Heat Treating Per.	A.S.M.E.		

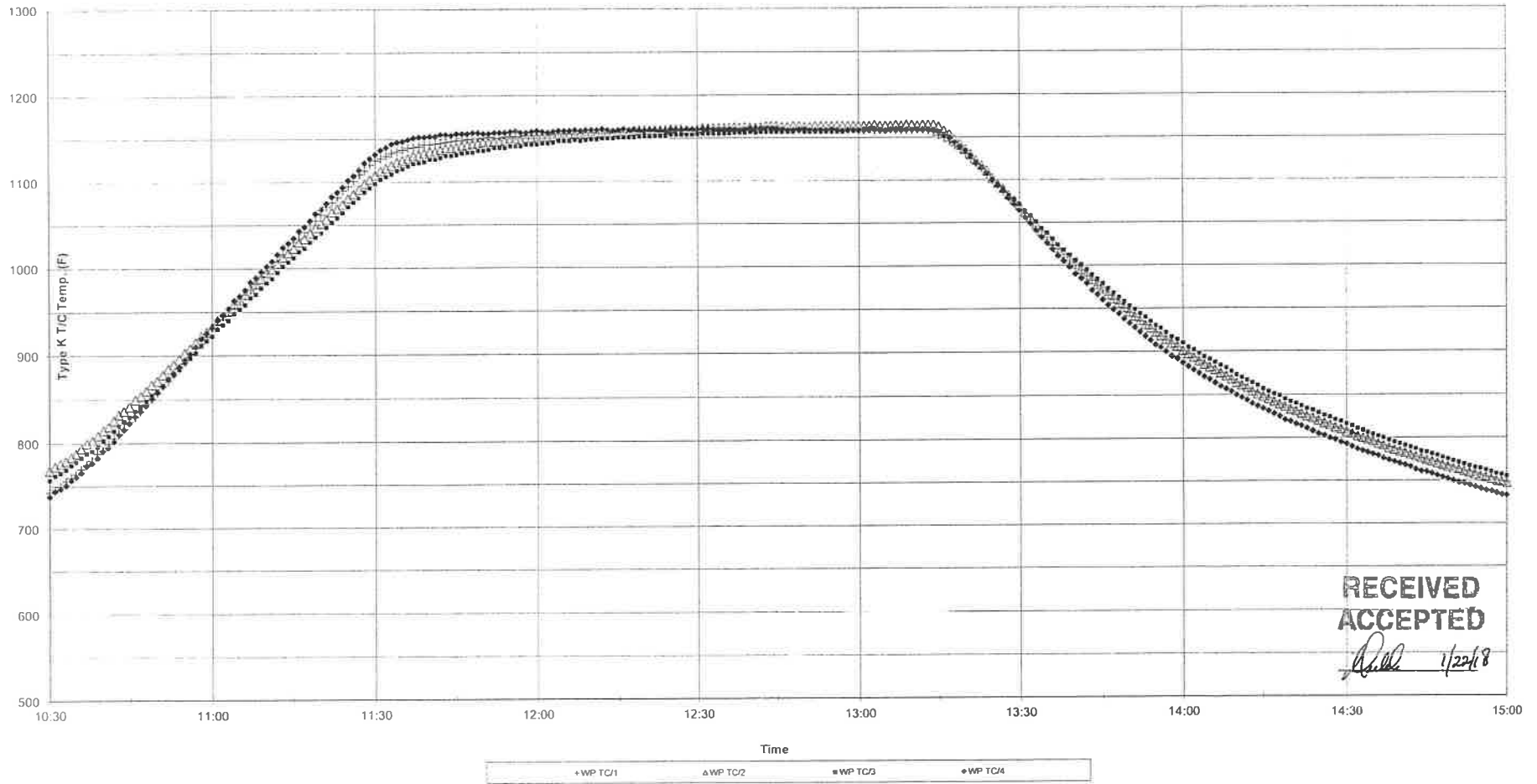
Rate of Rise:	800°F to 1150°F at 400°F per hour.
Holding Temp:	1150°F
Holding Time:	60 min. Minimum
Cooling Rate:	1150°F to 800°F at 500°F per hour
Material(s):	P1
Operator:	Barry Gulfriend

Notes:	WO-35550 (1) 60"X 5'-0"X 170 lbs SN:35550-01 (2) 4" bridles SN:35528-F05, 35528-F06
--------	--

Signature: *[Signature]* Date: Jan 19/18

Heat Number: #1-18-JAN-2018

HEAT TREATMENT RECORD



RECEIVED
ACCEPTED
[Signature] 1/22/18

SUPERHEAT FGH CONTROL UNIT CERTIFICATE OF CALIBRATION

Asset Number _____ Supercontroller Number 23600

Range 0 - 2000°F Sensor Type K

Calibration Procedure Number C1-TP-02-CMTE (Rev. 2)

Date September 2, 2017 Calibration Due February 28, 2018

This instrument has been calibrated within the manufacturer's specifications.

These specifications state that the maximum allowable error is \pm 6°F

During calibration, if the "°F As Found/°F As Left" numbers (values) are the same and no adjustments have been made, only one number (value) will be noted.

Zone 1A	Input Signal	200	600	1000	1400	1800
	°F As Found	203	603	1003	1403	1803
	°F As Left					
Zone 7A	Input Signal	200	600	1000	1400	1800
	°F As Found					
	°F As Left					
Zone 1B	Input Signal	200	600	1000	1400	1800
	°F As Found					
	°F As Left					
Zone 7B	Input Signal	200	600	1000	1400	1800
	°F As Found					
	°F As Left					

Environmental Conditions: Temperature (°F): 50.0

The above unit has been calibrated and tested. It is directly traceable to the National Institute of Standards & Technology (N.I.S.T) or the National Research Council (N.R.C).

Max Kohut

Calibrated By


Signature

MEASURING & TEST EQUIPMENT USED

Make: FGH Type: Ezeval Model: MK3

Serial No.	Cert. Date	Due Date
3450	April 28, 2017	October 27, 2017



C000000053189



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CERTIFICATE OF CONFORMANCE

INVOICED TO: AIRCOM INSTRUMENTATION

DELIVERED TO: AIRCOM INSTRUMENTATION

ATTN: ACCTS PAYABLE
9328 37 AVENUE
EDMONTON, AB, CANADA

9328-37 AVENUE
EDMONTON, AB, CANADA

T6E5K3

T6E5K3

CERTIFICATE NO:	DATE:	CUSTOMER PO:	SALES ORDER:	PAGE:	
C000000053189	8-Jan-14	20321	P105099	1 of 1	
DATE OF MFG:					
1/8/2014					
ITEM	PRODUCT	LOT #	# of Spools	Shipping QTY	Total
2	FW6381 CEFIR2200 ULTRA-20-KK Your Part N215-241	15014-115	2	1000ft	1000ft
<p>CALIBRATION RESULTS ARE TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) AND MEET DEVIATION TOLERANCES AS DEFINED IN ISA MC96.1 (FORMERLY ANSI) AND ASTM-E-230.</p> <p>ALL PRODUCTS MANUFACTURED IN THE USA.</p>					

This is to certify that the materials furnished on this shipment are in conformance with the requirements, specifications, and drawings of the above referenced customer purchase order. Inspection and test records are on file and available for customer review. This product contains no metallic Mercury or Mercury compounds and is free from Mercury contamination.

Signed by:

Date:

1/8/2014

PRESSURE-TEST REPORT

DATE OF TEST: Jan 22 2018 HYDRO-TEST NO.: 1-22-18 ABZ

CUSTOMER: Arc Resources Ltd. LOCATION: Bromley Mechanical
(LSD OR ADDRESS)

WORK ORDER NO.: 35528 SIZE: DIAMETER: 4"
LENGTH: 96 1/2"

SERIAL NO.: 35528-F05, F06

NUMBER OF ITEMS TESTED: Two BRIDLES

HYDRO-TEST PRESSURE: 1872 PSI OR 12907 KPA

MEDIUM: WATER MEDIUM TEMPERATURE: See Chart

TIME: HYDRO-TEST ON 1240 P M AMBIENT TEMP: SEE CHART PRESSURE: 1872 PSI INIT: [Signature]

HYDRO-TEST OFF 1322 P M AMBIENT TEMP: SEE CHART PRESSURE: 1872 PSI INIT: [Signature]

LENGTH OF TEST: 42 MINUTES

TEST GAUGE No.: FLU 10 RANGE: 0-10⁰⁰⁰ PSI

TEST GAUGE No.: FLU 9 RANGE: 0-10⁰⁰⁰ PSI

CHART RECORDER NO.: _____ RANGE: _____



QCI WITNESSED BY: [Signature]

OWNER WITNESSED BY: D R Hope [Signature]

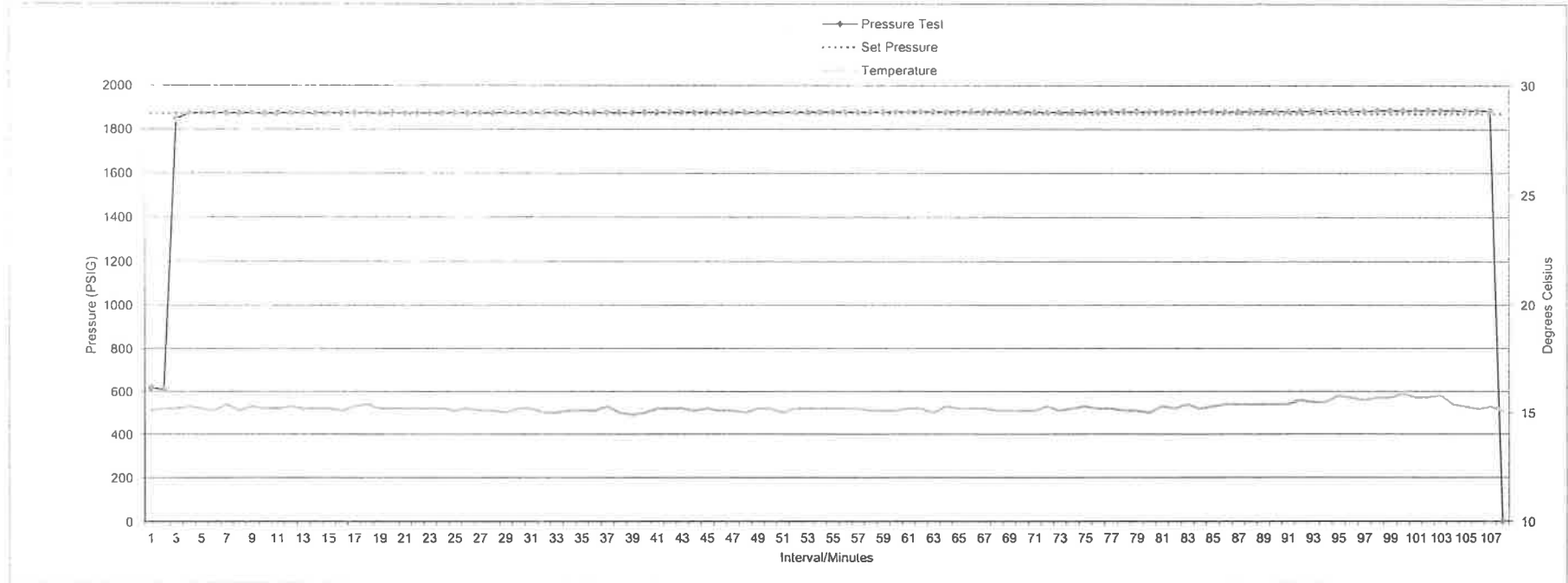
QCM APPROVED BY: [Signature]

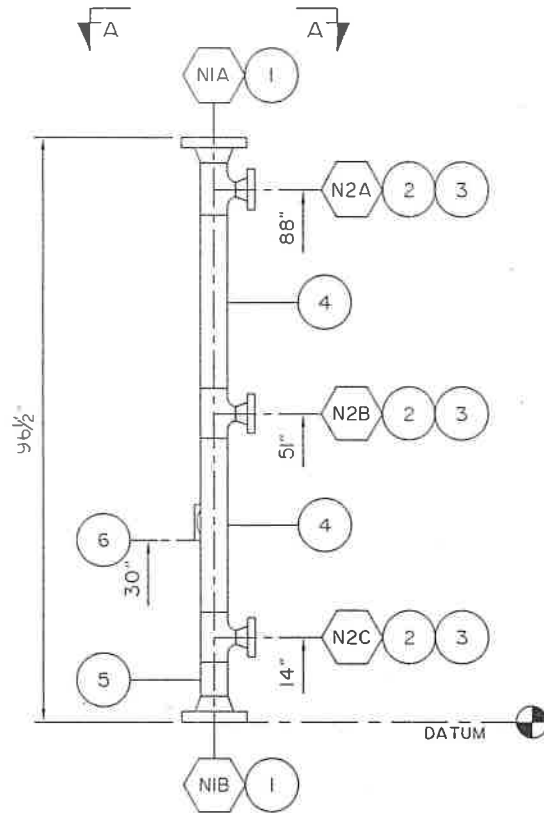


Data Started	1/22/2018	Date Finished	01/22/2018
Customer / WO Ref:	Arc Resources 35528		
Notes:	Vessel 35528-F05-F06		
	FLU10		
Gauge Details	FLUKE, 700G, 3486293, 4.04		
Interval	1 minutes		

Witnessed by:	DEREK HOPE 
Approved by:	M. KANEWISCHER 

PRESSURE TEST RECORD





FRONT VIEW



MATERIAL REPORT

DATE: Jan 19 2018

CUST: ARC RESOURCES LTD.

CHECKED: [Signature]

SERIAL NO: 35528-F05

SIZE: 4" NPS X 88" S/S

PRESSURE: 1440 PSI

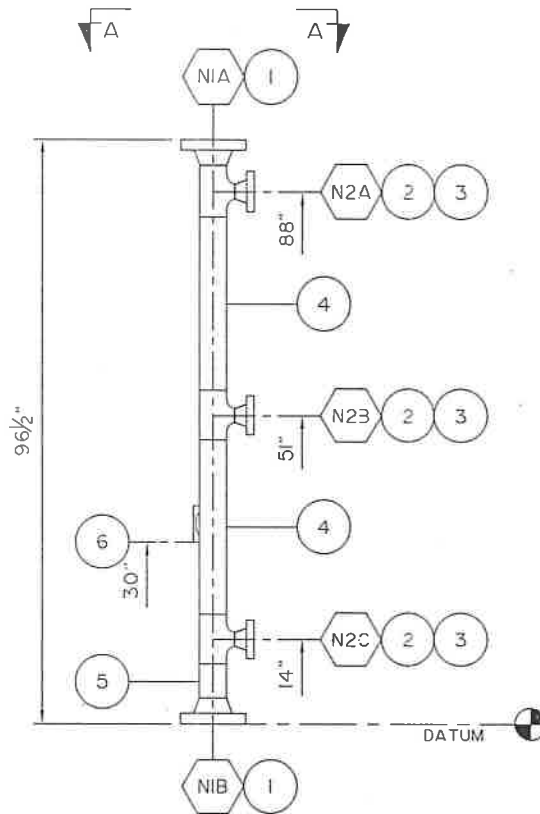
W.O 35528

CRN 0H18137.2

DRAWING NO.: 35227 - BRIDLE - REG Rev.0

CAD NO; 35228 - BRIDLE

ITEM	DESCRIPTION	HEAT NUMBER	HEAT NUMBER	MATERIAL	MIN.THK.
1	RFWN, 4" 600 ANSI SCH. 160	536937		SA105N	0.531"
2	RFWN, 2" 600 ANSI SCH. 160	522176		SA105N	0.344
3	WELD RED. TEE, 4" X 2" SCH. 160	17611822		SA234WPB ^{SA420} _{WP LG}	0.531"
4	PIPE, 4" SCH. 160 (0.531") X 28 3/4" LONG	VS 35908		SA106B	0.531"
5	PIPE, 4" SCH. 160 (0.531") X 5 5/8" LONG	VS 35908		SA106B	0.531"
6	TAG PLATE HOLDER & VESSEL ID PLATE			SA36 / ALUM	
7					
8					
9					
10					



FRONT VIEW

BROMLEY

MECHANICAL SERVICES
A DIVISION OF ARGO SALES INC.

MATERIAL REPORT

DATE: Jan 19 2018

CUST: ARC RESOURCES LTD.

CHECKED: *Paul*

SERIAL NO: 35528-F06

SIZE: 4" NPS X 88" S/S

PRESSURE: 1440 PSI

W.O. 35528

CRN GH18137.2

DRAWING NO.: 35227 - BRIDLE - REG Rev.0

CAD NC: 35228 - BRIDLE

ITEM	DESCRIPTION	HEAT NUMBER	HEAT NUMBER	MATERIAL	MIN. THK.
1	RFWN, 4" 600 ANSI SCH. 160	536937		SA105N	0.531"
2	RFWN, 2" 600 ANSI SCH. 160	522176		SA105N	0.344
3	WELD RED. TEE, 4" X 2" SCH. 160	17F11821-17G11822		SA234WPB ^{SA420} _{W.P.L.C.}	0.531"
4	PIPE, 4" SCH. 160 (0.531') X 28 3/4" LONG	VS 35908		SA106B	0.531"
5	PIPE, 4" SCH. 160 (0.531') X 5 5/8" LONG	VS 35908		SA106B	0.531"
6	TAG PLATE HOLDER & VESSEL ID PLATE			SA36 / ALUM	
7					
8					
9					
10					



SAN ENG STEEL FORGING CO LTD
 311, Jen Hsin Road, Jen Wu District
 Kaohsiung, Taiwan, R.O.C.
 TEL:07-3724249 ; FAX:07-3712923
 URL: www.saneng.com.tw
 e-mail: saneng@ksts.seed.net.tw

MILL TEST CERTIFICATE

EN10204-3.1

Customer: SEYBOLD INTERNATIONAL CORP.

Order No.: 7013335(3)-CCTF

Certificate No.: SE3335C1

Date: 07/26/2017

Page: 1 OF 1

PO# 4899889

PRODUCT			MATERIAL SPECIFICATIONS										DIMENSIONAL SPECIFICATIONS							
FORGED CARBON STEEL FLANGES			ASTM A105-15/ASME SA105-2015										ASME B16.5-13 CSA Z245.12							
Item No.	CODE NO	DESCRIPTION	QUANTITY	CHEMICAL COMPOSITION (%)																
				Min	C	Si	Mn	P	S	Cu	Cr	Ni	Mo	V	Nb	N	Ti	B	CE(*3)	
1	7535538	150 THRF 8" A105N	15 PCE	Max	0.350	0.350	1.050	0.035	0.040	0.400	0.300	0.400	0.120	0.080	0.020	-	-	-	-	
2	7533758	150 LJ 3" A105N	25 PCE		0.210	0.200	1.020	0.011	0.009	0.110	0.120	0.040	0.010	0.001	0.001	0.007	0.003	1.000	0.416	
3	7533543	150 LJ 6" A105N	10 PCE		0.204	0.290	1.090	0.014	0.009	0.015	0.047	0.056	0.005	0.008	0.001	0.003	0.002	3.000	0.402	
4	7530099	600 WNRF STD 4" A105N	8 PCE		0.200	0.210	1.030	0.013	0.007	0.120	0.110	0.040	0.010	0.001	0.001	0.003	0.002	1.000	0.407	
5	7530579	600 WNRF S160 3" A105N	25 PCE		0.191	0.280	1.100	0.014	0.012	0.013	0.041	0.051	0.005	0.012	0.005	0.003	0.003	3.000	0.390	
6	7530587	600 WNRF S160 4" A105N	30 PCE		0.196	0.200	1.070	0.009	0.013	0.010	0.030	0.051	0.005	0.002	0.005	0.006	0.002	3.000	0.386	
7	7531575	900 WNRF S160 3" A105N	12 PCE		0.196	0.200	1.070	0.009	0.013	0.010	0.030	0.051	0.005	0.002	0.005	0.006	0.002	3.000	0.386	
8	7531575	900 WNRF S160 3" A105N	58 PCE		0.204	0.250	1.130	0.012	0.011	0.012	0.054	0.046	0.005	0.021	0.005	0.005	0.002	5.000	0.412	
9	7533042	900/1500 WNRF XXS 1" A105N	20 PCE		0.207	0.240	1.090	0.009	0.018	0.013	0.025	0.058	0.005	0.002	0.005	0.004	0.003	3.000	0.400	
					Min	0.222	0.320	1.040	0.012	0.017	0.005	0.016	0.053	0.002	0.006	0.005	0.008	0.001	1.000	0.404

Item No.	Heat No.	T.S.(*) (MPA)	Y.S.(*) (MPA)	E.L.(*) (%)	Hardness (HB)	R.A.(*) (%)	Impact Test Temp:			Material Supplier	HEAT TREATMENT(*)	
							Minimum	Joule			<input type="checkbox"/> N	REMARKS
		Min	485.0	250.0	22.0	-	30.0	1	2	3	<input checked="" type="checkbox"/> N	
		Max	-	-	187	-	-					
1	Y500685	527.0	366.0	34.6	153/151	69.5				KOTOBUKI	880°CX4HRS CONFORMS WITH NACE MR0103/ISO17495-1:2016 AND NACE MR0175/ISO15156:2009 CLAUSE 7.2.1.4 REGION 3 AND ANNEX A. CONFORMS WITH Z245.12 CAT I GR248 SOUR SERVICE-09(FOR USE AS WELDING NECK AND BLIND FLANGES ONLY) MN TO C RATIO IS GREATER THAN 3.0" B/10000 COUNTRY OF ORIGIN: TAIWAN	
2	616244	520.0	366.0	36.6	152/150	71.3				NTMK		
3	Y500681	522.0	376.0	34.2	153/150	69.5				KOTOBUKI		
4	616019	533.0	385.0	36.6	154/151	69.5				NTMK		
5	538937	516.0	343.0	35.6	152/150	69.5				NTMK		
6	536937	516.0	343.0	35.6	152/150	69.5				NTMK		
7	626170	531.0	370.0	35.0	154/151	70.4				NTMK		
8	517151	512.0	335.0	35.8	151/148	70.4				NTMK		
9	931233	515.8	333.4	34.0	153/152	66.0				NTMK		

*1: T.S. = Tensile Strength, Y.S.=Yield Strength, E.L.=Elongation, R.A.=Reduction of Area.
 *2: N=Normalized, A=Annealed, Q=Quenched, T=Tempered, S.T=Solution Treated, S.R=Stress Relieved, A.C=Air Cooled, F.C=Furnace Cooled, W.C=Water Cooled, O.C=Oil Cooled.
 *3: C.E. Value = C + (Mn /6) + (Cr + Mo +V) / 5 + (Ni + Cu) / 15

We hereby certify that the material has been tested in accordance with the above specification and also with the requirements called for by the above order.

Quality Assurance Dept



SAN ENG STEEL FORGING CO LTD
 311, Jen Hsin Road, Jen Wu District
 Kaohsiung, Taiwan, R.O.C.
 TEL:07-3724249 ; FAX:07-3712923
 URL: www.saneng.com.tw
 e-mail: saneng@ksts.seed.net.tw

MILL TEST CERTIFICATE

EN10204-3.1.B(DIN50049/3.1.B)
 Customer: SEYBOLD INTERNATIONAL CORP.
 Order No.: 7010585-CCTF

PO# 4897461


Certificate No.: SE10585A
 Date: 08/05/2015
 Page: 3 OF 4

PRODUCT			MATERIAL SPECIFICATIONS										DIMENSIONAL SPECIFICATIONS					
FORGED CARBON STEEL FLANGES			ASTM A105-14/ASME SA-105-14										ASME B16.5-13 CSA Z245.12					
Item No.	CODE NO	DESCRIPTION	QUANTITY	CHEMICAL COMPOSITION (%)													CE(*3)	
				C	Si	Mn	P	S	Cu	Cr	Ni	Mo	V	Nb	N			
21	7530008	150 SWRF XS 1" A105N	126 PCE	0.200	0.190	1.130	0.014	0.006	0.007	0.010	0.010	0.004	0.004	0.001	0.006			0.393
22	7530010	150 SWRF XS 2" A105N	100 PCE	0.200	0.240	1.100	0.010	0.009	0.070	0.110	0.040	0.010	0.001	0.001	0.007			0.415
23	7536194	300 SORF 2" A105N	25 PCE	0.220	0.220	1.140	0.021	0.006	0.007	0.020	0.010	0.003	0.004	0.001	0.007			0.417
24	7535546	300 THRF 1/2" A105N	30 PCE	0.210	0.230	1.120	0.011	0.005	0.120	0.070	0.050	0.011	0.011	0.001	0.006			0.426
25	7535582	300 THRF 1 1/2" A105N	6 PCE	0.227	0.260	1.010	0.018	0.016	0.017	0.035	0.059	0.002	0.011	0.005	0.005			0.410
26	7535582	300 THRF 1 1/2" A105N	19 PCE	0.210	0.210	1.190	0.015	0.005	0.008	0.020	0.010	0.002	0.005	0.007	0.001			0.415
27	7530560	600 WNRF S160 2" A105N	300 PCE	0.211	0.230	1.070	0.010	0.007	0.007	0.034	0.047	0.005	0.008	0.005	0.007			0.402
28	7530560	600 WNRF S160 2" A105N	300 PCE	0.203	0.270	1.130	0.011	0.006	0.012	0.035	0.048	0.005	0.007	0.005	0.004			0.405
29	7531450	600 WNRTJ XS 4" A105N	10 PCE	0.190	0.190	1.040	0.023	0.007	0.160	0.090	0.070	0.014	0.004	0.001	0.008			0.400
30	7530749	600 SORF 3" A105N	10 PCE	0.210	0.220	1.150	0.017	0.008	0.007	0.010	0.010	0.003	0.006	0.001	0.006			0.407

Item No.	Heat No.	T.S.(*1) (MPA)	Y.S.(*1) (MPA)	E.L.(*1) (%)	Hardness (HB)	R.A.(*1) (%)	Impact Test Temp:			Material Supplier	HEAT TREATMENT(*2) <input checked="" type="checkbox"/> N
							Minimum: Joule				
		Min	Max				1	2	3	REMARKS	
21	2706981303	516.0	356.0	34.6	153/150	71.3				ACOMINAS	880°CX4HRS CONFORMS WITH NACE MRO103-12 AND NACE MRO175/ISO15156.2-09 CLAUSE 7.2.1 4 REGION 3 AND ANNEX A. CONFORMS WITH Z245.12 CAT I GR248 SOUR SERVICE-09(FOR JSE AS WELDING NECK AND BLIND FLANGES ONLY) MN TO C RATIO IS GREATER THAN 3 0"
22	392976	533.0	331.0	32.4	154/152	66.8				UBE STEEL	
23	4603008	524.0	370.0	33.4	154/151	70.4				ACOMINAS	
24	83612	543.3	389.3	34.0	157/155	69.5				WEI CHIH STEEL	
25	921028	519.8	339.3	32.8	159/156	64.0				NTMK	
26	4625118	529.0	352.0	32.6	153/151	65.9				ACOMINAS	
27	522176	514.0	345.0	35.4	152/150	71.3				NTMK	
28	522180	524.0	362.0	35.0	153/150	71.3				NTMK	
29	0102448	518.0	358.0	36.2	153/150	70.4				WEI CHIH STEEL	
30	4573165	531.0	370.0	33.2	154/152	69.5				ACOMINAS	

*1: T.S. = Tensile Strength, Y.S.=Yield Strength, E.L.=Elongation, R.A.=Reduction of Area.
 *2: N=Normalized, A=Annealed, Q=Quenched, T=Tempered, S.T=Solution Treated, S.R=Stress Relieved, A.C=Air Cooled, F.C=Furnace Cooled, W.C=Water Cooled, O.C=Oil Cooled.
 *3: C.E. Value = C + (Mn /6) + (Cr + Mo +V) / 5 + (Ni + Cu) / 15

We hereby certify that the material has been tested in accordance with the above specification and also with the requirements called for by the above order.


 Manager of Quality Assurance Dep't

Purchaser : TRANS-AM PIPING PRODUCTS LTD.

INSPECTION CERTIFICATE



Thai Benkan Co., Ltd.
58 Soi Watkrnai, Bangkok, Prapadseng,
Samutprakarn, 10130 Thailand.

TO EN10204 3.1

Purchase Order No.
CI-17-195 C/O: 1

Job No.
(MILL TEST REPORTS)

D M Y Certificate No.
28/07/2017 T - 2017060522

E-No.	Specification for Material Made from Seamless Pipe	Specification for Inspection	Visual Examination	Dimensional Inspection														
ME-295	ASTM A420-16/ ASME SA420-16 WPL6 CSA Z245.11-13 G.241 CAT II SS ANSINACE MFR0175MSO15156-2:15MFR0108:15	ASME B16.9-2012,B16.25-2012	Good	Good														
MFG. No.	Product & Size (T:*1)		Quantity	Hardness Actual Data														
17F11821	T WPL6 4 X 2 S160			HBW : 149-165														
	Material Heat No.																	
	J7L4324			ORIGINAL														
Specifi- cation	Chemical Composition %													*2 Tension Test			HARDNESS MAX 197 HB : GOOD	
	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	Al	V	Nb	C.E.	YS	TS	E	Impact Test (J)	
	X	X	X	X	X	X	X	X	X	X	X	X	X	MPa.		%	10 X 7.5 X 2V AT -45 °C	
Min.		15	50											240	415	30	251	AVE. 257
Max.	30	40	135	35	40	40	40	30	12		80	20			585		264	
	11	25	126	16	1	2	3	12	1		0	0	35	313	458	49	256	

NORMALIZING 910 C X 40 MINUTES. COOLED IN STILL AIR

C.E. = $C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15$

MAGNETIC PARTICLE EXAMINATION FOR TEE ONLY :

GOOD

We hereby certify that the product described herein has been manufactured in accordance with the specifications concerned and also with the purchaser's requirements and that the test results shown herein are correct.

* 1 : "T" symbolized wall thickness in mm. * 2 : YS Yield strength TS = Tensile strength E = Elongation
Form TZ-6J/1

Rungrade Kampranon

Quality Assurance Manager

Thai Benkan Co., Ltd.

PO# 110-001379-00 Item# 1
Heat Number : 17F11821
Trans Am Piping Products Ltd.
Shipmt / Seq #: S 17 - 1618
Rev'd By: SB
4 X 2 SCH 160 BW RED TEE
A / SA420 -WPL6

PO# 110.001379-00 Item# 3
 Heat Number : 17G11822
 Trans Am Piping Products Ltd. Rev'd By: SB
 Shipment / Seq #: S 17 . 1782 62
 4X2 SCH 160 BW RED TEE
 A/SA420-WPL6

Purchaser : TRANS-AM PIPING PRODUCTS LTD.

INSPECTION CERTIFICATE

TO EN10204 3.1



Thai Benkan Co., Ltd.
 58 Soi Watkrumai, Bangkru, Prapadaeng,
 Samutprakarn, 10130 Thailand.

D M Y Certificate No.

09/10/2017 T - 2017080772

Purchase Order No. Job No.
 CI-17-321 C/O: 3 (MILL TEST REPORTS)

E-No.	Specification for Material Made from Seamless Pipe	Specification for Inspection	Visual Examination	Dimensional Inspection															
ME-331	ASTM A420-16/ ASME SA420-17 WPL6 <small>CSA Z745.11-13 Gr 241 CAT B SS ANSINACE MR0176/MSO15158-2/15MR0103 15</small>	ASME B16.9-2012, B16.25-2012	Good	Good															
MFG. No.	Product & Size (T:*1)		Quantity	Hardness Actual Data															
17G11822	T WPL6 4 X 2 S160			HBW : 120 - 135															
	Material Heat No.																		
	J7L4324			ORIGINAL															
Specifi- cation	Chemical Composition %													*2 Tension Test			HARDNESS MAX 197 HB : GOOD		
	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	Al	V	Nb	C.E.	YS	TS	E	Impact Test (T)		
X	X	X	X	X	X	X	X	X	X	X	X	X	X	MPa.			%	10 X 7.5 X 2V AT -45 °C	
Min.		15	50											240	415	30	251	AVE. 257	
Max.	30	40	135	35	40	40	40	30	12		80	20			585		264		
	11	25	126	16	1	2	3	12	1		0	0	35	313	458	49	256		

NORMALIZING @10 C X 40 MINUTES. COOLED IN STILL AIR

C.E. = C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15

MAGNETIC PARTICLE EXAMINATION FOR TEE ONLY:

We hereby certify that the product described herein has been manufactured in accordance with the specifications concerned and also with the purchaser's requirements and that the test results shown herein are correct.

GOOD

Bangnara Kampranon
 Quality Assurance Manager

Thai Benkan Co., Ltd.

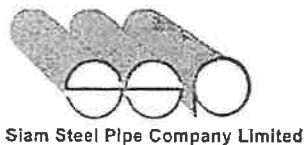
* 1 : "T" symbolized wall thickness in mm. * 2 : YS Yield strength TS = Tensile strength E = Elongation Form TZ-6J/1

BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT

INSPECTED BY: MICHAEL QUINN	GRADE: SA 333 GR6	DIA SIZE OR WITH: 4" <input checked="" type="checkbox"/> NPS <input type="checkbox"/> OD <input type="checkbox"/> ID
DATE: DECEMBER 15/2017	HEADS <input type="checkbox"/> 2:1	LENGTH 20'
P.O.# PO-88153	<input type="checkbox"/> HEMI	THICKNESS 160
SUPPLIER: BHD TUBULAR LIMITED	<input type="checkbox"/> WELD CAP	PIPE PUBLISHED NO 0.531"
PART ID#: SPI 68890	<input type="checkbox"/> OTHER	PLATE NOM
REQ. MIN TK:	SHELL <input type="checkbox"/>	<u>Weight per foot for pipe over 4"</u> 22.51
	PIPE <input checked="" type="checkbox"/> NDE BY MANUFACTURER	
	PLATE <input type="checkbox"/> <u>HYDRO</u> YES <u>NDE</u> NO <input type="checkbox"/>	
	REPAD <input type="checkbox"/> NO YES <input type="checkbox"/>	
	STRUCT. <input type="checkbox"/> NO NO <input type="checkbox"/>	
	OTHER <input type="checkbox"/> YES YES <input checked="" type="checkbox"/>	

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35908	96'	17-200499	0.521"	0.521"	0.536"	0.535"	0.530"	OK	OK	OK	ml
				0.527"	0.530"	0.524"	0.523"	OK	OK	OK	ml
				0.523"	0.527"	0.531"	0.531"	OK	OK	OK	ml
				0.530"	0.533"	0.531"	0.525"	OK	OK	OK	ml
				0.536"	0.528"	0.529"	0.533"	OK	OK	OK	ml

W/O#	RECEIVED & ACCEPTED BY: <i>[Signature]</i>	REQUIRED CODE MARKINGS:
CUSTOMER: STOCK	DATE: JAN 15 2018	SIAM STEEL PIPE COMPANY LIMITED-MADE IN THAILAND ALL MARKINGS STENCILED ON TO PIPE BY MANUFACTURE



SIAM STEEL PIPE COMPANY LIMITED

บริษัท สยาม สตีล ไปป์ จำกัด
MILL TEST CERTIFICATE

NO:SSP/QR 17-12

ใบรับประกันคุณภาพสินค้า
EN10204 3.1

CONTRACT NO.	2016THWM012	PRODUCT	CARBON STEEL SEAMLESS PIPE				SPECIFICATION	ASME(B36.10M)/ASTM A333 GR.6/API 5L X52 PLS-2 /CSA Z245.1 CAT II			DELIVERY CONDITION	N	Forming Method	HOT ROLLING							
CUSTOMER	BHD TUBULAR LTD					DATE OF ISSUE	16/05/2017	LICENCE	5L-0971		NO.	7203									
NO.	HEAT NO.	STEEL GRADE	SIZE	QUANTITY	LENGTH (M)	TENSILE TEST			(%)Per cent Shear area	IMPACT TEST -45°C			Hardness								
				PIECES		Y.S Mpa	T.S Mpa	E.L(%)		Or.	SIZE(mm)	AKV(J)		BHN							
1	17-200466	GR.359	4"SCH40	242	1476.2	370	500	38	80/80	T	5*10*55	53/55/57	160								
2	17-200478	GR.359	4"SCH80	172	1049.2	385	490	36	80/85	T	5*10*55	56/57/60	160								
3	17-200499	GR.359	4"SCH160	46	542.8	385	490	36	80/80	T	6.67*10*55	69/74/80	170								
4																					
TOTAL				466	3068.2																
NO.	Analysis	CHEMICAL COMPOSITION (%)														NDT	STRAIGHTNESS	HYDROSTATIC PRESSURE (>=5S)	VISUAL TEST	Flattening	DIMENSION & WEIGHT TEST
		C	Si	Mn	P	S	Cr	Ni	Cu	Ti	Mo	V	B	Nb	CE						
1	HEAT	0.13	0.25	1.26	0.011	0.021	0.040	0.018	0.025	/	0.007	0.004	0.001	0.002	0.321	OK	OK	20.7Mpa	OK	OK	OK
2	HEAT	0.12	0.24	1.26	0.017	0.004	0.030	0.026	0.024	/	0.007	0.003	0.001	0.002	0.295	OK	OK	20.7Mpa	OK	OK	OK
3	HEAT	0.12	0.26	1.24	0.015	0.006	0.050	0.010	0.024	/	0.007	0.004	0.001	0.002	0.298	OK	OK	20.7Mpa	OK	OK	OK
4																					

RESULT: ALL TEST RESULTS ABOVE COMPLY WITH THE REQUIREMENTS IN ASME(B36.10M)-07/ASTM A333 GR.6/API 5L X52 PLS-2./CSA Z245.1 GR. 359 CAT II SS. HARDNESS ACCORDING TO NACE MR-0175/ISO 15156/0103. THIS IS CERTIFY THAT IN ACCORDANCE WITH THE RELEVANT SPECIFICATION AND CONTRACTS, THE STEEL PIPES WERE TESTED QUALIFIED BY OUR QUALITY CONTROL DEPARTMENT AND ARE IN ACCEPTANCE CONDITIONS. CERTIFY THAT GOODS ARE SUPPLIED AS PER PURCHASE ORDER AND SPECIFICATION REQUIREMENTS. IMPACT TEST TEMPERATURE REDUCTION ACCORDING ASTM A333 STANDARD. 5*10*55 AT -56°C, 6.67*10*55 AT -50°C, 7.5*10*55 AT -48°C. MANUFACTURED FROM FULL KILLED CARBON STEEL. COUNTRY OF ORIGIN: THAILAND.

Address:210/17 Moo 12, Tungskula, Sriracha, Chonburi,20230, Thailand

BROMLEY MECHANICAL SERVICES
Checked to ASME

VS 35908

Sect IIA 2017 Edd. Min 0.521 "

SA 530 05 11/15/18

Date



PRESSURE PIPING CONSTRUCTION AND TEST DATA REPORT

In accordance with the provisions of the PESR Section 31(1)

Shop Construction ; Field Construction
 Final Data Report ; Partial Data Report (from one ABSA- authorized Contractor to another ABSA- authorized Contractor).

Complete both sides of this Form

1. Constructed By: Bromley Mechanical Services, A Division of Argo Sales Inc Owner's Job No: 35528-2
(Name of ABSA authorized primary contractor or subcontractor)
925 - 23rd Street SW, Medicine Hat, Alberta T1A 8R1
(Address)

Certificate of Authorization Permit No. AQP-1009 Expiry Date: October 26, 2019

2. Constructed For: N/A
(Name of primary contractor if different from above)

(Address)

Certificate of Authorization Permit No. AQP- [REDACTED] Expiry Date: _____
(Required when the primary contractor undertakes some/all of the quality functions, e.g., NDE, PWHT, Tie-in, fabrication, hydro test, final assembly etc.)

3. Owner: ARC Resources Ltd., 1200, 308 - 4 Avenue SW, Calgary, Alberta T2P 0H7
(Name and address)

LSD: 03-18-080-14 W6M
(Location of installation)

Certificate of Authorization Permit No. AQP- [REDACTED] Expiry Date: _____
(Required when the owner undertakes some/all of the quality functions, e.g., NDE, PWHT, Tie-in, fabrication, hydro test, final assembly etc.)

4. Piping Design Alberta Registration No.: PP-Registration by Owner
(Required if aggregate piping volume is over 0.5m³)

5. Design Responsibility: Owner ; Contractor

6. WP No.: WP-505.2; Company: Bromley Mechanical Services Owner's WP No. (If used): WP-
(Alberta Registration No.) (Alberta Registration No.)
 Spec No(s). used: BA-2, BM-19; Owner's Spec No(s). (If used): _____

7. Code: ASME B31.1 Non Boiler External Piping ; ASME B31.1 Boiler External Piping ;
 B31.5 ; B31.9 ; CSA Z662 Steam Pipelines ;
 ASME B31.3 - Service Category: Normal , D , M , High Pressure ; Severe Cyclic Condition
 High Purity

Drawing No. Rev. No. Line No.	Fluid (Air/Stm. Etc.)	Des. Press. kPa	Des. Temp.°C (Max. & Min.)	Pressure Test kPa	Test Medium	Pipe Mat'l Spec. & Grade	C.A. mm	Pipe NPS & Schedule	Flange Material & Rating	PWHT/ Preheat Temp. °C	NDE
35528 Spools 1 Rev.1 Spools 1-7	WOG	9929	54/-29	14893	WATER	SA106B SA333GR6	3.2	2" S80 4" S80 6" S80	SA105N/ SA350LF2CL1 600 #	621°C For 1 Hr /12°C	RT 100% Visual
35528 Spools 2 Rev.1 Spools 8-19	WOG	9929	54/-29	14893	WATER	SA106B SA333GR6	3.2	2" S80	SA105N/ SA350LF2CL1 600 #	621°C For 1 Hr /12°C	RT 100% Visual
35528 Spools 3 Rev.1 Spools 20-21	WOG	1965	54/-29	2951	WATER	SA106B SA333GR6	3.2	2" S80 3" S40 4" S40	SA105N/ SA350LF2CL1 150 #	621°C For 1 Hr /12°C	RT 100% Visual

Partial Data Reports certified by sub-contractors are listed below and attached to this Data Report

No.	Line No.	Spool No.	Dwg. No. (with Rev. No.)	Sub-contractor (Name)	AQP No. (if from Alberta)	Expiry (if from Alberta)
1			35528-2	Pronghorn Controls Ltd	21555	11/05/2019

Remarks: For partial data report provide information about the code work that was not completed by the subcontractor (e.g., hydrostatic test, PWHT etc.). For final data report provide information about the code work that was not completed by subcontractors and subsequently completed by the primary contractor (e.g., hydrostatic test of entire assembly, PWHT etc.)

Endorse certificate 'A' or 'B'

A. CERTIFICATE OF COMPLIANCE
Signed by the subcontractor when supplying this certificate as a
Partial Data Report

We certify that the statements in this Data Report are correct and that materials, construction and workmanship of the piping fabrication conform to the registered quality system and the applicable Piping code(s).

Date: _____
Contractor

Print Authorized Representative's Name Signature

This certificate is not valid unless it forms part of a Final Data Report signed by Primary Contractor

B. CERTIFICATE OF COMPLIANCE
Signed by the primary contractor when supplying this certificate as a
Final Data Report

We certify that the statements in this Data Report are correct and that piping job no. 35528-2 described in this Data Report was constructed in accordance with the Province of Alberta Safety Codes Act and Regulations, and applicable ASME Piping Code(s).

Date: Jan 13 2018 Bromley Mechanical Svcs
Contractor

FRANK MCHUGH
Print Authorized Representative's Name Signature

CERTIFICATE OF INSPECTION

I, the undersigned, employed by ARC Resources LTD have verified that all required examination and testing has been completed, and inspected the piping described in this construction data report to the extent necessary to be satisfied that it conforms to all applicable examination requirements of the Code and of the engineering design, and state that, to the best of my knowledge and belief, the contractor has constructed this piping in accordance with the Alberta Safety Codes Act and Regulations. By signing this certificate neither the inspector nor his or her employer makes any warranty, expressed or implied, concerning the piping described in this construction data report. Furthermore, neither the inspector nor his or her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date: MAY 07 2018 Date: _____

DR Hope
Owner's Inspector Name (please print) ABSA Safety Codes Officer (please print)
(BOILER EXTERNAL PIPING ONLY)

[Signature]
Owner's Inspector Signature: ABSA Safety Codes Officer's Signature

Current version of this Form may be obtained from www.absa.ca



PRESSURE PIPING CONSTRUCTION AND TEST DATA REPORT

In accordance with the provisions of the PESR Section 31(1)

Shop Construction ; Field Construction ;
 Final Data Report ; Partial Data Report (from one ABSA- authorized Contractor to another ABSA- authorized Contractor).

Complete both sides of this Form

1. Constructed By: Pronghorn Controls Ltd. Owner's Job No: 35528-2
(Name of ABSA authorized primary contractor or subcontractor)
101 - 4919, 72nd Avenue SE, Calgary AB., T2C 3H3
(Address)

Certificate of Authorization Permit No. AQP-21555 Expiry Date: Nov 5, 2019

2. Constructed For: Bromley Mechanical Services, A Division of Argo Sales ULC
(Name of primary contractor if different from above)
925 23rd Street SW Medicine Hat ab, T1A 8R1
(Address)

Certificate of Authorization Permit No. AQP-N/A Expiry Date: N/A
(Required when the primary contractor undertakes some/all of the quality functions, e.g., NDE, PWHT, Tie-in, fabrication, hydro test, final assembly etc.)

3. Owner: Arc Resources Ltd.
(Name and address)

(Location of installation)
 Certificate of Authorization Permit No. AQP- N/A Expiry Date: N/A
(Required when the owner undertakes some/all of the quality functions, e.g., NDE, PWHT, Tie-in, fabrication, hydro test, final assembly etc.)

4. Piping Design Alberta Registration No.: PP-
(Required if aggregate piping volume is over 0.5m³)

5. Design Responsibility: Owner ; Contractor

6. WP No.: WP-N/A; Company: N/A Owner's WP No. (If used): WP-N/A
(Alberta Registration No.) (Alberta Registration No.)
 WPS No(s). used: N/A; Owner's WPS No(s). (If used): N/A

7. Code: ASME B31.1 Non Boiler External Piping ; ASME B31.1 Boiler External Piping ;
 B31.5 ; B31.9 ; CSA Z662 Steam Pipelines ;
 ASME B31.3 - Service Category: Normal , D , M , High Pressure ; Severe Cyclic Condition
 High Purity

Drawing No. 35528-2 Vessel # 35528-42 FM Line No.	Fluid (Air/Stm. Etc.)	Des. Press. psi	Des. Temp. °C (Max. & Min.)	Pressure Test psi	Test Medium	Pipe Mat'l Spec. & Grade	C.A. mm	Pipe NPS & Schedule	Flange Material & Rating	PWHT/ Preheat Temp. °C	NDE
Process Drains V-0210	Emulsion	1440	-29/100	2160	H2O	SA213-10/TP316/TP316L SS	NIL	½ .049	N/A	N/A	N/A
Process Drains V-0240	Emulsion	1440	-29/100	2160	H2O	SA213-10/TP316/TP316L SS	NIL	½ .049	N/A	N/A	N/A

Partial Data Reports certified by sub-contractors are listed below and attached to this Data Report

No.	Line No.	Spool No.	Dwg. No. (with Rev. No.)	Sub-contractor (Name)	AQP No. (if from Alberta)	Expiry (if from Alberta)

Remarks: For partial data report provide information about the code work that was not completed by the subcontractor (e.g., hydrostatic test, PWHT etc.). For final data report provide information about the code work that was not completed by subcontractors and subsequently completed by the primary contractor (e.g., hydrostatic test of entire assembly, PWHT etc.)

Endorse certificate 'A' or 'B'	
<p style="text-align: center;">A. CERTIFICATE OF COMPLIANCE Signed by the subcontractor when supplying this certificate as a Partial Data Report</p> <p>We certify that the statements in this Data Report are correct and that materials, construction and workmanship of the piping fabrication conform to the registered quality system and the applicable Piping code(s).</p> <p>Date: _____</p> <p style="text-align: right;">_____ Contractor</p> <p>_____ Print Authorized Representative's Name _____ Signature</p> <p>This certificate is not valid unless it forms part of a Final Data Report signed by Primary Contractor</p>	<p style="text-align: center;">B. CERTIFICATE OF COMPLIANCE Signed by the primary contractor when supplying this certificate as a Final Data Report</p> <p>We certify that the statements in this Data Report are correct and that piping job no. <u>35528-2</u> described in this Data Report was constructed in accordance with the Province of Alberta Safety Codes Act and Regulations, and applicable ASME Piping Code(s).</p> <p>Date: <u>20 Feb 2018</u> <u>Pronghorn Controls</u></p> <p style="text-align: right;">_____ Contractor</p> <p><u>Fred Middlemiss</u> Print Authorized Representative's Name Signature</p>

CERTIFICATE OF INSPECTION

I, the undersigned, employed by ARC Resources have verified that all required examination and testing has been completed, and inspected the piping described in this construction data report to the extent necessary to be satisfied that it conforms to all applicable examination requirements of the Code and of the engineering design, and state that, to the best of my knowledge and belief, the contractor has constructed this piping in accordance with the Alberta Safety Codes Act and Regulations. By signing this certificate neither the inspector nor his or her employer makes any warranty, expressed or implied, concerning the piping described in this construction data report. Furthermore, neither the inspector nor his or her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date: 20 FEB 18 Date: _____

DR Hope
Owner's Inspector Name (please print) _____
ABSA Safety Codes Officer (please print)
(BOILER EXTERNAL PIPING ONLY)

DR
Owner's Inspector Signature: _____
ABSA Safety Codes Officer's Signature

Current version of this Form may be obtained from www.abst.ca

BROMLEY MECHANICAL SERVICES

Spooling/Piping System Travel Sheet

DO NOT START CONSTRUCTION WITHOUT 3 rd PARTY INSPECTOR/OWNERS INSPECTOR REVIEW									
AI REVIEW & ACCEPTANCE:					AI DATE:				
INSPECTOR NAME: DEREK HOPE			CONTACT #		REVIEW DATE: JAN 09 2018				
WO NO: 35528-2		SPOOLING TYPE/DESCRIPTION: DUAL TEST SEPARATOR PKG.							
DRAWING NO.:		DWG. REVISION NO: /			TRAVEL SHEET INITIATION BY: T.H.				
Seq.	Item	Comments	Q.C.I.	Date	A.I. Hold Points	A.I.	Date	Owner	Date
1.	Calculations in File		WHT	JAN 09 2018				D Hope	MAY 07 2018
2.	Release of App'd Dwg.		WHT	JAN 09 2018				D Hope	MAY 07 2018
3.	WPS(S) Checked		WHT	JAN 09 2018				D Hope	MAY 07 2018
4.	Welder(s) Qualified		WHT	JAN 09 2018				D Hope	MAY 07 2018
5.	PP Number							D Hope	MAY 07 2018
6.	Fluid Service Category	NORMAL	WHT	JAN 09 2018				D Hope	MAY 07 2018
7.	Thicknesses Verified & Recorded		WHT	JAN 16 2018				D Hope	MAY 07 2018
8.	Material Examination		WHT	JAN 16 2018				D Hope	MAY 07 2018
9.	MTR's Checked		WHT	JAN 16 2018				D Hope	MAY 07 2018
10.	Nozzle & Flange Rating Checked		WHT	JAN 16 2018				D Hope	MAY 07 2018
11.	Fit up Check		WHT	JAN 16 2018				D Hope	MAY 07 2018
12.	Weld Size Checked		WHT	JAN 16 2018				D Hope	MAY 07 2018
13.	R/T	100%	WHT	JAN 16 2018				D Hope	MAY 07 2018
14.	Other NDE							D Hope	MAY 07 2018
15.	Final Internal/External Inspection Prior to PWHT		WHT	JAN 16 2018				D Hope	MAY 07 2018
16.	PWHT/PWHT Chart Checked	1150°F FOR 60 MIN	WHT	JAN 17 2018				D Hope	MAY 07 2018
17.	Hydrostatic Test Gauge #'s	SEE OVER	WHT	JAN 18 2018				D Hope	MAY 07 2018
18.	Weld Mapping/Weld ID/RT/Heat #'s		WHT	JAN 18 2018				D Hope	MAY 07 2018
19.	Final Inspection		WHT	JAN 18 2018				D Hope	MAY 07 2018
20.	N.C.R. #							D Hope	MAY 07 2018
21.	Pressure Piping Construction & Test Data Report		WHT	JAN 18 2018				D Hope	MAY 07 2018

The Owners Inspector shall be presented with the Travel Sheet prior to construction so that he can designate additional inspection points and/or Hold Points. Any revisions shall be marked with a delta symbol with revision number and described at the bottom of this page.

I/R Denotes Inspection/Review Point W/H Denotes Witness/ Hold Point

BILL OF MATERIAL

ITEM	QTY.	DESCRIPTION
1	1	RFWN, 5" 600 ANSI SCH. 80, SA3350LF2 QLI
2	10	RFWN, 4" 600 ANSI SCH. 80, SA3350LF2 QLI
3	4	RFWN, 3" 600 ANSI SCH. 80, SA3350LF2 QLI
4	4	RFWN, 3" 600 ANSI SCH. 80, SA3350LF2 QLI
5	13	RFWN, 2" 600 ANSI SCH. 80, SA3350LF2 QLI
6	4	WELD 90, 4" SCH. 80 LR, SA2334WFB
7	4	WELD 90, 4" SCH. 80 LR, SA2334WFB
8	5	WELD 90, 4" SCH. 80 LR, SA2334WFB
9	2	WELD 45, 4" SCH. 80 LR, SA2334WFB
10	1	WELD TEE, 6" SCH. 80, SA2334WFB
11	4	WELD CONC, 6" X 4" SCH. 80, SA2334WFB
12	4	WELD CONC, 4" X 3" SCH. 80, SA2334WFB
13	5	WOL 2" SCH. 80, SA3350LF2 QLI
14	2	TOL 1" 3M SA3350LF2 QLI
15	3	TOL 1" 3M SA3350LF2 QLI
16	2	TOL 3/4" 3M SA3350LF2 QLI
17	5	TOL 3/4" 3M SA3350LF2 QLI
18	1	PPE, 4 SCH. 80 (10.3371) SA3350LF2 X 7 1/8" LONG
19	2	PPE, 4 SCH. 80 (10.3371) SA3350LF2 X 5 3/4" LONG
20	2	PPE, 4 SCH. 80 (10.3371) SA3350LF2 X 8 3/8" LONG
21	2	PPE, 4 SCH. 80 (10.3371) SA3350LF2 X 9 7/8" LONG
22	2	PPE, 4 SCH. 80 (10.3371) SA3350LF2 X 12 1/4" LONG
23	2	PPE, 4 SCH. 80 (10.3371) SA3350LF2 X 3" LONG
24	2	PPE, 4 SCH. 80 (10.3371) SA3350LF2 X 11/2" LONG
25	2	PPE, 4 SCH. 80 (10.3371) SA3350LF2 X 16 1/8" LONG
26	2	PPE, 4 SCH. 80 (10.3371) SA3350LF2 X 12 1/8" LONG
27	2	PPE, 4 SCH. 80 (10.3371) SA3350LF2 X 13 13/16" LONG
28	2	PPE, 2 SCH. 80 (10.2871) SA1068 X 12" LONG
29	2	PPE, 2 SCH. 80 (10.2871) SA1068 X 3" LONG
30	4	PPE, 2 SCH. 80 (10.2871) SA1068 X 6 1/2" LONG
31	1	PPE, 2 SCH. 80 (10.2871) SA1068 X 7 3/8" LONG

Bromley
MECHANICAL SERVICES
A DIVISION OF ARC RESOURCES LTD.

APPROVED FOR CONSTRUCTION
PROCEED-NO CHANGES AS NOTED

BY: ck DATE: 12/21/17

REV.	MM	DD	YY	DATE	DESCRIPTION	BY	CHKD	APPD
1	12	06	17	12/06/17	ISSUED FOR CONSTRUCTION	ck	ck	
2	12	06	17	12/06/17	SPPOOL 6 REVISED	ck	ck	

BROMLEY MECHANICAL SERVICES
925 - 23rd Street S.W., Medicine Hat, Alberta, Canada, T1A 4G3 526-342

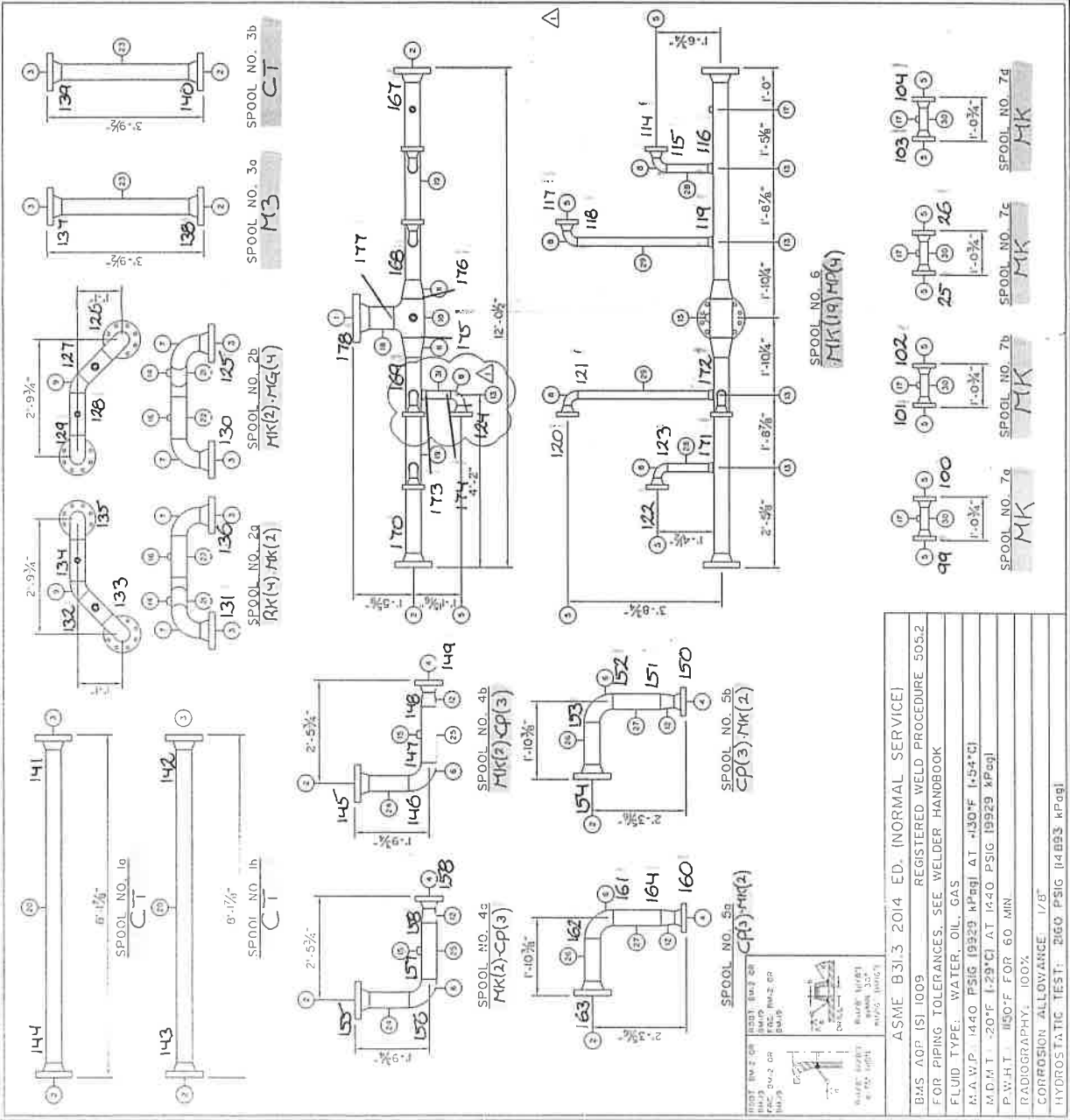
CLIENT: **ARC RESOURCES LTD.**

PROJECT: **TYPICAL DUAL/TEST SEPARATOR PACKAGE**

TITLE: **PIPING SPOOLS 1-7**

W/O No.: 35528
DRAWN BY: C. KARPIUK
DATE: 12/06/17

REV. No.: 1
SCALE: 3/8"=1'
CAD. No.: 35528-SP00LS-1



ASME B31.3 2014 ED. (NORMAL SERVICE)

BMS AOP ISI 1009 REGISTERED WELD PROCEDURE S052 FOR PIPING TOLERANCES, SEE WELDER HANDBOOK

FLUID TYPE: WATER, OIL, GAS

M.A.W.P. 1440 PSIG (9929 kPag) AT +130°F (+54°C)

M.D.M.T. -20°F (-29°C) AT 1440 PSIG (9929 kPag)

P.W.H.T. 150°F FOR 60 MIN

RADIOGRAPHY: 100%

CORROSION ALLOWANCE: 1/8"

HYDROSTATIC TEST: 2160 PSIG (14883 kPag)

TNY
618

12/21/17

#2

BILL OF MATERIAL

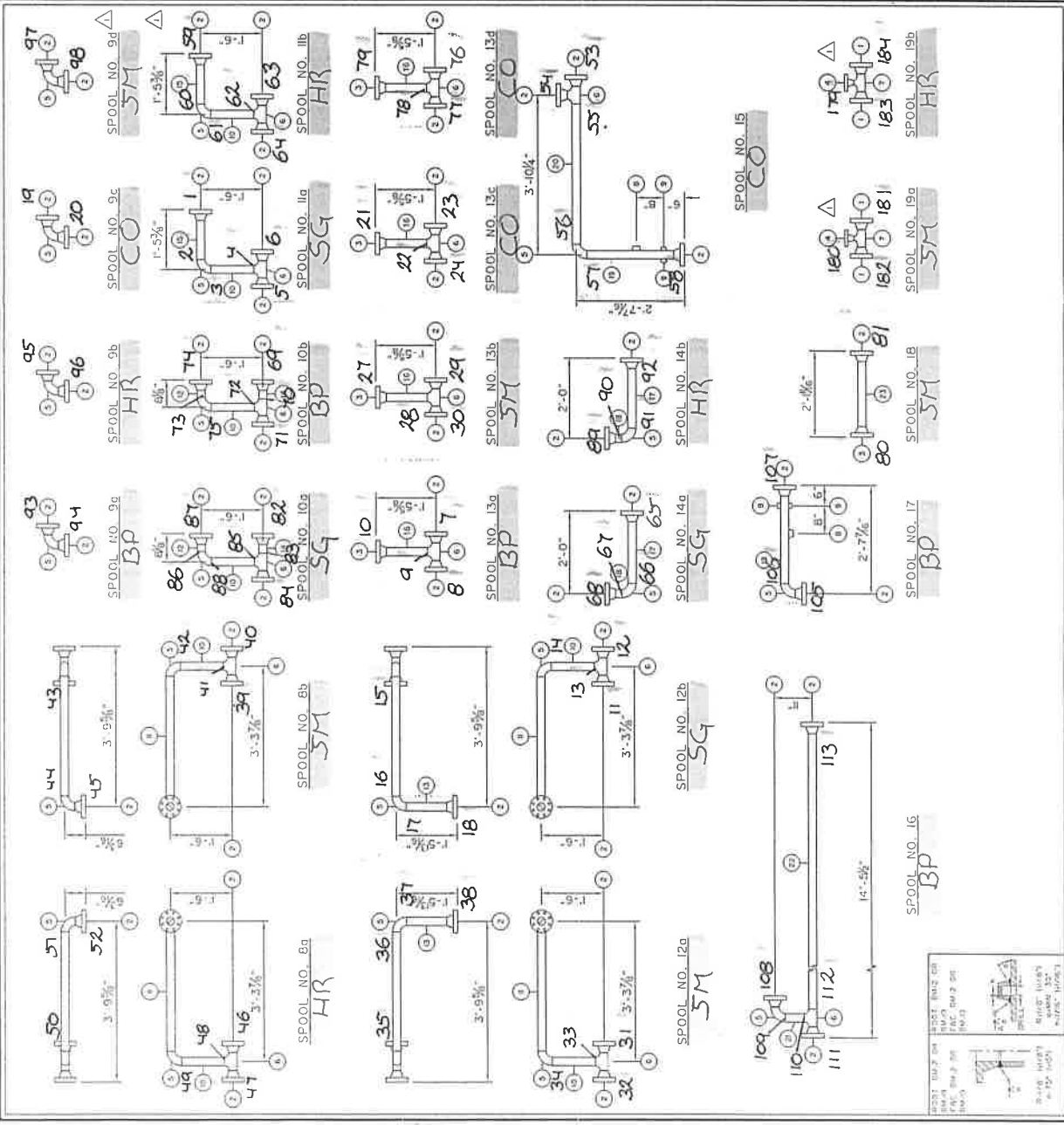
ITEM	QTY.	DESCRIPTION
1	4	RFWN. 2" 600 ANSI SCH. 80, SA106
2	53	RFWN. 2" 600 ANSI SCH. 80, SA106
3	5	RFWN. 2" 600 ANSI SCH. 80, SA106
4	2	RFWN. 1" 600 ANSI SCH. 80, SA106
5	2	WELD 90° 2" SCH. 80, SA106
6	14	WELD TEE 2" X 1" SCH. 80, SA106
7	2	WELD RED. TEE 2" X 1" SCH. 80, SA106
8	2	TOL. 1" 3M SA106
9	4	TOL. 1/2" 3M SA106
10	4	PIPE, 2" SCH. 80 10.281, SA106 X 12 1/2" LONG
11	4	PIPE, 2" SCH. 80 10.281, SA106 X 33 7/8" LONG
12	2	PIPE, 2" SCH. 80 10.281, SA106 X 2" LONG
13	2	PIPE, 2" SCH. 80 10.281, SA106 X 1 3/4" LONG
14	2	PIPE, 2" SCH. 80 10.281, SA106 X 2 1/2" LONG
15	2	PIPE, 2" SCH. 80 10.281, SA106 X 1 1/4" LONG
16	4	PIPE, 2" SCH. 80 10.281, SA106 X 12 7/8" LONG
17	2	PIPE, 2" SCH. 80 10.281, SA106 X 17 7/8" LONG
18	2	PIPE, 2" SCH. 80 10.281, SA106 X 1 3/4" LONG
19	2	PIPE, 2" SCH. 80 10.281, SA106 X 25 5/16" LONG
20	1	PIPE, 2" SCH. 80 10.281, SA106 X 40 3/4" LONG
21	1	PIPE, 2" SCH. 80 10.281, SA106 X 5 1/2" LONG
22	1	PIPE, 2" SCH. 80 10.281, SA106 X 162 1/8" LONG
23	1	PIPE, 2" 504, 80 10.281, SA106 X 19 7/16" LONG

APPROVED FOR CONSTRUCTION
 MECHANICAL SERVICES
 DATE: 12/12/17
 BY: CK

REV.	NO.	DATE	DESCRIPTION	BY	CHKD	APPD
1	12	17	REVISD BILL OF MATERIALS, CHANGED ITEMS 4 & 7 TO 1	CK	CK	
2	12	06	ISSUED FOR CONSTRUCTION	CK	CK	

ASME B31.3 2014 ED. (NORMAL SERVICE)
 BMS AGP (S) 1009 REGISTERED WELD PROCEDURE 505.2
 FOR PIPING TOLERANCES, SEE WELDER HANDBOOK
 FLUID TYPE: WATER, OIL, GAS
 M.A.W.P.: 1440 PSIG (9929 kPa) AT +130°F (+54°C)
 M.D.M.T.: -20°F (-29°C) AT 1440 PSIG (9929 kPa)
 P.W.H.T.: 150°F FOR 60 MIN.
 RADIOGRAPHY: 100%
 CORROSION ALLOWANCE: 1/8"
 HYDROSTATIC TEST: 2160 PSIG (14893 kPa)

BROMLEY MECHANICAL SERVICES
 925 - 23rd Street S.W., Medicine Hat, Alberta, Canada, T1A 8R1 (403) 526-3442
 CLIENT: ARC RESOURCES LTD.
 PROJECT: TYPICAL DUAL/TEST SEPARATOR PACKAGE
 TITLE: PIPING SPOOLS 8-19
 No. No.: 3552B
 DRAWN BY: C. KARRIUK
 DATE: 12/06/17
 REV. No.: 1
 DATE: 12/21/17
 SCALE: 3/8"=1'
 CAD No.: 3552B-SPOOLS-2



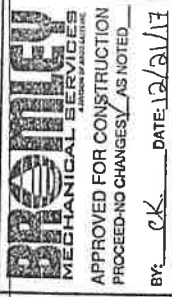
#2
 Halli
 TM
 618

BILL OF MATERIAL

ITEM	QTY.	DESCRIPTION
1	1	RFWN, 4" ISO ANSI SCH. 40, SA350LF2 CL
2	4	RFWN, 3" ISO ANSI SCH. 40, SA350LF2 CL
3	4	RFWN, 2" ISO ANSI SCH. 80, SA350LF2 CL
4	1	WELD 90, 3" SCH. 80 LR, SA233WPB
5	2	WELD 90, 2" SCH. 80 LR, SA233WPB
6	2	WELD TEE, 4" X 3" SCH. 40, SA233WPB
7	1	WELD CONC. 4" X 2" SCH. 40/50, SA233WPB
8	1	PIPE, 4" SCH. 40 10.371, SA1008 X 33 1/8" LONG
9	1	PIPE, 3" SCH. 40 10.371, SA1008 X 20 1/2" LONG
10	1	PIPE, 3" SCH. 40 10.371, SA1008 X 33 1/4" LONG
11	1	PIPE, 3" SCH. 40 10.371, SA1008 X 20 1/2" LONG
12	1	PIPE, 3" SCH. 40 10.371, SA1008 X 20 1/2" LONG
13	1	PIPE, 2" SCH. 80 10.267, SA1008 X 20 1/2" LONG
14	2	PIPE, 2" SCH. 80 10.267, SA1008 X 3 9/16" LONG
15	2	PIPE, 2" SCH. 80 10.267, SA1008 X 3 9/16" LONG
16		
17		
18		
19		
20		

TIM
6/18

12/1/17

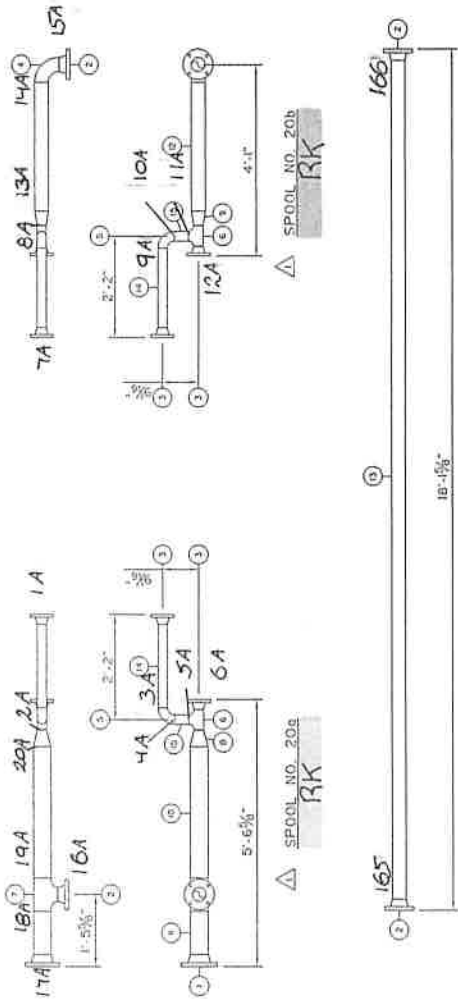


#2

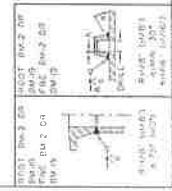
REV.	NO.	DATE	DESCRIPTION	BY	CHKD	APPD
1	12	21	17	SPools 20a & 20b REVISED (MIRROR ORIENTATION)	CK	CK
2	12	06	17	ISSUED FOR CONSTRUCTION	CK	CK

ASME B31.3 2014 ED. (NORMAL SERVICE)
 BMS AQP ISI 1009 REGISTERED WELD PROCEDURE 5052
 FOR PIPING TOLERANCES, SEE WELDER HANDBOOK
 FLUID TYPE: WATER, OIL, GAS
 M.A.W.P.: 285 PSIG (1965 kPag) AT +130°F (+54°C)
 M.D.M.T.: -20°F (-29°C) AT 285 PSIG (1965 kPag)
 P.W.H.T.: 1150°F FOR 60 MIN.
 RADIOGRAPHY: 100%
 CORROSION ALLOWANCE: 1/8"
 HYDROSTATIC TEST: 428 PSIG (2961 kPag)

BROMLEY MECHANICAL SERVICES
 355 - 23rd Street S.W., Medicine Hat, Alberta, Canada, T1A 6B1 (403) 526-3442
 CLIENT: ARC RESOURCES LTD.
 PROJECT: TYPICAL DUAL/TEST SEPARATOR PACKAGE
 TITLE: PIPING SPOOLS 20-21
 W/O No.: 35528
 DRAWN BY: C. KARPIUK
 DATE: 12/06/17
 REV. No.: 1
 SCALE: 3/8"=1'
 CAD No.: 35528-SP001.5-3



SPOOL NO. 21
 RK



Integrity Engineering Ltd

403-362-5757 1-800-442-8721


DATE: Jan 09 2018

PAGE 1 OF 1

CLIENT ADDRESS	<u>Bromley Mechanical</u>	VIE JOB NO.	<u>BMS-110</u>	TOTAL HRS	<u>3.5</u>	KM'S	
		P.O. NO.	<u>88241</u>	IN	<u>22:30</u>	DAILY SUBS	
		AFE NO.		OUT	<u>2:00</u>	ROOMS	
JOB LOCATION	<u>Arc</u>	WORK ORDER #	<u>35528</u>	IN		DAILY MEALS	
CONTRACTOR	<u>BMS</u>	PROJECT NO.	<u>Pkg 2</u>	OUT		LATE MEAL	

TECHNIQUE NO.	<u>RT001 tech 03</u>	WT	WALL THICKNESS	WELD DEFECTS 1. SLIGHT 2. MEDIUM 3. REJECT					
MAX SOURCE SIZE	<u>2.7 x 2.9 mm</u>	WS	WELDER SYMBOL	AB	ARC BURN	C	CRACK	S	SLAG
TYPE OF MATERIAL	<u>C-5</u>	EX	NUMBER OF EXPOSURES	EP	EXCESSIVE PENETRATION		HL	HIGH LOW	
LEAD SCREENS FRONT	<u>0.010</u>	SO	SOURCE TO OBJECT DISTANCE OR C FOR CONTACT	IP	INCOMPLETE PENETRATION		P	POROSITY	
LEAD SCREENS BACK	<u>0.010</u>			IC	INTERNAL CONCAVITY		LC	LOW COVER	
FILM PER CASSETTE	<u>1</u>	SSF	MAX. DISTANCE FROM SOURCE SIDE OF OBJECT TO FILM	IUC	INTERNAL UNDERCUT		CR	CONCAVE ROOT	
FILM DENSITY	<u>2.2 - 2.9</u>			EUC	EXTERNAL UNDERCUT		LF	LACK OF FUSION	
FILM BRAND	<u>Agfa</u>	EW	ASTM ESSENTIAL WIRE #	BT	BURN THROUGH		HB	HOLLOW BEAD	




NO.	WELD SIZE	WT	WS	NO. EX	SO	SSF	EW #	FILM TYPE	CODE	LIST ACCEPTABLE DEFECTS	OK	SHOW LOCATION OF UNACCEPTABLE DEFECTS	REJECT
1													
2													
X1A	2"	AK	AK	3	C	.42	7	03	2		✓		
X2A	↓	↓	↓							P-1	✓		
X3A	↓	↓	↓								✓		
X4A	↓	↓	↓							welder stamp	✓		
X5A	↓	↓	↓							P-1	✓		
X6A	↓	↓	↓								✓		
X7A	↓	↓	↓								✓		
X8A	↓	↓	↓								✓		
X9A	↓	↓	↓							MIG wire	✓		
X10A	↓	↓	↓								✓		
X11A	↓	↓	↓								✓		
X12A	↓	↓	↓								✓		
X13A	3"	STD	AK	3	C	.44	7	03	2		✓		
X14A	↓	↓	↓								✓		
X15A	↓	↓	↓								✓		
X16A	↓	↓	↓								✓		
X17A	4"	STD	AK	3	C	.44	7	03	2		✓		
X18A	↓	↓	↓							P-1	✓		
X19A	↓	↓	↓								✓		
X20A	↓	↓	↓								✓		
23													
24													
25													
26													
27										SNT # 5335	✓	2RT NT PT	
28													
29													
30													

AUTHORIZED BY (signature):	WELDING CODES:	TECHNICIANS SIGNATURE	 Kevin Hayward RT, MT, PT Level II CGSB/SNT-TC-1A # 5335
<u>[Signature]</u>	<u>B31.3N-14</u>	<u>[Signature]</u>	
		<u>5500 ASSISTANT</u> <u>Jessie Miller</u>	INTERPRETED BY (stamp)

Client Name :	Bromley Mechanical Services	VIE Project # :	BMS-110	Hrs	3	Km's	
Address :	925 23 St SW, Medicine Hat, AB	Client PO#	88241	In		Daily Sub	
		Client WO#	35528	Out		Rooms	
Job Location:	VIE Shop Medicine Hat	Project #:	Package 2	In		Daily Meals	
Contractor:	Bromley Mechanical Services			Out		Late Meal	

Exposure Device:	Delta 880	WT	Wall Thickness	Weld Defects: 1. Slight, 2. Medium, 3. Reject					
Film Brand:	Agfa	WS	Welder Symbol	C	Crack	S	Slag	HL	High Low
Technique No >	RT001 Rev.1 Tech 03	EX	No. Exposures	POR	Porosity	AB	Arc Burn	LC	Low Cover
Max Source size >	3.64mm	SO	Source to Object distance or C= contact	IUC	Internal Undercut		IP	Incomplete Penetration	
IQI film/source side >	Film Side			EUC	External Undercut		EP	Excessive Penetration	
Type of material >	Carbon Steel	SSF	Max. Distance From Source Side of Object to Film	IC	Internal Concavity		HB	Hollow Bead	
Lead screens front >	0.010			LF	Lack Of Fusion		CR	Concave Root	
Lead screens back >	0.010	EW	ASTM Essential Wire #	BT	Burn Through				
Film per cassette >	1.000						weld ok	✓	
Film density >	2.05 - 3.8 H&D								

No.	Weld			WS	No. EX	SO	SSF	EW	Film Type	Tech	List Acceptable Imperfections	OK	Show Location of Unacceptable Imperfection	Reject X
	Size	WT												
X1	2"	XH	SG	3	C	0.410"	6	D3	3		✓			
X2	2"	XH	SG	3	C	0.410"	6	D3	3	Welder Stamp @ 10cm		P @ 7cm	X	
X3	2"	XH	SG	3	C	0.410"	6	D3	3		✓			
X4	2"	XH	SG	3	C	0.410"	6	D3	3		✓			
X5	2"	XH	SG	3	C	0.410"	6	D3	3	Welder Stamp @ 7cm	✓			
X6	2"	XH	SG	3	C	0.410"	6	D3	3	Welder Stamp @ 15cm	✓			
X7	2"	XH	BP	3	C	0.410"	6	D3	3		✓			
X8	2"	XH	BP	3	C	0.410"	6	D3	3		✓			
X9	2"	XH	BP	3	C	0.410"	6	D3	3		✓			
X10	2"	XH	BP	3	C	0.410"	6	D3	3	S (1)	✓			
X11	2"	XH	SG	3	C	0.410"	6	D3	3	film mark @ 18cm	✓			
X12	2"	XH	SG	3	C	0.410"	6	D3	3		✓			
X13	2"	XH	SG	3	C	0.410"	6	D3	3	IUC (1)	✓			
X14	2"	XH	SG	3	C	0.410"	6	D3	3	Welder Stamp @ 17cm IUC (1)	✓			
X15	2"	XH	SG	3	C	0.410"	6	D3	3	Welder Stamp @ 1cm	✓			
X16	2"	XH	SG	3	C	0.410"	6	D3	3		✓			
X17	2"	XH	SG	3	C	0.410"	6	D3	3	Welder Stamp @ 14cm	✓			
X18	2"	XH	SG	3	C	0.410"	6	D3	3		✓			
X19	2"	XH	CO	3	C	0.410"	6	D3	3		✓			
X20	2"	XH	CO	3	C	0.410"	6	D3	3		✓			

 160118 Authorized by: (signature)	Acceptance Standards	Vision Technicians	 Rick Humphrey CGSB/SNT-TC-1A #12122 Level II RT
	ASME B31.3 N - 14	Rick Humphrey	
	Assistant		
	Logan Krastel	Inspected by	

Client Name :	Bromley Mechanical Services	VIE Project # :	BMS-110	Hrs	3	Km's	
Address :	925 23 St SW, Medicine Hat, AB	Client PO#	88241	In		Daily Sub	
		Client WO#	35528	Out		Rooms	
Job Location:	VIE Shop Medicine Hat	Project #:	Package 2	In		Daily Meals	
Contractor:	Bromley Mechanical Services			Out		Late Meal	

Exposure Device:	Delta 880	WT	Wall Thickness	Weld Defects: 1. Slight, 2. Medium, 3. Reject					
Film Brand:	Agfa	WS	Welder Symbol	C	Crack	S	Slag	HL	High Low
Technique No >	RT001 Rev.1 Tech 03	EX	No. Exposures	POR	Porosity	AB	Arc Burn	LC	Low Cover
Max Source size >	3.64mm	SO	Source to Object distance or C= contact	IUC	Internal Undercut	IP	Incomplete Penetration		
IQI film/source side >	Film Side			EUC	External Undercut	EP	Excessive Penetration		
Type of material >	Carbon Steel	SSF	Max. Distance From Source Side of Object to Film	IC	Internal Concavity	HB	Hollow Bead		
Lead screens front >	0.010			LF	Lack Of Fusion	CR	Concave Root		
Lead screens back >	0.010	EW	ASTM Essential Wire #	BT	Burn Through				
Film per cassette >	1.000						weld ok		✓
Film density >	2.05 - 3.8 H&D								

No.	Weld			WS	No. EX	SO	SSF	EW	Film Type	Tech	List Acceptable Imperfections	OK	Show Location of Unacceptable Imperfection	Reject X
	Size	WT												
X21	2"	XH	CO	3	C	0.410"	6	D3	3	P (1)	✓			
X22	2"	XH	CO	3	C	0.410"	6	D3	3		✓			
X23	2"	XH	CO	3	C	0.410"	6	D3	3	P (1)	✓			
X24	2"	XH	CO	3	C	0.410"	6	D3	3		✓			
X25	2"	XH	MK	3	C	0.410"	6	D3	3	IC (1) S (1)	✓			
X26	2"	XH	MK	3	C	0.410"	6	D3	3			P @ 1cm	X	
X27	2"	XH	JM	3	C	0.410"	6	D3	3	Welder Stamp @ 3.5cm	✓			
X28	2"	XH	JM	3	C	0.410"	6	D3	3	S (1) P (2)	✓			
X29	2"	XH	JM	3	C	0.410"	6	D3	3	P (1)	✓			
X30	2"	XH	JM	3	C	0.410"	6	D3	3	P (1)	✓			
X31	2"	XH	JM	3	C	0.410"	6	D3	3	P (1)	✓			
X32	2"	XH	JM	3	C	0.410"	6	D3	3	P (1)	✓			
X33	2"	XH	JM	3	C	0.410"	6	D3	3		✓			
X34	2"	XH	JM	3	C	0.410"	6	D3	3	film mark @ 9cm	✓			
X35	2"	XH	JM	3	C	0.410"	6	D3	3	P (1) Welder Stamp @ 14cm	✓			
X36	2"	XH	JM	3	C	0.410"	6	D3	3		✓			
X37	2"	XH	JM	3	C	0.410"	6	D3	3		✓			
X38	2"	XH	JM	3	C	0.410"	6	D3	3	Welder Stamp @ 16cm	✓			
X39	2"	XH	JM	3	C	0.410"	6	D3	3	P (1)	✓			
X40	2"	XH	JM	3	C	0.410"	6	D3	3		✓			

 160118 Authorized by: (signature)	Acceptance Standards ASME B31.3 N - 14	Vision Technicians Rick Humphrey	 Rick Humphrey CGSB/SNT-TC-1A #12122 Level II RT
	Assistant Logan Krastel	 Inspected by	

Client Name :	Bromley Mechanical Services	VIE Project # :	BMS-110	Hrs	2	Km's	
Address :	925 23 St SW, Medicine Hat, AB	Client PO#	88241	In		Daily Sub	
		Client WO#	35528	Out		Rooms	
Job Location:	VIE Shop Medicine Hat	Project #:	Package 2	In		Daily Meals	
Contractor:	Bromley Mechanical Services			Out		Late Meal	

Exposure Device:	Delta 880	WT	Wall Thickness	Weld Defects: 1. Slight, 2. Medium, 3. Reject					
Film Brand:	Agfa	WS	Welder Symbol	C	Crack	S	Slag	HL	High Low
Technique No >	RT001 Rev.1 Tech 03	EX	No. Exposures	POR	Porosity	AB	Arc Burn	LC	Low Cover
Max Source size >	3.64mm	SO	Source to Object distance or C= contact	IUC	Internal Undercut	IP	Incomplete Penetration		
IQI film/source side >	Film Side		EUC	External Undercut	EP	Excessive Penetration			
Type of material >	Carbon Steel	SSF	Max. Distance From Source Side of Object to Film	IC	Internal Concavity	HB	Hollow Bead		
Lead screens front >	0.010		LF	Lack Of Fusion	CR	Concave Root			
Lead screens back >	0.010	EW	ASTM Essential Wire #	BT	Burn Through		weld ok ✓		
Film per cassette >	1.000								
Film density >	2.05 - 3.8 H&D								

Weld No.	Weld Size	WT	WS	No. EX	SO	SSF	EW	Film Type	Tech	List Acceptable Imperfections	OK	Show Location of Unacceptable Imperfection	Reject
													X
X41	2"	XH	JM	3	C	0.410"	6	D3	3		✓		
X42	2"	XH	JM	3	C	0.410"	6	D3	3	P (1) Welder Stamp @ 0cm	✓		
X43	2"	XH	JM	3	C	0.410"	6	D3	3		✓		
X44	2"	XH	JM	3	C	0.410"	6	D3	3		✓		
X45	2"	XH	JM	3	C	0.410"	6	D3	3		✓		
X46	2"	XH	HR	3	C	0.410"	6	D3	3	Welder Stamp @ 4cm	✓		
X47	2"	XH	HR	3	C	0.410"	6	D3	3	film mark @ 11cm & Welder Stamp @ 15cm	✓		
X48	2"	XH	HR	3	C	0.410"	6	D3	3	Welder Stamp @ 0cm	✓		
X49	2"	XH	HR	3	C	0.410"	6	D3	3		✓		
X50	2"	XH	HR	3	C	0.410"	6	D3	3	Welder Stamp @ 14cm	✓		
X51	2"	XH	HR	3	C	0.410"	6	D3	3		✓		

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	Assistant Logan Krastel		



Integrity Engineering Ltd

Radiography Inspection Report

Report No:

805024




Date: 15-Jan-18

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Client Name :	Bromley Mechanical Services	VIE Project # :	BMS-110	Hrs	3	Km's	
Address :	925 23 St SW, Medicine Hat, AB	Client PO#	88241	In		Daily Sub	
		Client WO#	35528	Out		Rooms	
Job Location:	VIE Shop Medicine Hat	Project #:	Package 2	In		Daily Meals	
Contractor:	Bromley Mechanical Services			Out		Late Meal	

Exposure Device:	Delta 880	WT	Wall Thickness	Weld Defects: 1. Slight, 2. Medium, 3. Reject					
Film Brand:	Agfa	WS	Welder Symbol	C	Crack	S	Slag	HL	High Low
Technique No >	RT001 Rev.1 Tech 03	EX	No. Exposures	POR	Porosity	AB	Arc Burn	LC	Low Cover
Max Source size >	3.64mm	SO	Source to Object distance or C= contact	IUC	Internal Undercut		IP	Incomplete Penetration	
IQI film/source side >	Film Side			EUC	External Undercut		EP	Excessive Penetration	
Type of material >	Carbon Steel	SSF	Max. Distance From Source Side of Object to Film	IC	Internal Concavity		HB	Hollow Bead	
Lead screens front >	0.010			LF	Lack Of Fusion		CR	Concave Root	
Lead screens back >	0.010	EW	ASTM Essential Wire #	BT	Burn Through				
Film per cassette >	1.000						weld ok	✓	
Film density >	2.05 - 3.8 H&D								

No.	Weld		WS	No. EX	SO	SSF	EW	Film Type	Tech	List Acceptable Imperfections	OK	Show Location of Unacceptable Imperfection	Reject X
	Size	WT											
X52	2"	XH	HR	3	C	0.410"	6	D3	3	P (1)	✓		
X53	2"	XH	CO	3	C	0.410"	6	D3	3		✓		
X54	2"	XH	CO	3	C	0.410"	6	D3	3	Welder Stamp @ 9cm	✓		
X55	2"	XH	CO	3	C	0.410"	6	D3	3	P (1)	✓		
X56	2"	XH	CO	3	C	0.410"	6	D3	3	S (1)	✓		
X57	2"	XH	CO	3	C	0.410"	6	D3	3		✓		
X58	2"	XH	CO	3	C	0.410"	6	D3	3	Welder Stamp @ 13cm	✓		
X59	2"	XH	HR	3	C	0.410"	6	D3	3		✓		
X60	2"	XH	HR	3	C	0.410"	6	D3	3	Welder Stamp @ 16cm	✓		
X61	2"	XH	HR	3	C	0.410"	6	D3	3	IC (1) IUC (1)	✓		
X62	2"	XH	HR	3	C	0.410"	6	D3	3	IC (1)	✓		
X63	2"	XH	HR	3	C	0.410"	6	D3	3	Welder Stamp @ 3.5cm	✓		
X64	2"	XH	HR	3	C	0.410"	6	D3	3		✓		
X65	2"	XH	SG	3	C	0.410"	6	D3	3	Welder Stamp @ 12cm	✓		
X66	2"	XH	SG	3	C	0.410"	6	D3	3		✓		
X67	2"	XH	SG	3	C	0.410"	6	D3	3	Welder Stamp @ 1cm	✓		
X68	2"	XH	SG	3	C	0.410"	6	D3	3	film mark @ 12cm	✓		
X69	2"	XH	BP	3	C	0.410"	6	D3	3	S (1)	✓		
X70	2"	XH	BP	3	C	0.410"	6	D3	3		✓		
X71	2"	XH	BP	3	C	0.410"	6	D3	3		✓		

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	ASME B31.3 N - 14	Rick Humphrey	
	Assistant		Inspected by
	Logan Krastel		

Client Name :	Bromley Mechanical Services	VIE Project # :	BMS-110	Hrs	3	Km's	
Address :	925 23 St SW, Medicine Hat, AB	Client PO#	88241	In		Daily Sub	
		Client WO#	35528	Out		Rooms	
Job Location:	VIE Shop Medicine Hat	Project #:	Package 2	In		Daily Meals	
Contractor:	Bromley Mechanical Services			Out		Late Meal	

Exposure Device:	Delta 880	WT	Wall Thickness	Weld Defects: 1. Slight, 2. Medium, 3. Reject					
Film Brand:	Agfa	WS	Welder Symbol	C	Crack	S	Slag	HL	High Low
Technique No >	RT001 Rev.1 Tech 03	EX	No. Exposures	POR	Porosity	AB	Arc Burn	LC	Low Cover
Max Source size >	3.64mm	SO	Source to Object distance or C= contact	IUC	Internal Undercut		IP	Incomplete Penetration	
IQI film/source side >	Film Side			EUC	External Undercut		EP	Excessive Penetration	
Type of material >	Carbon Steel	SSF	Max. Distance From Source Side of Object to Film	IC	Internal Concavity		HB	Hollow Bead	
Lead screens front >	0.010			LF	Lack Of Fusion		CR	Concave Root	
Lead screens back >	0.010	EW	ASTM Essential Wire #	BT	Burn Through				
Film per cassette >	1.000						weld ok	✓	
Film density >	2.05 - 3.8 H&D								

Weld No.	Weld Size	WT	WS	No. EX	SO	SSF	EW	Film Type	Tech	List Acceptable Imperfections	OK	Show Location of Unacceptable Imperfection	Reject X
X73	2"	XH	BP	3	C	0.410"	6	D3	3		✓		
X74	2"	XH	BP	3	C	0.410"	6	D3	3		✓		
X75	2"	XH	BP	3	C	0.410"	6	D3	3		✓		
X76	2"	XH	CO	3	C	0.410"	6	D3	3		✓		
X77	2"	XH	CO	3	C	0.410"	6	D3	3	Welder Stamp @ 8cm	✓		
X78	2"	XH	CO	3	C	0.410"	6	D3	3	S (1)	✓		
X79	2"	XH	CO	3	C	0.410"	6	D3	3	Welder Stamp @ 12cm	✓		
X80	2"	XH	JM	3	C	0.410"	6	D3	3	P (1) Welder Stamp @ 7cm	✓		
X81	2"	XH	JM	3	C	0.410"	6	D3	3	P (1) Welder Stamp @ 13cm	✓		
X82	2"	XH	SG	3	C	0.410"	6	D3	3	IC (1) @ 7cm Welder Stamp @ 5cm	✓		
X83	2"	XH	SG	3	C	0.410"	6	D3	3	Welder Stamp 18cm	✓		
X84	2"	XH	SG	3	C	0.410"	6	D3	3		✓		
X85	2"	XH	SG	3	C	0.410"	6	D3	3	Welder Stamp @ 0cm	✓		
X86	2"	XH	SG	3	C	0.410"	6	D3	3	IC (1) IUC (1)	✓		
X87	2"	XH	SG	3	C	0.410"	6	D3	3	P (1)	✓		
X88	2"	XH	SG	3	C	0.410"	6	D3	3	P (1)	✓		
X89	2"	XH	HR	3	C	0.410"	6	D3	3	Welder Stamp @ 15cm	✓		
X90	2"	XH	HR	3	C	0.410"	6	D3	3		✓		
X91	2"	XH	HR	3	C	0.410"	6	D3	3	Welder Stamp @ 14cm	✓		

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	ASME B31.3 N - 14	Rick Humphrey	
	Assistant		Inspected by
	Logan Krastel		

Client Name :	Bromley Mechanical Services	VIE Project # :	BMS-110	Hrs	3	Km's	
Address :	925 23 St SW, Medicine Hat, AB	Client PO#	88241	In		Daily Sub	
		Client WO#	35528	Out		Rooms	
Job Location:	VIE Shop Medicine Hat	Project #:	Package 2	In		Daily Meals	
Contractor:	Bromley Mechanical Services			Out		Late Meal	

Exposure Device:	Delta 880	WT	Wall Thickness	Weld Defects: 1. Slight, 2. Medium, 3. Reject					
Film Brand:	Agfa	WS	Welder Symbol	C	Crack	S	Slag	HL	High Low
Technique No >	RT001 Rev.1 Tech 03	EX	No. Exposures	POR	Porosity	AB	Arc Burn	LC	Low Cover
Max Source size >	3.64mm	SO	Source to Object distance or C= contact	IUC	Internal Undercut		IP	Incomplete Penetration	
IQI film/source side >	Film Side		EUC	External Undercut		EP	Excessive Penetration		
Type of material >	Carbon Steel	SSF	Max. Distance From Source Side of Object to Film	IC	Internal Concavity		HB	Hollow Bead	
Lead screens front >	0.010		LF	Lack Of Fusion		CR	Concave Root		
Lead screens back >	0.010	EW	ASTM Essential Wire #	BT	Burn Through		weld ok		
Film per cassette >	1.000								✓
Film density >	2.05 - 3.8 H&D								

Weld No.	Size	WT	WS	No. EX	SO	SSF	EW	Film Type	Tech	List Acceptable Imperfections	OK	Show Location of Unacceptable Imperfection	Reject
													X
X92	2"	XH	HR	3	C	0.410"	6	D3	3	Welder Stamp	✓		
X93	2"	XH	BP	3	C	0.410"	6	D3	3		✓		
X94	2"	XH	BP	3	C	0.410"	6	D3	3		✓		
X95	2"	XH	HR	3	C	0.410"	6	D3	3	P (1)	✓		
X96	2"	XH	HR	3	C	0.410"	6	D3	3		✓		
X97	2"	XH	JM	3	C	0.410"	6	D3	3	P (1)	✓		
X98	2"	XH	JM	3	C	0.410"	6	D3	3	Welder Stamp	✓		
X99	2"	XH	MK	3	C	0.410"	6	D3	3	P (1)	✓		
X100	2"	XH	MK	3	C	0.410"	6	D3	3	IC (1)	✓		
X101	2"	XH	MK	3	C	0.410"	6	D3	3	HB (1) @ 1cm & 7cm IC (1) Welder Stamp @ 0cm	✓		
X102	2"	XH	MK	3	C	0.410"	6	D3	3	HB (1)	✓		
X103	2"	XH	MK	3	C	0.410"	6	D3	3	HB (1)	✓		
X104	2"	XH	MK	3	C	0.410"	6	D3	3	P (1)	✓		
X105	2"	XH	BP	3	C	0.410"	6	D3	3		✓		
X106	2"	XH	BP	3	C	0.410"	6	D3	3		✓		
X107	2"	XH	BP	3	C	0.410"	6	D3	3		✓		
X108	2"	XH	BP	3	C	0.410"	6	D3	3		✓		
X109	2"	XH	BP	3	C	0.410"	6	D3	3	P (1)	✓		
X110	2"	XH	BP	3	C	0.410"	6	D3	3		✓		
X111	2"	XH	BP	3	C	0.410"	6	D3	3		✓		

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	ASME B31.3 N - 14	Rick Humphrey	
	Assistant		Inspected by
	Logan Krastel		

Client Name :	Bromley Mechanical Services	VIE Project # :	BMS-110	Hrs	1	Km's	
Address :	925 23 St SW, Medicine Hat, AB	Client PO#	88241	In		Daily Sub	
		Client WO#	35528	Out		Rooms	
Job Location:	VIE Shop Medicine Hat	Project #:	Package 2	In		Daily Meals	
Contractor:	Bromley Mechanical Services			Out		Late Meal	

Exposure Device:	Delta 880	WT	Wall Thickness	Weld Defects: 1. Slight, 2. Medium, 3. Reject					
Film Brand:	Agfa	WS	Welder Symbol	C	Crack	S	Slag	HL	High Low
Technique No >	RT001 Rev.1 Tech 03	EX	No. Exposures	POR	Porosity	AB	Arc Burn	LC	Low Cover
Max Source size >	3.64mm	SO	Source to Object distance or C= contact	IUC	Internal Undercut		IP	Incomplete Penetration	
IQI film/source side >	Film Side			EUC	External Undercut		EP	Excessive Penetration	
Type of material >	Carbon Steel	SSF	Max. Distance From Source Side of Object to Film	IC	Internal Concavity		HB	Hollow Bead	
Lead screens front >	0.010			LF	Lack Of Fusion		CR	Concave Root	
Lead screens back >	0.010	EW	ASTM Essential Wire #	BT	Burn Through				
Film per cassette >	1.000								weld ok
Film density >	2.05 - 3.8 H&D								

No.	Weld		WS	No. EX	SO	SSF	EW	Film Type	Tech	List Acceptable Imperfections	OK	Show Location of Unacceptable Imperfection	Reject X
	Size	WT											
X112	2"	XH	BP	3	C	0.410"	6	D3	3		✓		
X113	2"	XH	BP	3	C	0.410"	6	D3	3		✓		

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	Assistant Logan Krastel		

Client Name :	Bromley Mechanical Services	VIE Project # :	BMS-110	Hrs	3	Km's	
Address :	925 23 St SW, Medicine Hat, AB	Client PO#	88241	In		Daily Sub	
		Client WO#	35528	Out		Rooms	
Job Location:	VIE Shop Medicine Hat	Project #:	Package 2	In		Daily Meals	
Contractor:	Bromley Mechanical Services			Out		Late Meal	

Exposure Device:	Delta 880	WT	Wall Thickness	Weld Defects: 1. Slight, 2. Medium, 3. Reject					
Film Brand:	Agfa	WS	Welder Symbol	C	Crack	S	Slag	HL	High Low
Technique No >	RT001 Rev.1 Tech 03	EX	No. Exposures	POR	Porosity	AB	Arc Burn	LC	Low Cover
Max Source size >	3.64mm	SO	Source to Object distance or C= contact	IUC	Internal Undercut		IP	Incomplete Penetration	
IQI film/source side >	Film Side		EUC	External Undercut		EP	Excessive Penetration		
Type of material >	Carbon Steel	SSF	Max. Distance From Source Side of Object to Film	IC	Internal Concavity		HB	Hollow Bead	
Lead screens front >	0.010		LF	Lack Of Fusion		CR	Concave Root		
Lead screens back >	0.010	EW	ASTM Essential Wire #	BT	Burn Through				
Film per cassette >	1.000						weld ok	✓	
Film density >	2.05 - 3.8 H&D								




Weld No.	Weld Size	WT	WS	No. EX	SO	SSF	EW	Film Type	Tech	List Acceptable Imperfections	OK	Show Location of Unacceptable Imperfection	Reject X
X114	2"	XH	MK	3	C	0.410"	6	D3	3		✓		
X115	2"	XH	MK	3	C	0.410"	6	D3	3	S (1) P (1)	✓		
X116	2"	XH	MK	3	C	0.410"	6	D3	3		✓		
X117	2"	XH	MK	3	C	0.410"	6	D3	3		✓		
X118	2"	XH	MK	3	C	0.410"	6	D3	3	IC (1)	✓		
X119	2"	XH	MK	3	C	0.410"	6	D3	3		✓		
X120	2"	XH	MK	3	C	0.410"	6	D3	3	S (1)	✓		
X121	2"	XH	MK	3	C	0.410"	6	D3	3		✓		
X122	2"	XH	MK	3	C	0.410"	6	D3	3	S (1)	✓		
X123	2"	XH	MK	3	C	0.410"	6	D3	3	HB (1)	✓		
X124	2"	XH	MK	3	C	0.410"	6	D3	3	Welder Stamp @ 4cm	✓		
X125	4"	XH	MK	3	C	0.529"	7	D3	3		✓		
X126	4"	XH	MG	3	C	0.529"	7	D3	3	IC (1)	✓		
X127	4"	XH	MG	3	C	0.529"	7	D3	3	P (1)	✓		
X128	4"	XH	MG	3	C	0.529"	7	D3	3		✓		
X129	4"	XH	MG	3	C	0.529"	7	D3	3		✓		
X130	4"	XH	MK	3	C	0.529"	7	D3	3		✓		
X131	4"	XH	MK	3	C	0.529"	7	D3	3	P (1)	✓		
X132	4"	XH	RK	3	C	0.529"	7	D3	3		✓		
X133	4"	XH	RK	3	C	0.529"	7	D3	3	P (1)	✓		

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	Assistant Logan Krastel			Inspected by

Client Name :	Bromley Mechanical Services	VIE Project # :	BMS-110	Hrs	3	Km's	
Address :	925 23 St SW, Medicine Hat, AB	Client PO#	88241	In		Daily Sub	
		Client WO#	35528	Out		Rooms	
Job Location:	VIE Shop Medicine Hat	Project #:	Package 2	In		Daily Meals	
Contractor:	Bromley Mechanical Services			Out		Late Meal	

Exposure Device:	Delta 880	WT	Wall Thickness	Weld Defects: 1. Slight, 2. Medium, 3. Reject					
Film Brand:	Agfa	WS	Welder Symbol	C	Crack	S	Slag	HL	High Low
Technique No >	RT001 Rev.1 Tech 03	EX	No. Exposures	POR	Porosity	AB	Arc Burn	LC	Low Cover
Max Source size >	3.64mm	SO	Source to Object distance or C= contact	IUC	Internal Undercut		IP	Incomplete Penetration	
IQI film/source side >	Film Side			EUC	External Undercut		EP	Excessive Penetration	
Type of material >	Carbon Steel	SSF	Max. Distance From Source Side of Object to Film	IC	Internal Concavity		HB	Hollow Bead	
Lead screens front >	0.010			LF	Lack Of Fusion		CR	Concave Root	
Lead screens back >	0.010	EW	ASTM Essential Wire #	BT	Burn Through				
Film per cassette >	1.000						weld ok	✓	
Film density >	2.05 - 3.8 H&D								

No.	Weld			WS	No. EX	SO	SSF	EW	Film Type	Tech	List Acceptable Imperfections	OK	Show Location of Unacceptable Imperfection	Reject X
	Size	WT												
X134	4"	XH	RK	3	C	0.529"	7	D3	3		✓			
X135	4"	XH	RK	3	C	0.529"	7	D3	3	Mig Wire	✓			
X136	4"	XH	MK	3	C	0.529"	7	D3	3		✓			
X137	4"	XH	M3	3	C	0.529"	7	D3	3		✓			
X138	4"	XH	M3	3	C	0.529"	7	D3	3		✓			
X139	4"	XH	CT	3	C	0.529"	7	D3	3		✓			
X140	4"	XH	CT	3	C	0.529"	7	D3	3		✓			
X141	4"	XH	CT	3	C	0.529"	7	D3	3		✓			
X142	4"	XH	CT	3	C	0.529"	7	D3	3	film mark @ 0cm	✓			
X143	4"	XH	CT	3	C	0.529"	7	D3	3		✓			
X144	4"	XH	CT	3	C	0.529"	7	D3	3		✓			
X145	4"	XH	MK	3	C	0.529"	7	D3	3		✓			
X146	4"	XH	MK	3	C	0.529"	7	D3	3		✓			
X147	4"	XH	CP	3	C	0.529"	7	D3	3		✓			
X148	4"	XH	CP	3	C	0.529"	7	D3	3		✓			
X149	3"	XH	CP	3	C	0.492"	7	D3	3		✓			
X150	3"	XH	CP	3	C	0.492"	7	D3	3		✓			
X151	4"	XH	CP	3	C	0.529"	7	D3	3		✓			
X152	4"	XH	CP	3	C	0.529"	7	D3	3		✓			
X153	4"	XH	MK	3	C	0.529"	7	D3	3	P (1)	✓			

 170118 Authorized by: (signature)	Acceptance Standards	Vision Technicians	 Rick Humphrey CGSB/SNT-TC-1A #12122 Level II RT
	ASME B31.3 N - 14	Rick Humphrey	
	Assistant	 Inspected by	
	Logan Krastel		

Client Name :	Bromley Mechanical Services	VIE Project # :	BMS-110	Hrs	3	Km's	
Address :	925 23 St SW, Medicine Hat, AB	Client PO#	88241	In		Daily Sub	
		Client WO#	35528	Out		Rooms	
Job Location:	VIE Shop Medicine Hat	Project #:	Package 2	In		Daily Meals	
Contractor:	Bromley Mechanical Services			Out		Late Meal	

Exposure Device:	Delta 880	WT	Wall Thickness	Weld Defects: 1. Slight, 2. Medium, 3. Reject					
Film Brand:	Agfa	WS	Welder Symbol	C	Crack	S	Slag	HL	High Low
Technique No >	RT001 Rev.1 Tech 03	EX	No. Exposures	POR	Porosity	AB	Arc Burn	LC	Low Cover
Max Source size >	3.64mm	SO	Source to Object distance or C= contact	IUC	Internal Undercut		IP	Incomplete Penetration	
IQI film/source side >	Film Side			EUC	External Undercut		EP	Excessive Penetration	
Type of material >	Carbon Steel	SSF	Max. Distance From Source Side of Object to Film	IC	Internal Concavity		HB	Hollow Bead	
Lead screens front >	0.010			LF	Lack Of Fusion		CR	Concave Root	
Lead screens back >	0.010	EW	ASTM Essential Wire #	BT	Burn Through		weld ok		
Film per cassette >	1.000						✓		
Film density >	2.05 - 3.8 H&D								




Weld No.	Weld Size	WT	WS	No. EX	SO	SSF	EW	Film Type	Tech	List Acceptable Imperfections	OK	Show Location of Unacceptable Imperfection	Reject
													X
X154	4"	XH	MK	3	C	0.529"	7	D3	3		✓		
X155	4"	XH	MK	3	C	0.529"	7	D3	3		✓		
X156	4"	XH	MK	3	C	0.529"	7	D3	3		✓		
X157	4"	XH	CP	3	C	0.529"	7	D3	3		✓		
X158	4"	XH	CP	3	C	0.529"	7	D3	3		✓		
X159	3"	XH	CP	3	C	0.492"	7	D3	3		✓		
X160	3"	XH	CP	3	C	0.492"	7	D3	3		✓		
X161	4"	XH	CP	3	C	0.529"	7	D3	3		✓		
X162	4"	XH	CP	3	C	0.529"	7	D3	3		✓		
X163	4"	XH	MK	3	C	0.529"	7	D3	3	film mark @ 8cm & 10cm	✓		
X164	4"	XH	MK	3	C	0.529"	7	D3	3	P (1)	✓		
X165	3"	STD	RK	3	C	0.408"	6	D3	3		✓		
X166	3"	STD	RK	3	C	0.408"	6	D3	3		✓		
X167	4"	XH	MK	3	C	0.529"	7	D3	3		✓		
X168	4"	XH	MK	3	C	0.529"	7	D3	3		✓		
X169	4"	XH	MK	3	C	0.529"	7	D3	3		✓		
X170	4"	XH	MK	3	C	0.529"	7	D3	3		✓		
X171	2"	XH	MK	3	C	0.410"	6	D3	3	P (1)	✓		
X172	2"	XH	MK	3	C	0.410"	6	D3	3		✓		
X173	2"	XH	MK	3	C	0.410"	6	D3	3	P (1)	✓		

 Authorized by: (signature)	Acceptance Standards	Vision Technicians	 Rick Humphrey CGSB/SNT-TC-1A #12122 Level II RT
	ASME B31.3 N - 14	Rick Humphrey	
	Assistant		Inspected by
	Logan Krastel		

Client Name :	Bromley Mechanical Services	VIE Project # :	BMS-110	Hrs	3	Km's	
Address :	925 23 St SW, Medicine Hat, AB	Client PO#	88241	In		Daily Sub	
		Client WO#	35528	Out		Rooms	
Job Location:	VIE Shop Medicine Hat	Project #:	Package 2	In		Daily Meals	
Contractor:	Bromley Mechanical Services			Out		Late Meal	

Exposure Device:	Delta 880	WT	Wall Thickness	Weld Defects: 1. Slight, 2. Medium, 3. Reject					
Film Brand:	Agfa	WS	Welder Symbol	C	Crack	S	Slag	HL	High Low
Technique No >	RT001 Rev.1 Tech 03	EX	No. Exposures	POR	Porosity	AB	Arc Burn	LC	Low Cover
Max Source size >	3.64mm	SO	Source to Object distance or C= contact	IUC	Internal Undercut		IP	Incomplete Penetration	
IQI film/source side >	Film Side			EUC	External Undercut		EP	Excessive Penetration	
Type of material >	Carbon Steel	SSF	Max. Distance From Source Side of Object to Film	IC	Internal Concavity		HB	Hollow Bead	
Lead screens front >	0.010			LF	Lack Of Fusion		CR	Concave Root	
Lead screens back >	0.010	EW	ASTM Essential Wire #	BT	Burn Through		weld ok		
Film per cassette >	1.000								✓
Film density >	2.05 - 3.8 H&D								




Weld No.	Weld Size	WT	WS	No. EX	SO	SSF	EW	Film Type	Tech	List Acceptable Imperfections	OK	Show Location of Unacceptable Imperfection		Reject X
X174	2"	XH	MK	3	C	0.410"	6	D3	3		✓			
X175	6"	XH	MP	3	C	0.624"	7	D3	3		✓			
X176	6"	XH	MP	3	C	0.624"	7	D3	3		✓			
X177	6"	XH	MP	3	C	0.624"	7	D3	3		✓			
X178	6"	XH	MP	3	C	0.624"	7	D3	3		✓			
X179	1"	S160	HR	3	15"	0.442"	7	D3	3		✓			
X180	1"	S160	JM	3	15"	0.442"	7	D3	3		✓			
X181	2"	S160	JM	4	C	0.536"	7	D3	3		✓			
X182	2"	S160	JM	4	C	0.536"	7	D3	3		✓			
X183	2"	S160	HR	4	C	0.536"	7	D3	3		✓			
X184	2"	S160	HR	4	C	0.536"	7	D3	3		✓			

 17-01-18 Authorized by: (signature)	Acceptance Standards ASME B31.3 N - 14	Vision Technicians Rick Humphrey	 Rick Humphrey CGSB/SNT-TC-1A #12122 Level II RT
	Assistant Logan Krastel	 Inspected by	

Client Name :	Bromley Mechanical Services	VIE Project # :	BMS-110	Hrs	1	Km's	
Address :	925 23 St SW, Medicine Hat, AB	Client PO#	88241	In		Daily Sub	
		Client WO#	35528	Out		Rooms	
Job Location:	VIE Shop Medicine Hat	Project #:	Package 2	In		Daily Meals	
Contractor:	Bromley Mechanical Services			Out		Late Meal	

Exposure Device:	Delta 880	WT	Wall Thickness	Weld Defects: 1. Slight, 2. Medium, 3. Reject					
Film Brand:	Agfa	WS	Welder Symbol	C	Crack	S	Slag	HL	High Low
Technique No >	RT001 Rev.1 Tech 03	EX	No. Exposures	POR	Porosity	AB	Arc Burn	LC	Low Cover
Max Source size >	3.64mm	SO	Source to Object distance or C= contact	IUC	Internal Undercut		IP	Incomplete Penetration	
IQI film/source side >	Film Side			EUC	External Undercut		EP	Excessive Penetration	
Type of material >	Carbon Steel	SSF	Max. Distance From Source Side of Object to Film	IC	Internal Concavity		HB	Hollow Bead	
Lead screens front >	0.010			LF	Lack Of Fusion		CR	Concave Root	
Lead screens back >	0.010	EW	ASTM Essential Wire #	BT	Burn Through				
Film per cassette >	1.000						weld ok		
Film density >	2.05 - 3.8 H&D								✓

Weld			WS	No. EX	SO	SSF	EW	Film Type	Tech	List Acceptable Imperfections	OK	Show Location of Unacceptable Imperfection	Reject X
No.	Size	WT											
X2R	2"	XH	SG	3	C	0.410"	6	D3	3	P (1)	✓		
X26R	2"	XH		3	C	0.410"	6	D3	3		✓		

 17018 Authorized by: (signature)	Acceptance Standards	Vision Technicians	 Rick Humphrey CGSB/SNT-TC-1A #12122 Level II RT
	ASME B31.3 N - 14	Rick Humphrey	
	Assistant		
	Logan Krastel		Inspected by

Heat Treatment Instructions

Customer:	Seven Generations / Arc Resources	Date:	1/9/2018
WO No.(s):	WO-35551, 35528		

COMPONENT DESCRIPTION:

Dwg No. / Line No. / Serial No.	Diameter	Thk. (in.)	Material	Length	Weight (lbs)
WO-35551 Pkgs 1-4 spool 4	3"	0.300	P1	359"	1000
WO-35528 Pkg 2 spool 20a&b	3"	0.216	P1	87 1/2	400

TYPE OF HEAT TREATMENT: **PRESSURE VESSEL STRESS RELIEF P-No. 1**

HEATING

Temperature to be raised from 800°F (427°C) to 1150°F (621°C) at a maximum rate of

400 °F/hr, (**204** °C /hr)

NOTE: THIS VALUE MUST NEVER EXCEED 400°F (222°C) PER HOUR.

[Calculated rate = 400 degrees F /hr. (222 degrees C/hr) divided by the maximum metal thickness of the shell or head plate in inches.]

HOLDING

Temperature to be held at a minimum of 1150°F (621°C) for: **60** minutes

[Holding time to be determined by Table UCS-56 for Nominal Thickness as specified in UW-40(f)]

COOLING

Temperature to be lowered from 1150°F (621°C) to 800°F (427°C) at a maximum rate of

500 °F/hr, (**260** °C /hr)

NOTE: THIS VALUE MUST NEVER EXCEED 500°F (278°C) PER HOUR.


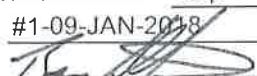
[Calculated rate = 500 degrees F /hr. (278 degrees C/hr) divided by the maximum metal thickness of the shell or head plate in inches.]

From 800°F (427°C) items may be cooled in still air

ADDITIONAL REQUIREMENTS

1. Job Number and description required on heat treatment charts along with the operator's signature and date.
2. Reporting of thermocouple attachment method and location and verification of furnace thermocouple calibration is required.
3. A sufficient number of thermocouples shall be located to control and maintain uniform distribution of temperature on all vessels and parts. Thermocouples shall be directly attached to the item or provision shall be made for thermocouple placement at bottom, centre and top of the furnace charge in accordance with the ASME Code
4. During the heating period, there shall not be a greater variation in temperature throughout the portion of the vessel being heated than 250°F (139°C) within any 15 ft. (4.6m) interval of length. An adequate number of thermocouples must be used to ensure this Code requirement is met. This limitation is also applicable to the temperature variations between the different thicknesses of various vessel components
5. During the holding period, there shall not be a greater difference than 150°F (83°C) between the highest and lowest temperature throughout the portion of the vessel being heat treated, except where the range is further limited by these instructions.
6. If Capacitor Discharge welding is used to attach thermocouples an ASME Code Section IX Welding Procedure Specification is required (WPS qualification is not required), and the energy output must be limited to 125 W-Seconds.
7. The method of thermocouple removal shall not damage the heat treated item.

APPROVALS

Quality Control Inspector Signature  Date 100118
 Thermocouple Attachment Method/Locations Capacitor Discharge/per UW 40
 Furnace Heat Number: #1-09-JAN-2018
 Furnace Operator Signature:  Date: 1/9/18



9753 Spring St W Medicine Hat AB T1A 8R1

HEAT TREATMENT SERVICES

Date Started:	9-Jan-18	Date Finished:	9-Jan-18
Customer/WO Ref:	Stevin Generators / Arc Resources	WO-35551-35528	
Furnace S/N	23640		
Furnace Cal Date:	9/1/2017		
Procedure:	Internal PWHT Instructions/Cust Supplied		
Heat Treating Per:	A S M E		

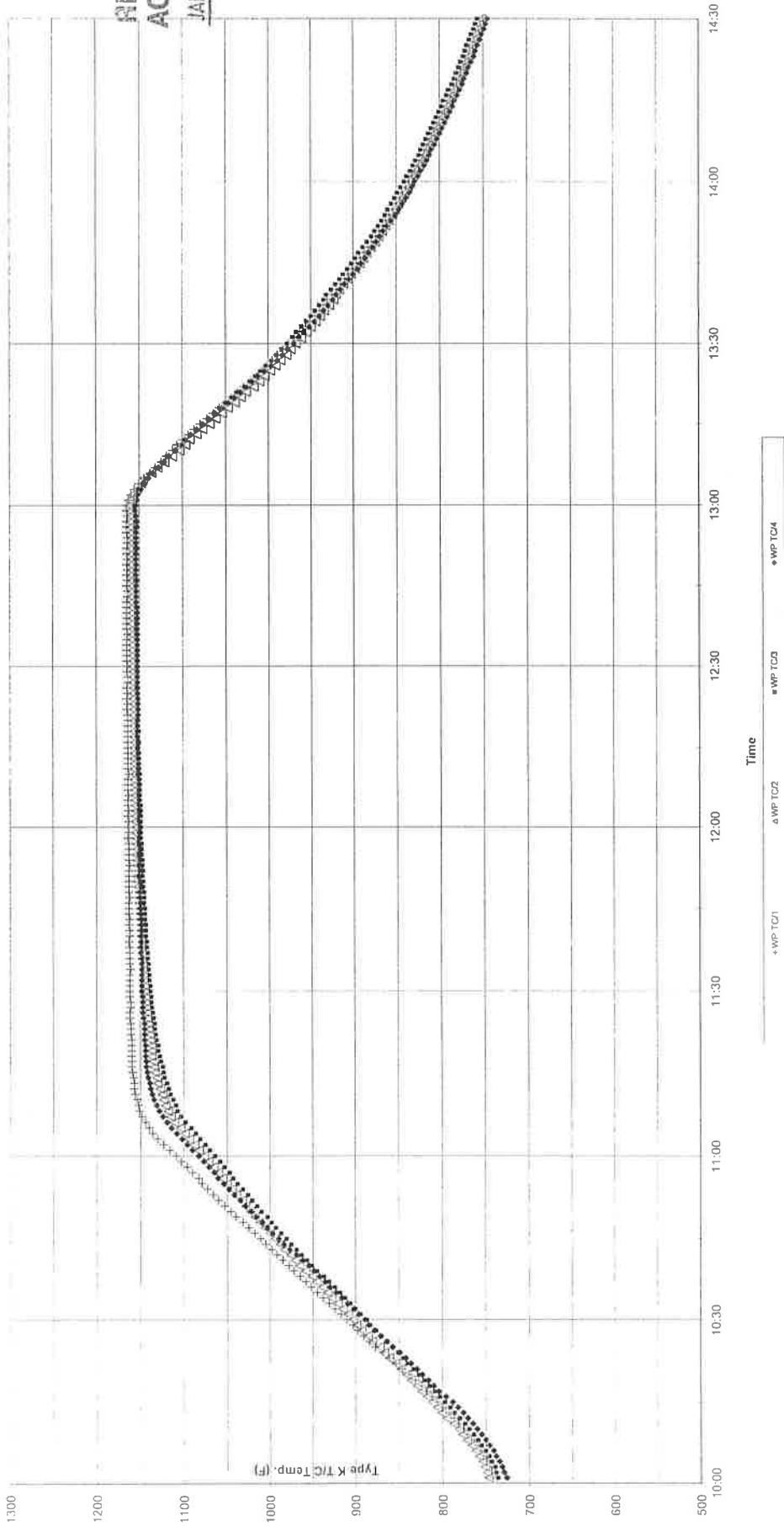
Rate of Rise:	800°F to 1150°F at 400°F per hour.
Holding Temp:	1150°F
Holding Time:	60 min. Minimum
Cooling Rate:	1150°F to 800°F at 500°F per hour
Material(s):	P1
Operator:	Barry Guilford

Notes	WO-35551 Phys 1-4 spool # 4 WO-35528 Phys 2 spool # 20#4b
-------	--

Signature: *[Signature]* Date: *Jan 9/18*

Heat Number: P1-09-JAN-2018

HEAT TREATMENT RECORD



RECEIVED
ACCEPTED
JAN 10 2018

Heat Treatment Instructions

Customer:	Arc Resources	Date:	1/17/2018
WO No.(s):	WO-35528		

COMPONENT DESCRIPTION:

Dwg No. / Line No. / Serial No.	Diameter	Thk. (in.)	Material	Length	Weight (lbs)
WO-35528 Package 2 spools	2,3,4,6"	0.432	P1	217"	5000

TYPE OF HEAT TREATMENT: **PRESSURE VESSEL STRESS RELIEF P-No. 1**

HEATING

Temperature to be raised from 800°F (427°C) to 1150°F (621°C) at a maximum rate of

400 °F/hr, (**204** °C /hr)

NOTE: THIS VALUE MUST NEVER EXCEED 400°F (222°C) PER HOUR.

[Calculated rate = 400 degrees F /hr. (222 degrees C/hr) divided by the maximum metal thickness of the shell or head plate in inches.]

HOLDING

Temperature to be held at a minimum of 1150°F (621°C) for: **60** minutes

[Holding time to be determined by Table UCS-56 for Nominal Thickness as specified in UW-40(f)]

COOLING

Temperature to be lowered from 1150°F (621°C) to 800°F (427°C) at a maximum rate of

500 °F/hr, (**260** °C /hr)

NOTE: THIS VALUE MUST NEVER EXCEED 500°F (278°C) PER HOUR.

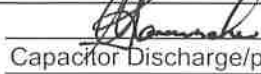
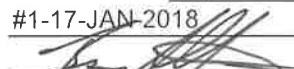
[Calculated rate = 500 degrees F /hr. (278 degrees C/hr) divided by the maximum metal thickness of the shell or head plate in inches.]

From 800°F (427°C) items may be cooled in still air

ADDITIONAL REQUIREMENTS

1. Job Number and description required on heat treatment charts along with the operator's signature and date.
2. Reporting of thermocouple attachment method and location and verification of furnace thermocouple calibration is required.
3. A sufficient number of thermocouples shall be located to control and maintain uniform distribution of temperature on all vessels and parts. Thermocouples shall be directly attached to the item or provision shall be made for thermocouple placement at bottom, centre and top of the furnace charge in accordance with the ASME Code
4. During the heating period, there shall not be a greater variation in temperature throughout the portion of the vessel being heated than 250°F (139°C) within any 15 ft. (4.6m) interval of length. An adequate number of thermocouples must be used to ensure this Code requirement is met. This limitation is also applicable to the temperature variations between the different thicknesses of various vessel components
5. During the holding period, there shall not be a greater difference than 150°F (83°C) between the highest and lowest temperature throughout the portion of the vessel being heat treated, except where the range is further limited by these instructions.
6. If Capacitor Discharge welding is used to attach thermocouples an ASME Code Section IX Welding Procedure Specification is required (WPS qualification is not required), and the energy output must be limited to 125 W-Seconds.
7. The method of thermocouple removal shall not damage the heat treated item.

APPROVALS

Quality Control Inspector Signature  Date Jan 18, 2018
 Thermocouple Attachment Method/Locations Capacitor Discharge/per UW 40
 Furnace Heat Number: #1-17-JAN-2018
 Furnace Operator Signature:  Date: 1/17/18



925 23 Street S.W. Medicine Hat, AB T1A 6R1

HEAT TREATMENT SERVICES

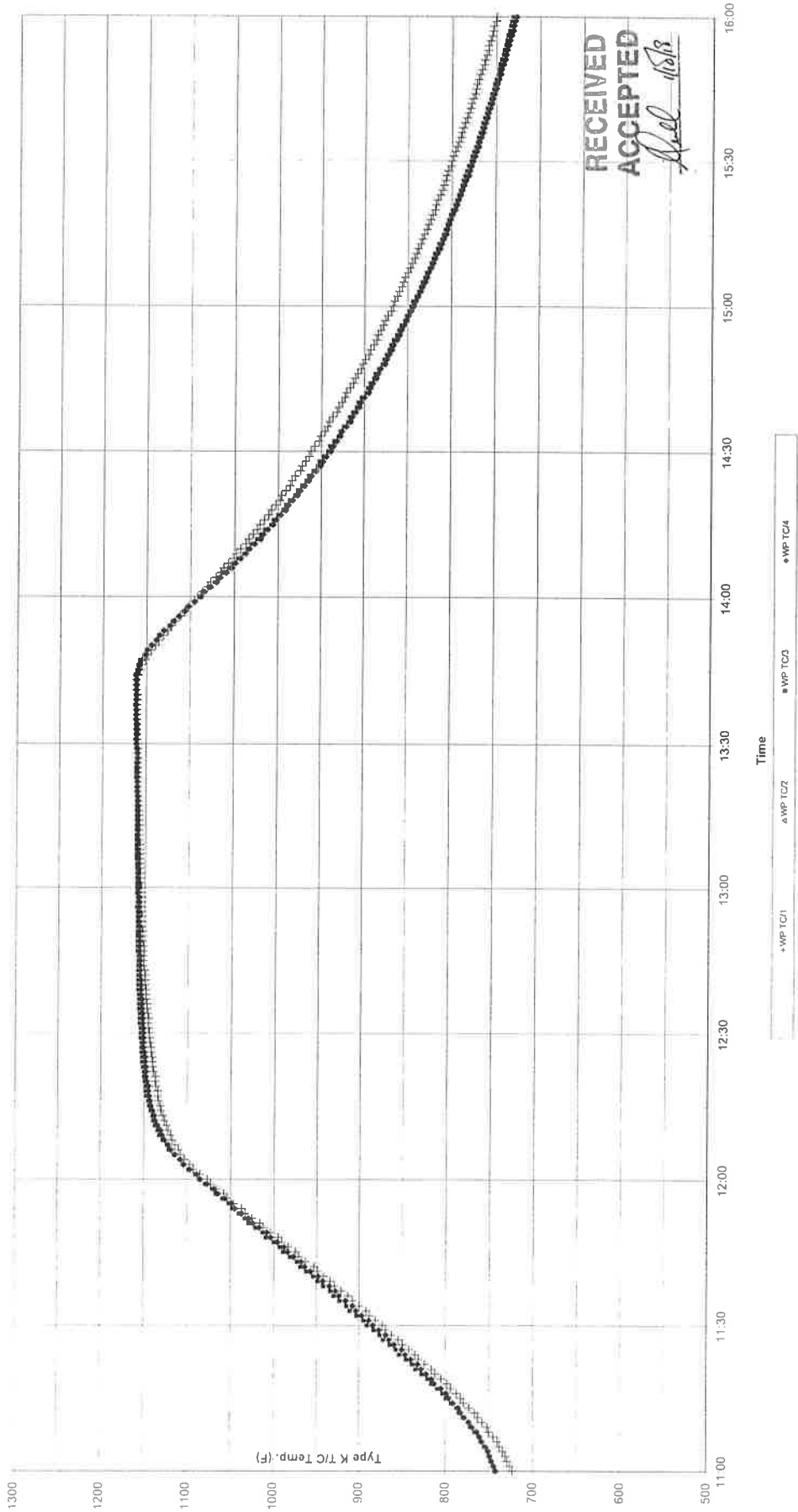
Date Started:	17-Jan-18	Date Finished:	17-Jan-18
Customer/WO Ref:	Arc Resources	WO-35528	
Furnace S/N	23600		
Furnace Cal Date:	9/7/2017		
Procedure:	Internal PWHT Instructions/Cust Supplied		
Heat Treating Per:	A. S.M.E		

Rate of Rise:	600°F to 1150°F at 400°F per hour
Holding Temp:	1150°F
Holding Time:	60 min. Minimum
Cooling Rate:	1150°F to 800°F at 500°F per hour
Material(s):	P1
Operator:	Barry Gutfriend

Notes:	WO-35528 Pickle 2 spoils
--------	--------------------------

Signature:	<i>[Signature]</i>	Date:	Jan 17/18
Heat Number:	#1517-JAN-2018		

HEAT TREATMENT RECORD



RECEIVED
ACCEPTED
[Signature]



SUPERHEAT FGH CONTROL UNIT CERTIFICATE OF CALIBRATION

Asset Number _____ Supercontroller Number 23600

Range 0 - 2000°F Sensor Type K

Calibration Procedure Number C1-TP-02-CMTE (Rev. 2)

Date September 2, 2017 Calibration Due February 28, 2018

This instrument has been calibrated within the manufacturer's specifications.
These specifications state that the maximum allowable error is $\pm 6^{\circ}\text{F}$
During calibration, if the "°F As Found"/"°F As Left" numbers (values) are the same and no adjustments have been made, only one number (value) will be noted.

Zone 1A	Input Signal	200	600	1000	1400	1800
	°F As Found	203	603	1003	1403	1803
	°F As Left					
Zone 7A	Input Signal	200	600	1000	1400	1800
	°F As Found					
	°F As Left					
Zone 1B	Input Signal	200	600	1000	1400	1800
	°F As Found					
	°F As Left					
Zone 7B	Input Signal	200	600	1000	1400	1800
	°F As Found					
	°F As Left					

Environmental Conditions: Temperature (°F): 50.0

The above unit has been calibrated and tested. It is directly traceable to the National Institute of Standards & Technology (N.I.S.T) or the National Research Council (N.R.C).

Max Kohut

Calibrated By

Signature

MEASURING & TEST EQUIPMENT USED

Make: FGH Type: Ezecal Model: MK3

Serial No.	Cert. Date	Due Date
3450	April 28, 2017	October 27, 2017



C000000053189



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CERTIFICATE OF CONFORMANCE

INVOICED TO:	AIRCOM INSTRUMENTATION	DELIVERED TO:	AIRCOM INSTRUMENTATION
	ATTN: ACCTS PAYABLE 9328-37 AVENUE EDMONTON, AB, CANADA T6E5K3		9328-37 AVENUE EDMONTON, AB, CANADA T6E5K3

CERTIFICATE NO:	DATE:	CUSTOMER PO:	SALES ORDER:	PAGE:	
C000000053189	8-Jan-14	20321	P105099	1 of 1	
DATE OF MFG:					
1/8/2014					
ITEM	PRODUCT	LOT #	# of Spools	Shipping QTY	Total
2	FW6381 CEFIR2200 ULTRA-20-KK Your Part N215-241	15014-115	2	1000ft	1000ft
<p>CALIBRATION RESULTS ARE TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) AND MEET DEVIATION TOLERANCES AS DEFINED IN ISA MC96.1 (FORMERLY ANSI) AND ASTM-E-230.</p> <p>ALL PRODUCTS MANUFACTURED IN THE USA.</p>					

This is to certify that the materials furnished on this shipment are in conformance with the requirements, specifications, and drawings of the above referenced customer purchase order. Inspection and test records are on file and available for customer review. This product contains no metallic Mercury or Mercury compounds and is free from Mercury contamination.

Signed by:

Date:

1/8/2014

PRESSURE-TEST REPORT

DATE OF TEST: JANUARY 10/2018 HYDRO-TEST NO.: ARC-528

CUSTOMER: ARC RESOURCES LOCATION: Bromley Mechanical Services
(LSD OR ADDRESS)

WORK ORDER NO.: 35528-2 SIZE: DIAMETER: Various
LENGTH: Various

Spool NO.: 20A-20B

NUMBER OF ITEMS TESTED: 2

HYDRO-TEST PRESSURE: 428 PSI OR 2951 KPA

MEDIUM: WATER MEDIUM TEMPERATURE: See Chart
SEE

TIME: HYDRO-TEST ON 0845 A M AMBIENT TEMP: CHART PRESSURE: 440 INIT: [Signature]

HYDRO-TEST OFF 0859 A M AMBIENT TEMP: SEE PRESSURE: 440 INIT: [Signature]

LENGTH OF TEST: 14. MINUTES

TEST GAUGE No.: _____ FLU 16 RANGE: 0 - 10,000 PSI

TEST GAUGE No.: _____ FLU 12 RANGE: 0-10000 PSI

CHART RECORDER NO.: _____ RANGE: _____

QCI WITNESSED BY: [Signature]

OWNER WITNESSED BY: DR HCPE [Signature]

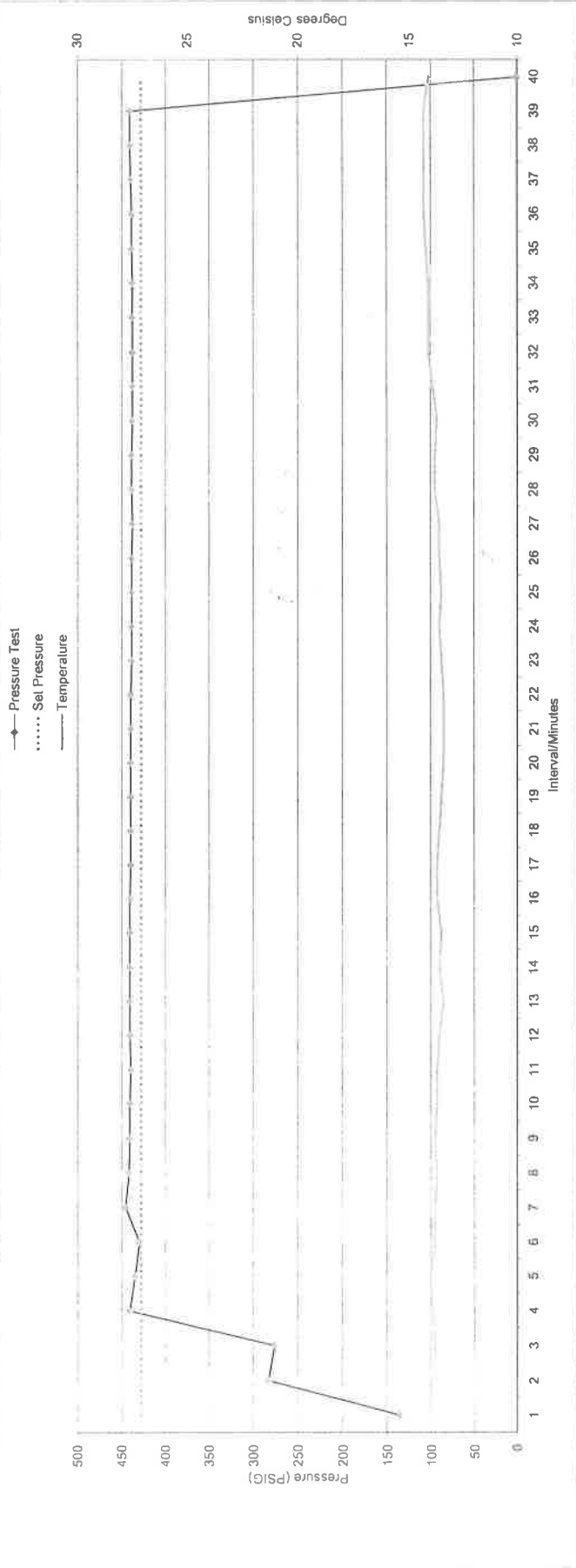
QCM APPROVED BY: [Signature]



Date Started	1/10/2018	Date Finished	1/10/2018
Customer / WO Ref:	ARC Resources/WO: 35528-2		
Notes:	Spools 20a & 20b @ +28 Psi 10 Jan 18		
Gauge Details	FLUKE, 700G, 3820016, 4.04		
Interval	1 minutes		

Witnessed by:	DEREK HOPE
Approved by:	FRANK MCHUGH

PRESSURE TEST RECORD



PRESSURE-TEST REPORT

DATE OF TEST: JANUARY 18/2018 HYDRO-TEST NO.: ARC-28-2

CUSTOMER: ARC RESOURCES LOCATION: Bromley Mechanical Services
(LSD OR ADDRESS)

WORK ORDER NO.: 35528-2 SIZE: DIAMETER: Various
LENGTH: Various

SERIAL NO.: Spools- 21

NUMBER OF ITEMS TESTED: 1

HYDRO-TEST PRESSURE: 428 PSI OR 2951 KPA

MEDIUM: WATER MEDIUM TEMPERATURE: See Chart
SEE

TIME: HYDRO-TEST ON 12:30 A M AMBIENT TEMP: CHART PRESSURE: 428 Psi INIT: [Signature]

HYDRO-TEST OFF 12:46 A M AMBIENT TEMP: SEE PRESSURE: 428 Psi INIT: [Signature]

LENGTH OF TEST: 16 MINUTES

TEST GAUGE No.: FLU 10 RANGE: 0 - 10,000 PSI

TEST GAUGE No.: FLU 14 RANGE: 0-10000 PSI

CHART RECORDER NO.: _____ RANGE: _____

QCI WITNESSED BY: [Signature]

OWNER WITNESSED BY: D.R. Hope [Signature]

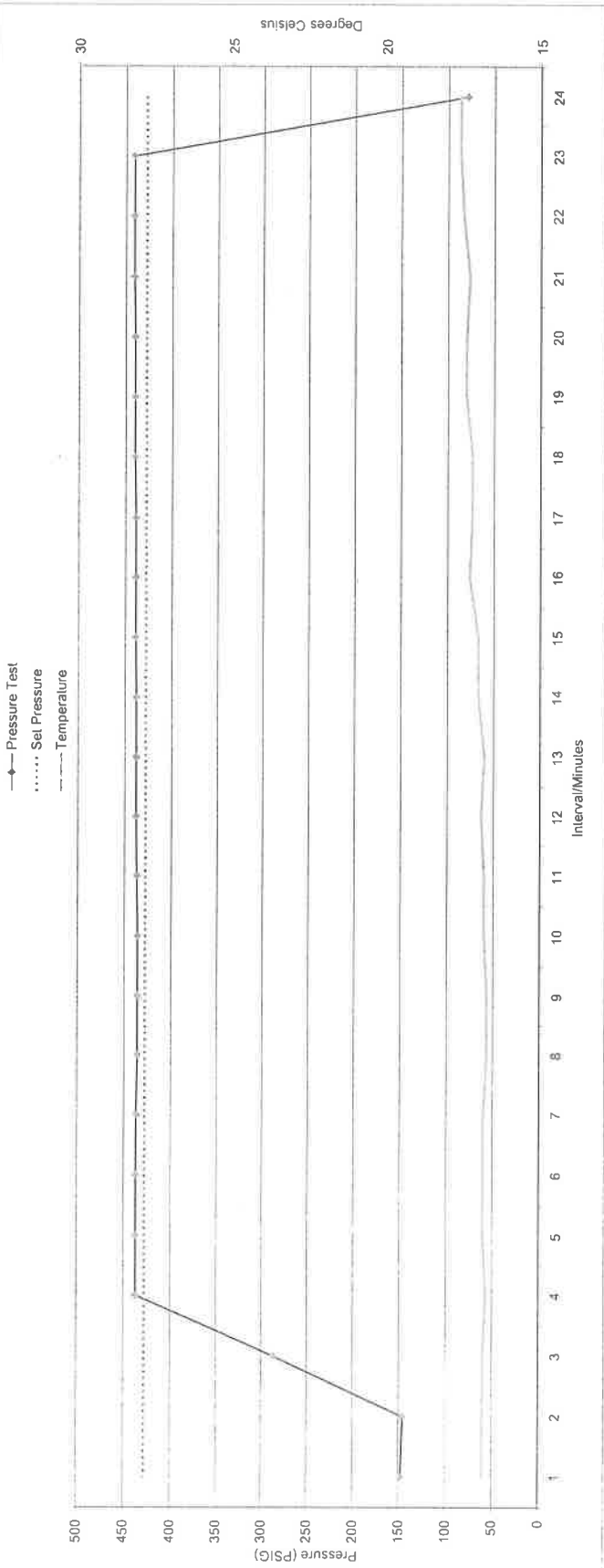
QCM APPROVED BY: [Signature]



Date Started	1/18/2018	Date Finished	1/18/2018
Customer / WO Ref:	Arc Resources/WO# 35525-2		
Notes:	Spools 20a-20b & 21 @ 4.28FSI 18 Jan 2018		
Gauge Details	FLUJO	FLUKE	700G, 3486293, 4.04
Interval	1 minutes		

Witnessed by:	DEREK HOPE
Approved by:	M. KANEWISCHER

PRESSURE TEST RECORD



PRESSURE-TEST REPORT

DATE OF TEST: JANUARY 18/2013 HYDRO-TEST NO.: ARC-28-2

CUSTOMER: ARC RESOURCES LOCATION: Bromley Mechanical Services
(LSD OR ADDRESS)

WORK ORDER NO.: 35528-2 SIZE: DIAMETER: Various
LENGTH: Various

SERIAL NO.: Spools 1-19

NUMBER OF ITEMS TESTED: 39

HYDRO-TEST PRESSURE: 2160 PSI OR 14893 KPA

MEDIUM: WATER MEDIUM TEMPERATURE: See Chart
SEE

TIME: HYDRO-TEST ON 12:34 A M AMBIENT TEMP: CHART PRESSURE: 2160 Psi INIT: [Signature]

HYDRO-TEST OFF 12 50 A M AMBIENT TEMP: SEE PRESSURE: 2160 Psi INIT: [Signature]

LENGTH OF TEST: 16 MINUTES

TEST GAUGE No.: FLU 17 RANGE: 0 - 10,000 PSI

TEST GAUGE No.: FLU 6 RANGE: 0 - 10 000 PSI

CHART RECORDER NO.: _____ RANGE: _____

QCI WITNESSED BY: [Signature]

OWNER WITNESSED BY: [Signature]

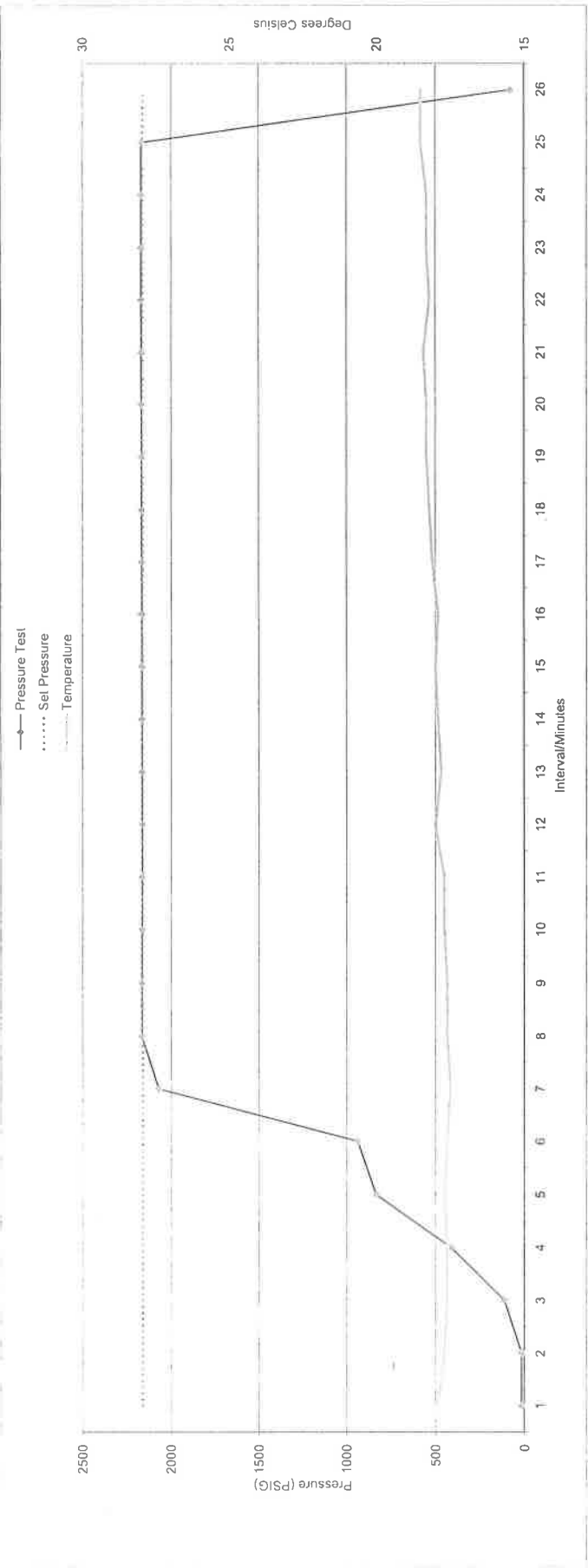
QCM APPROVED BY: [Signature]



Date Started	1/18/2018	Date Finished	1/18/2018
Customer / WO Ref:	Arc Resources/WO 35528-2		
Notes:	Spools 1-19 @ 2100 PSI 18 Jan 2018		
Gauge Details	FLUKE 700G 3812477-4.04		
Interval	1 minutes		

Witnessed by:	DEREK HOPE
Approved by:	M. KANEWISCHER

PRESSURE TEST RECORD



FUNCTION TEST RECORD

DATE OF TEST: 20 FEB 18

CUSTOMER: Arc Resources

WORK ORDER NO.: 35528-2

VESSEL SERIAL NO.: 35528-2, 3528-4

WITNESSED BY: DR Hope  DATE: 20 FEB 18

PERFORMED BY: Fred Middleton ³⁹ DATE: 20 FEB 18

COMPANY: Prairiehorn Controls

SPARTAN CONTROLS

PRESSURE MANAGEMENT INSPECTION TEST REPORT

CUSTOMER		ORDER#	WO#	Metal Tag:		
Bromley Mechanical Services		2955369	2955369-004			
PO:	PO-88195			Sup. Tag:		
Req#	WO-35528: ARC					
MODEL:	TYPE:	VALVE SIZE:	ORIFICE	FactorySerial#	CRN#	
1E2JOS-E45J	JOS	1"600RFx2"150RF	E	1101-1708-093133	0G15494.5CL	
SERVICE:						
SERVICE:	Gas	StampSymbol:	UV NB			
CAPACITY:	5612 SCFM	Metric Only:	No			
<u>Set Pressure</u>	<u>Constant BP</u>	<u>Variable BP</u>	<u>Diff</u>	<u>Cold Diff</u>	<u>Temp. Corr.</u>	<u>Temperature</u>
1440 PSIG	0 PSIG	0 PSIG	1440 PSIG	1440 PSIG	0 PSIG	130 F (54 C)
MATERIAL/HEAT NUMBER ASSIGNMENT:						
Body	C1921	Nozzle	SD325A	Valve Inspected for Hvdro Tested Parts		
Bonnet	C2173	Disc		AM		
PERFORMANCE TEST DATA:						
TEST FLUID	<input checked="" type="checkbox"/> Air	Final Test Pressure	1438.9	Upper B.D.R. Setting:	N/A	Notches
	<input type="checkbox"/> Water		PSIG	Lower B.D.R. Setting:	-5	Notches
	<input type="checkbox"/> Air Over Water	Shop Test Gauges Used: 1. S11V 2. S11V				
	<input type="checkbox"/> Saturated Steam					
BACK PRESSURE TEST:						
<input type="checkbox"/> Not Applicable, (Open Bonnet / Cap Design)						
<input checked="" type="checkbox"/> 30 PSIG Air						
SEAT TIGHTNESS TEST: API-527						
TEST FLUID	Req'd At	Leak Test Pressure	1296	Tech Tested		
<input checked="" type="checkbox"/> Air	<input checked="" type="checkbox"/> 90%	No Visible Leaks	PSIG	Date Tested	DEC 29, 2017	
<input type="checkbox"/> Water	<input type="checkbox"/> 95%	Leak Rate	14	CI Final Inspection		
<input type="checkbox"/> Air Over Water	<input type="checkbox"/> 5 PSIG < Set					
<input type="checkbox"/> Saturated Steam						
FOR WITNESS TESTING ONLY						
Tested By: _____			Date: _____			
Customer Witness: _____			Spartan Witness: _____			

WO 35528

SPARTAN CONTROLS

PRESSURE MANAGEMENT INSPECTION TEST REPORT

CUSTOMER	ORDER#	WO#	Metal Tag:
Bromley Mechanical Services	2955369	2955369-002	
PO:	PO-88195		
Req#	WO-35528: ARC		Sup. Tag:

MODEL:	TYPE:	VALVE SIZE:	ORIFICE	FactorySerial#	CRN#
1E2JOS-E45J	JOS	1"600RFx2"150RF	E	1101-1708-093138	OG15494.5CL

SERVICE:

SERVICE: Gas StampSymbol: UV NB

CAPACITY: 5612 SCFM Metric Only: No

Set Pressure	Constant BP	Variable BP	Diff	Cold Diff	Temp. Corr.	Temperature
1440 PSIG	0 PSIG	0 PSIG	1440 PSIG	1440 PSIG	0 PSIG	130 F (54 C)

MATERIAL/HEAT NUMBER ASSIGNMENT:

Body: C2035 Nozzle: SD325A Valve Inspected for Hydro Tested Parts: AM

Bonnet: H3034 Disc:

PERFORMANCE TEST DATA:

TEST FLUID: Air Water Air Over Water Saturated Steam

Final Test Pressure: 1438.1 PSIG

Upper B.D.R. Setting: N/A Notches

Lower B.D.R. Setting: -5 Notches

Shop Test Gauges Used: 1. SILV 2. SILJ

BACK PRESSURE TEST:

Not Applicable, (Open Bonnet / Cap Design)

30 PSIG Air

SEAT TIGHTNESS TEST: API-527

TEST FLUID: Air Water Air Over Water Saturated Steam

Req'd At: 90% 95%

Leak Test Pressure: 1296 PSIG

No Visible Leaks:

Leak Rate: 32 B.P.M.

Tech Tested: C. V. [Signature]

Date Tested: DEC 29, 2017

CI Final Inspection: [Signature]

FOR WITNESS TESTING ONLY

Tested By: _____ Date: _____

Customer Witness: _____ Spartan Witness: _____

WO 35528

**BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT**

DIA SIZE OR WITH: 2"
 NPS OD ID

INSPECTED BY: MICHAEL QUINN

GRADE: SA 106B

DATE: DECEMBER 13/2017

HEADS 2:1
 HEMI
 WELD CAP
 OTHER

LENGTH: 40'
 THICKNESS: 80
 PIPE PUBLISHED NO: 0.218"
 PLATE NOM: _____

P.O.#: PO-88056

SUPPLIER: BHD TUBULAR LIMITED

SHELL:
 PIPE: → NDE BY MANUFACTURER
 PLATE: HYDRO YES NDE NO
 REPAD: NO YES
 STRUCT.: NO NO
 OTHER: YES YES

PART ID#: SPI 29719

Weight per foot for pipe over 4"
5.02

REQ. MIN TK: _____

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35902	418'	A7387	0.200"	0.216"	0.210"	0.210"	0.212"	OK	OK	OK	ML
				0.214"	0.217"	0.219"	0.210"	OK	OK	OK	ML
				0.219"	0.219"	0.219"	0.221"	OK	OK	OK	ML
				0.219"	0.212"	0.218"	0.219"	OK	OK	OK	ML
				0.220"	0.212"	0.219"	0.219"	OK	OK	OK	ML
				0.220"	0.219"	0.210"	0.214"	OK	OK	OK	ML
				0.220"	0.210"	0.213"	0.215"	OK	OK	OK	ML

W/O# _____

RECEIVED & ACCEPTED BY: *[Signature]*

REQUIRED CODE MARKINGS: _____

CUSTOMER: BMS STOCK

DATE: 8/22/18

**MAHARASHTRA SEAMLESS LIMITED-MADE IN INDIA
ALL MARKING STENCILED ONTO PIPE BY MANUFACTURE**



MAHARASHTRA SEAMLESS LIMITED
WORKS (MILL) TEST CERTIFICATE
 DIN:50049:3.1. B/EN:10204:3.1

QCF.20A

To No : MSL-7/QC/ 0580A/2017 Customer : BHD TUBULAR LTD.
 Date : 25-MAY-17
 Specification : ASME/ASTM SA/A 106 B (2015), API 5L GR.B/X-42
 PSL-1 (2012), CSA 2245.1 GR.290 CAT-I(2014)
 Process/Product: HOT FINISH SEAMLESS Carbon Steel Pipes P.O. No : 116530 Dt. 17-MAR-17
 W.O. No : 6160294

DESCRIPTION								Hydro Test Pressure at 5 Sec	Bend Test	Flattening Test	Flaring Test	Drift Test	Crushing Test
Sl NO	Material/Item Code	SIZE (Inch)	Length Range (Feet/Mtr)	Heat No.	Wt Of PCS	Length Feet/Mtr	End Finish						
1		2.375 X 0.218	38	A7310	217	8246	BEVEL	3000 PSI	OK	NA	NA	NA	NA
2		2.375 X 0.218	38	A7354	213	8094	BEVEL	3000 PSI	OK	NA	NA	NA	NA
3		2.375 X 0.218	38	A7369	32	1216	BEVEL	3000 PSI	OK	NA	NA	NA	NA
4		2.375 X 0.218	38	A7378	247	9386	BEVEL	3000 PSI	OK	NA	NA	NA	NA
5		2.375 X 0.218	38	A7387	256	9728	BEVEL	3000 PSI	OK	NA	NA	NA	NA

PHYSICAL PROPERTIES								CHEMICAL COMPOSITION (%)															
Sl No	Heat No	YST (PSI)	UTS (PSI)	E1 (%)	Hardness HRB	Impact Test Charpy V-notch	LA/PA	C	Mn	Si	P	S	Cr	Mo	Ni	V	Cu	Al	Ti	Nb	CE		
G.L. = 2", G.W 3/4" - L at room temp																							
Required (Max)								.28	1.06		.03	.03	.4	.15	.4	.08	.4					.4	
Required (Min)	42100	60200							.29	.1													

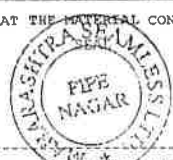
1	A7310	59719	71805	32.00	74 - 76		LA	.140	.690	.180	.012	.003	.311	.008	.030	.003	.005	.034	.001	.001	.322
							PA	.135	.682	.182	.012	.004	.320	.005	.031	.003	.005	.034	.001	.001	.318
							LA	.138	.675	.193	.011	.004	.348	.008	.034	.003	.005	.033	.001	.001	.323
							PA	.140	.680	.240	.012	.004	.321	.002	.010	.003	.007	.034	.001	.001	.320
2	A7354	58991	74767	34.00	74 - 76		LA	.125	.672	.230	.011	.005	.330	.003	.013	.003	.005	.037	.002	.001	.315
							PA	.137	.682	.240	.013	.005	.340	.003	.014	.003	.005	.038	.002	.001	.321
3	A7369	56310	71123	32.00	74 - 76		LA	.130	.740	.240	.010	.004	.346	.002	.009	.003	.005	.047	.001	.001	.325
							PA	.127	.720	.230	.012	.005	.322	.003	.035	.003	.005	.041	.002	.001	.315
							LA	.130	.712	.240	.013	.005	.330	.003	.032	.003	.005	.042	.002	.001	.318
							PA	.150	.700	.190	.012	.007	.320	.005	.012	.003	.017	.038	.001	.002	.334
4	A7378	59002	72040	34.00	74 - 76		LA	.158	.675	.189	.016	.005	.325	.003	.050	.004	.010	.029	.001	.001	.341
							PA	.152	.672	.193	.015	.005	.330	.003	.050	.005	.009	.026	.002	.001	.335
5	A7387	57129	72173	32.00	74 - 76		LA	.130	.710	.200	.019	.003	.352	.002	.010	.005	.008	.035	.001	.001	.321
							PA	.135	.660	.230	.017	.005	.304	.004	.054	.004	.009	.024	.002	.001	.311
							PA	.132	.670	.233	.018	.005	.312	.004	.050	.004	.010	.025	.002	.001	.312

Dimensions : Outside diameter, thickness, weight, length conforms to above specification.
 Coating : All Pipes are coated with rust preventive from outside surface only.
 N.D.T. : Not Applicable
 Heat Treatment : Not applicable
 Raw material : Fully killed
 Marking/Stencilling : MSL ASME (B36.10M) ASTM/ASME A/SA 106 B, CSA GR.290 CAT-1 SS, API 5L B/X-42 PSL-1, BE SMLS OD 2.375 INCH X WT 0.218 INCH X LENGTH (IN FEET) HPS HEAT NO. ... 3000 PSI+WEIGHT=5.03 LB/FT+MADE IN INDIA+BHD TUBULAR LTD PO#116530+PIPE NO.
 Remarks : Material conforms to NACE MR-0175/MR-0103 restricted to Sulphur contents 0.01% max and Hardness 22 HRC max.

CERTIFY THAT THE MATERIAL CONFORMS TO ABOVE SPECIFICATION.

FOR MAHARASHTRA SEAMLESS LIMITED

R.K. SRIVASTAVA - Asst. ENGINEER






BROMLEY MECHANICAL SERVICES MATERIAL INSPECTION REPORT

INSPECTED BY: MICHAEL QUINN	GRADE: SA 106B	DIA SIZE OR WITH: 2" <input checked="" type="checkbox"/> NPS <input type="checkbox"/> OD <input type="checkbox"/> ID
DATE: OCTOBER 12/2017	HEADS: <input type="checkbox"/> 2:1 <input type="checkbox"/> HEMI <input type="checkbox"/> WELD CAP <input type="checkbox"/> OTHER	LENGTH: 20' THICKNESS: 80 PIPE PUBLISHED NO: 0.218" PLATE NOM:
P.O.#: PO-87541	SHELL: <input type="checkbox"/>	
SUPPLIER: APEX DISTRIBUTION INC.	PIPE: <input checked="" type="checkbox"/> NDE BY MANUFACTURER	
PART ID#: SPI 29719	PLATE: <input type="checkbox"/> HYDRO YES NDE NO <input type="checkbox"/>	<u>Weight per foot for pipe over 4"</u> 5.02
REQ. MIN TK:	REPAD: <input type="checkbox"/> NO YES <input type="checkbox"/>	
	STRUCT.: <input type="checkbox"/> NO YES <input type="checkbox"/>	
	OTHER: <input type="checkbox"/> YES YES <input checked="" type="checkbox"/>	

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35784	208	2587	0.214"	0.221"	0.220"	0.218"	0.217"	OK	OK	OK	MJ
				0.220"	0.218"	0.217"	0.226"	OK	OK	OK	MJ
				0.221"	0.222"	0.218"	0.221"	OK	OK	OK	MJ
				0.219"	0.218"	0.225"	0.224"	OK	OK	OK	MJ
				0.224"	0.222"	0.220"	0.229"	OK	OK	OK	MJ
				0.222"	0.220"	0.219"	0.221"	OK	OK	OK	MJ
				0.219"	0.214"	0.220"	0.222"	OK	OK	OK	MJ

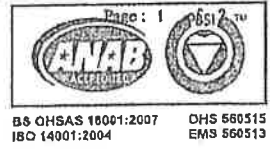
W/O#	RECEIVED & ACCEPTED BY: <i>[Signature]</i>	REQUIRED CODE MARKINGS:
CUSTOMER: BMS STOCK	DATE: 11/14/17	ISMT LIMITED-MADE IN INDIA ALL MARKING STENCILED ONTO PIPE BY MANUFACTURE

71069
2" XH A106
HT# 2587

TEST CERTIFICATE ACC TO EN: 10204: 3.1		Format No. QFB-QU-14/R-01																														
Customer : BRI-STEEL DISTRIBUTION		Test Certificate No. : RO342409	Date: 30-MAR-2017																													
Consignee : BRI-STEEL DISTRIBUTION		W.O. No. : QFSO153711	Date: 30-MAR-2017																													
P.O.No : E-88903		Invoice No. : DAO1645617	Date: 12-JAN-2017																													
Customer Item: ITEM NO.41 PART NO. 2XH SRL ORD A/SA 106																																
Specification : ASTM A106/A106M-15 Grade B/ASME BPVC SA-106/SA-106M Grade B SECTION II, PART A Edition 2011 MR 0103																																
Product : HOT FINISHED SEAMLESS STEEL PIPE		Bearing No. / Part No.: 2XH																														
Ends : BEVELLED ENDS		Batch Number : BOB768																														
Heat Number : 2587		Steel Grade : SAE 1019																														
Steel Supplier: BMM		Manufacturing Route : EAF-LRF-VD-CCM(Fully killed)																														
<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Dimensions</th> <th colspan="3">Tolerance</th> </tr> <tr> <th>MM</th> <th>Inch</th> <th>JOM</th> </tr> </thead> <tbody> <tr> <td>OD :</td> <td>60.300</td> <td>2.374</td> <td>0.800 -0.800</td> </tr> <tr> <td>ID :</td> <td>49.220</td> <td>1.938</td> <td>0.000 0.000</td> </tr> <tr> <td>WT :</td> <td>5.540</td> <td>0.218</td> <td>10.000 -10.000</td> </tr> </tbody> </table>		Dimensions	Tolerance			MM	Inch	JOM	OD :	60.300	2.374	0.800 -0.800	ID :	49.220	1.938	0.000 0.000	WT :	5.540	0.218	10.000 -10.000	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Number</th> <th colspan="2">Quantity</th> <th rowspan="2">Weight</th> </tr> <tr> <th>Meter / Feet</th> <th></th> </tr> </thead> <tbody> <tr> <td>80</td> <td>508.000 /</td> <td>1666.748</td> <td>3.920 Ton</td> </tr> </tbody> </table>		Number	Quantity		Weight	Meter / Feet		80	508.000 /	1666.748	3.920 Ton
Dimensions	Tolerance																															
	MM	Inch	JOM																													
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80	508.000 /	1666.748	3.920 Ton																													
Length: R/ 6096.000 - 6400.800 MM, R20.001 -21.001 Feet																																
Chemical Analysis :		Mechanical Properties : ASTM A 370																														
Elements	UOM	Min	Max	Mill	Product1	Product2	YS (ReH) MPa 0.2%	U.T.S.(Rm) MPa	% E (A) 50.00MM	Hardness HBW																						
C	%		0.3000	0.1800	0.1800	0.1800																										
Si	%	0.1000		0.2700	0.2600	0.2800																										
	%		0.0350	0.0060	0.0060	0.0050																										
	%		0.0350	0.0230	0.0230	0.0240																										
	%	0.2900	1.3500	0.7200	0.7100	0.7300																										
	%		0.4000	0.0080	0.0070	0.0080																										
	%		0.4000	0.0160	0.0160	0.0170																										
	%		0.1500	0.0004	0.0004	0.0003																										
	%		0.4000	0.0090	0.0080	0.0090																										
	%			0.0001	0.0001	0.0002																										
	%			0.0280	0.0280	0.0290																										
	%			0.0019	0.0018	0.0019																										
	%		0.0800	0.0013	0.0012	0.0013																										
	%			0.0010	0.0010	0.0020																										
	%			0.0003	0.0003	0.0002																										
	%			0.0004	0.0004	0.0003																										
	%			0.3047	0.3029	0.3065																										
Sample Orientation : Longitudinal		Tensile Specimen Type : Strip		Gauge Width(mm) : 25.4																												
		 MTR Reviewed <i>Ke</i> 2017 May 8																														
Bend Test (As Per Specn.)										:Ok																						
Ultrasonic Test (As Per ASTM E213)										:Ok																						
Hydraulic Test (As Per Specn.)										:Ok																						
HOLDING TIME 5 SEC. MINIMUM										18 MPa																						
Remarks :																																
1. NO WELD REPAIR PERFORMED, COLOUR CODE : GREEN BAND AT BOTH ENDS.																																
We hereby Certify that the material described above conforms to specifications & Purchase Order																																
 SUNIL MAHADEO KHARTODE JUNIOR SUPERVISOR-QA Authorized signatory																																

SA 530
 Sect. IIA 2015 Ed. 1
 MIN 0.24%
 Date 11/14/17
 US 55787

Checked to ASME



BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT

INSPECTED BY: MICHAEL QUINN	GRADE: SA 106B	DIA SIZE OR WITH: 2" <input checked="" type="checkbox"/> NPS <input type="checkbox"/> OD <input type="checkbox"/> ID
DATE: NOVEMBER 8/2017	HEADS: <input type="checkbox"/> 2:1	LENGTH: 40'
P.O.#: PO-87716	<input type="checkbox"/> HEMI	THICKNESS: 80
SUPPLIER: BHD TUBULAR LIMITED	<input type="checkbox"/> WELD CAP	PIPE PUBLISHED NO: 0.218"
PART ID#: SPI 29719	<input type="checkbox"/> OTHER	PLATE NOM:
REQ. MIN TK:	SHELL: <input type="checkbox"/>	<u>Weight per foot for pipe over 4"</u>
	PIPE: <input checked="" type="checkbox"/> → NDE BY MANUFACTURER	
	PLATE: <input type="checkbox"/> HYDRO YES NDE NO <input type="checkbox"/>	
	REPAD: <input type="checkbox"/> NO YES <input type="checkbox"/>	
	STRUCT.: <input type="checkbox"/> NO NO <input type="checkbox"/>	
	OTHER: <input type="checkbox"/> YES YES <input checked="" type="checkbox"/>	

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35832	416'	A7354	0.204"	0.204"	0.210"	0.218"	0.213"	OK	OK	OK	ml
				0.213"	0.215"	0.212"	0.216"	OK	OK	OK	ml
				0.210"	0.211"	0.218"	0.215"	OK	OK	OK	ml
				0.220"	0.222"	0.220"	0.216"	OK	OK	OK	ml
				0.218"	0.225"	0.226"	0.220"	OK	OK	OK	ml
				0.215"	0.213"	0.216"	0.216"	OK	OK	OK	ml
				0.214"	0.211"	0.212"	0.215"	OK	OK	OK	ml

W/O#	RECEIVED & ACCEPTED BY: <i>os</i>	REQUIRED CODE MARKINGS:
CUSTOMER: BMS STOCK	DATE: JAN 15 2018	MAHARASHTRA SEAMLESS LIMITED-MADE IN INDIA ALL MARKING STENCILED ONTO PIPE BY MANUFACTURE



MAHARASHTRA SEAMLESS LIMITED

WORKS (MILL) TEST CERTIFICATE

DIN:50049:3.1. B/EN:10204:3.1

QCF.20A

Tc No : MSL-7/QC/ 0580A/2017 Customer : BHD TUBULAR LTD.
 Date : 25-MAY-17
 Specification : ASME/ASTM SA/A 106 B (2015), API 5L GR.B/X-42
 PSL-1 (2012), CSA 2245.1 GR.290 CAT-I(2014) P.O. No : 116530 Dt. 17-MAR-17
 Process/Product: HOT FINISH SEAMLESS Carbon Steel Pipes W.O. No : 6160294

DESCRIPTION								Hydro Test Pressure at 5 Sec	Bend Test	Flattening Test	Flaring Test	Drift Test	Crushing Test
Sl NO	Material/Item Code	SIZE (Inch)	Length Range (Feet/Mtr)	Heat No.	No Of PCS	Length Feet/Mtr	End Finish						
1		2.375 X 0.218	38	A7310	217	8246	BEVEL	3000 PSI	OK	NA	NA	NA	NA
2		2.375 X 0.218	38	A7354	213	8094	BEVEL	3000 PSI	OK	NA	NA	NA	NA
3		2.375 X 0.218	38	A7369	32	1216	BEVEL	3000 PSI	OK	NA	NA	NA	NA
4		2.375 X 0.218	38	A7378	247	9386	BEVEL	3000 PSI	OK	NA	NA	NA	NA
5		2.375 X 0.218	38	A7387	256	9728	BEVEL	3000 PSI	OK	NA	NA	NA	NA

PHYSICAL PROPERTIES								CHEMICAL COMPOSITION (%)													
Sl No	Heat No	YST (PSi)	UTS (PSi)	E1 (%)	Hardness HRB	Impact Test Charpy V-notch	LA/PA	C	Mn	Si	P	S	Cr	Mo	Ni	V	Cu	Al	Ti	Nb	CE

Required (Max)								.28	1.06		.03	.03	.4	.15	.4	.08	.4					.4
Required (Min)	42100	60200						.29	.29	.1												

1	A7310	59719	71805	32.00	74 - 76	--	LA	.140	.690	.180	.011	.003	.311	.008	.036	.003	.005	.034	.000	.001		.322
							PA	.135	.682	.182	.012	.004	.320	.009	.032	.003	.005	.034	.001	.000		.318
2	A7354	58991	74767	34.00	74 - 76	--	LA	.140	.680	.240	.011	.004	.321	.002	.010	.003	.003	.032	.000	.001		.320
							PA	.135	.672	.230	.011	.005	.330	.003	.013	.003	.005	.037	.002	.000		.315
3	A7369	56310	71123	32.00	74 - 76	--	LA	.130	.740	.240	.010	.004	.346	.002	.009	.003	.005	.047	.000	.001		.325
							PA	.127	.720	.230	.012	.005	.322	.003	.035	.003	.005	.041	.002	.000		.315
4	A7378	59002	72040	34.00	74 - 76	--	LA	.150	.700	.190	.012	.007	.320	.005	.012	.003	.017	.036	.000	.002		.334
							PA	.158	.675	.189	.016	.005	.325	.003	.050	.004	.010	.025	.002	.000		.341
5	A7387	57129	72173	32.00	74 - 76	--	LA	.152	.672	.193	.015	.005	.330	.003	.050	.005	.009	.026	.002	.000		.335
							PA	.130	.710	.200	.019	.003	.352	.002	.010	.005	.008	.035	.000	.001		.321
							PA	.135	.660	.230	.017	.005	.304	.004	.054	.004	.009	.024	.007	.000		.311
							PA	.132	.670	.233	.018	.005	.312	.004	.050	.004	.010	.025	.002	.000		.312

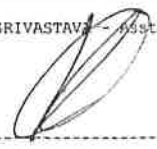
Dimensions : Outside diameter, thickness, weight, length conforms to above specification.
 Coating : All Pipes are coated with rust preventive from outside surface only.
 N.D.T. : Not Applicable
 Heat Treatment : Not applicable
 Raw material : Fully killed
 Marking/Stencilling : MAND

MSL ASME (B36.10M) ASTM/ASME A/SA 106 B, CSA GR.290 CAT-1 SS, API 5L B/X-42 PSL-1, BE SHLS OD 2.375 INCH X WT 0.218 INCH X LENGTH (IN FEET) HFS HEAT NO...3000 PSI+WEIGHT=5.03 LB/FT+MADE IN INDIA+BHD TUBULAR LTD POW116530+PIPE NO.
 Remarks : Material conforms to NACE MR-0175/MR-0103 restricted to Sulphur contents 0.01% max and Hardness 22 HRC max.

CERTIFY THAT THE MATERIAL CONFORMS TO ABOVE SPECIFICATION.

FOR MAHARASHTRA SEAMLESS LIMITED

R. K. SRIVASTAVA - ASST. ENGINEER



Warning/Modification or unauthorized use of this certification is strictly prohibited. Violation calls for criminal prosecution. For authenticity verification, you can contact us at : msltc@mahaseam.com
 W. & R.O: Pipenagar, Vill. Sukeli, N.H.17, B.K.G. Road, Dist. Raigad, Maharashtra-402126 Phone:02194236511,222010 Fax:238513 Rev.No:7,01.10.2004

BROMLEY MECHANICAL SERVICES
 Checked to ASME

VJ 35832

Seal HA 2017 Edd. Min 0.204"

SA 530 04 11/18

Date

BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT

INSPECTED BY: **MICHAEL QUINN**

GRADE: **SA 106B**

DIA SIZE OR WITH: **2"**
 NPS OD ID

DATE: **MAY 9/2017**

- HEADS 2:1
 HEMI
 WELD CAP
 OTHER

LENGTH: **20'**
 THICKNESS: **80**
 PIPE PUBLISHED NO: **0.218"**
 PLATE NOM

P.O.#: **PO-86718**

SUPPLIER: **BHD TUBULAR LIMITED**

- SHELL
 PIPE → **NDE BY MANUFACTURER**
 PLATE **HYDRO** YES **NDE** NO
 REPAD NO YES
 STRUCT. NO NO
 OTHER YES YES

PART ID#: **SPI 29719**

Weight per foot for pipe over 4"
5.03

REQ. MIN TK:

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35558	609'	A6835	0.217"	0.219"	0.218"	0.217"	0.222"	OK	OK	OK	ML
				0.220"	0.219"	0.222"	0.221"	OK	OK	OK	ML
				0.219"	0.213"	0.219"	0.220"	OK	OK	OK	ML
				0.222"	0.220"	0.219"	0.217"	OK	OK	OK	ML
				0.221"	0.222"	0.220"	0.219"	OK	OK	OK	ML
				0.217"	0.219"	0.219"	0.219"	OK	OK	OK	ML
				0.219"	0.219"	0.219"	0.219"	OK	OK	OK	ML

W/O# _____ RECEIVED & ACCEPTED BY: *[Signature]*

REQUIRED CODE MARKINGS: _____

CUSTOMER: **BMS STOCK**

DATE: **6/5/17**

MAHARASHTRA SEAMLESS LIMITED-MADE IN INDIA
ALL MARKING STENCILED ONTO PIPE BY MANUFACTURE

MAHARASHTRA SEAMLESS LIMITED
WORKS (MILL) TEST CERTIFICATE
 DIN:50049:3.1. B/EN:10204:3.1

OCF.20A

MSL-14/QC/ 3344L/2016 Customer : BHD TUBULAR LTD.
 20-JAN-17
 Specification : ASME/ASTM SA/A 106 B (2015), API 5L GR.X-42
 PSL-1 (2012), CSA Z245.1 GR.290 CAT-I(2014)
 Process/Product: HOT FINISH SEAMLESS Carbon Steel Pipes P.O. No : 115968 Dt. 13-OCT-16
 W.O. No : 6160143

DESCRIPTION								Hydro Test	Bend	Flattening	Flaring	Drift	Crushing
Sl NO	Material/Item Code	SIZE (Inch)	Length Range (Feet/Mtr)	Heat No.	No Of PCS	Length (Feet/Mtr)	End Finish	Pressure at 5 Sec	Test	Test	Test	Test	Test
1		2.375 X 0.218	21	A6652	300	6300	BEVEL	2970 PSI	OK	NA	NA	NA	NA
2		2.375 X 0.218	21	A6655	549	11529	BEVEL	2970 PSI	OK	NA	NA	NA	NA
3		2.375 X 0.218	21	A6835	427	8967	BEVEL	2970 PSI	OK	NA	NA	NA	NA
4		2.375 X 0.218	21	A6847	159	3339	BEVEL	2970 PSI	OK	NA	NA	NA	NA

PHYSICAL PROPERTIES								CHEMICAL COMPOSITION (%)															
Sl No	Heat No	YST (PSI)	UTS (PSI)	El (%)	Hardness HRC	Impact Test Charpy v-notch	LA/PA	C	Mn	Si	P	S	Cr	Mo	Ni	V	Cu	Al	Ti	Nb	CB		
	G.L. = 2", G.W. 3/4" - L at room temp				L10X3.33X55 Minus 15 Deg.C			.28	1.06		.03	.03	.4	.15	.4	.08	.4					.4	
	Required (Max)																						
	Required (Min)	42100	60200																				
1	A6652	57242	74121	34.00	74 - 76		LA	.170	1.040	.220	.034	.004	.012	.002	.004	.002	.005	.028	.002	.000	.347		
							PA	.152	1.020	.210	.033	.005	.013	.002	.035	.002	.005	.028	.002	.000	.328		
							PA	.155	1.030	.220	.033	.005	.013	.002	.034	.002	.005	.029	.002	.000	.333		
2	A6655	58135	75926	36.00	-		LA	.170	1.040	.250	.034	.002	.012	.002	.005	.005	.005	.031	.002	.002	.348		
							PA	.165	1.020	.242	.034	.004	.011	.002	.035	.005	.005	.029	.002	.000	.341		
							PA	.162	1.021	.250	.033	.004	.012	.002	.034	.005	.005	.029	.002	.000	.339		
3	A6835	60810	76446	35.80	-		LA	.170	1.010	.240	.036	.002	.014	.002	.006	.002	.005	.028	.003	.002	.343		
							PA	.162	1.010	.230	.036	.002	.012	.003	.035	.002	.005	.027	.002	.000	.336		
							PA	.165	1.011	.242	.037	.002	.011	.003	.034	.002	.005	.028	.002	.000	.339		
4	A6847	52424	67197	36.00	71 - 73		LA	.150	.700	.250	.035	.004	.019	.002	.008	.002	.005	.025	.002	.002	.272		
							PA	.145	.690	.242	.034	.005	.020	.002	.035	.002	.005	.027	.002	.000	.268		
							PA	.150	.672	.252	.034	.005	.021	.002	.034	.002	.005	.028	.002	.000	.270		

BROMLEY MECHANICAL SERVICES
 Checked to ASME
 Spec: SA 2015 Edd. MIN 0.217"
 SA 530 Date
 US 35558

Dimensions : Outside diameter, thickness, weight, length conforms to above specification.
 Coating : All Pipes are coated with rust preventive from outside surface only.
 N.D.T. : All Pipes are tested by EMI method conforming to ASTM E570 for longitudinal & transverse defect & WT monitored ultrasonically.
 Heat Treatment : Not applicable
 Raw material : Fully killed
 Marking/Stencilling : MAHA: MSL ASME (B36.10M) ASME/ASTM SA/A 106 B CSA Z245.1-14 GR.290 CAT-I S9 API 5L X-42 PSL-1 BE SMLS OD 2.375 INCH X WT 0.218 INCH X LENGTH (IN FEET) HPS HEAT NO. ... 2970 PSI+NDE+WEIGHT=5.03 LB/FT+MADE IN INDIA+BHD TUBULAR LTD. P08115960-PIPE NO.

Remarks : Material conforms to NACE MR-0175 restricted to Sulphur contents 0.01% max and Hardness 22 HRC max.

CERTIFY THAT THE MATERIAL CONFORMS TO ABOVE SPECIFICATION. FOR MAHARASHTRA SEAMLESS LIMITED
 R.K. SRIVASTAVA ENGINEER

Warning: Modification or unauthorized use of this certification is strictly prohibited. Violation calls for criminal prosecution. For authenticity verification, you can contact us at msl@maharashtraseamless.com
 M. En. O. Piponagar, Vill. Sukedi, N.H. 17, B.E.G. Road, Dist. Raigad, Maharashtra-402126 Phone: 02194230511, 222010 Fax: 238513 Rev. No: 7.01.10.2004

BROMLEY MECHANICAL SERVICES

MATERIAL INSPECTION REPORT

DIA SIZE OR WITH: 2"
 NPS OD ID

INSPECTED BY: MICHAEL QUINN

DATE: MAY 5/2017

P.O.#: PO-86717

SUPPLIER: MRC CANADA ULC

PART ID#: SPI 29719

REQ. MIN TK:

GRADE: SA 106B

HEADS 2:1
 HEMI
 WELD CAP
 OTHER

SHELL

PIPE **NDE BY MANUFACTURER**

PLATE HYDRO YES NDE NO

REPAD NO YES

STRUCT. NO NO

OTHER YES YES

LENGTH: 20'

THICKNESS: 80

PIPE PUBLISHED NO: 0.218"

PLATE NOM

Weight per foot for pipe over 4"

5.03

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35561	798'	A6977	0.215"	0.218"	0.219"	0.216"	0.219"	OK	OK	OK	ML
				0.221"	0.218"	0.220"	0.216"	OK	OK	OK	ML
				0.217"	0.220"	0.220"	0.219"	OK	OK	OK	ML
				0.219"	0.221"	0.219"	0.219"	OK	OK	OK	ML
				0.220"	0.225"	0.221"	0.219"	OK	OK	OK	ML
				0.218"	0.229"	0.220"	0.219"	OK	OK	OK	ML
				0.220"	0.229"	0.220"	0.215"	OK	OK	OK	ML

W/O#

CUSTOMER: BMS STOCK

RECEIVED & ACCEPTED BY: *[Signature]*

DATE: 6/5/17

REQUIRED CODE MARKINGS:

MAHARASHTRA SEAMLESS LIMITED-MADE IN INDIA

ALL MARKING STENCILED ONTO PIPE BY MANUFACTURE



MAHARASHTRA SEAMLESS LIMITED

QCF.20A

WORKS (MILL) TEST CERTIFICATE
DIN:50049:3.1. B/EN:10204:3.1

PO# 4899263

Page 1 of 1

Tc No	: MSL-14/QC/ 4217B/2016	Customer	: CCTF CORPORATION
Date	: 16-FEB-17		
Specification	: SA 106B(13), A 106B/CSA Z245.1 GR.290 CAT-1 (14), SA 53B(15), A 53B/API 5LB PSL1(12)	P.O. No	: GVN/G/SC/16-17/1133 Dt. 16-DEC-16
Process/Product	: HOT FINISH SEAMLESS Carbon Steel Pipes	W.O. No	: 6160206

Inv-50

DESCRIPTION								Hydro Test Pressure at 5 Sec	Bend Test	Flattening Test	Flaring Test	Drift Test	Crushing Test
Sl NO	Material/Item Code	SIZE (Inch)	Length Range (Feet/Mtr)	Heat No.	No Of PCS	Length Feet/Mtr	End Finish						
1	2860026	2.375 X 0.218	21	A6977	934	19614	BEVEL	2970 PSI	OK	NA	NA	NA	NA

PHYSICAL PROPERTIES							CHEMICAL COMPOSITION (%)																
Sl No	Heat No	YST (Psi)	UTS (Psi)	El (%)	Hardness HRB	Impact Test Charpy V-notch	LA/PA	C	Mn	Si	P	S	Cr	Mo	Ni	V	Cu	Al	Ti	Nb	CE		
G.L. = 2", G.W. 3/4" - L at room temp		10X1.33X55 - 56DEG. C							.28	1.06		.03	.03	.4	.15	.4	.08	.4					
Required (Max)		42100	60200	30																			
Required (Min)																							
1	A6977	61882	78084	32.00	74 - 76		LA	.170	1.040	.200	.018	.004	.013	.002	.006	.007	.005	.025	.002	.001	.349		
		63308	79963	36.20			PA	.174	1.035	.198	.018	.005	.013	.002	.006	.007	.005	.025	.002	.001	.352		
		62546	78948	34.00			PA	.175	1.043	.186	.018	.005	.013	.002	.006	.007	.006	.025	.002	.001	.354		

BROWLEY MECHANICAL SERVICES
Checked to ASME

Sect. 1A 2015 Ed. MW 0.25"
SA 53B Pull 4/5/17
US 35561 Date

Dimensions : Outside diameter, thickness, weight, length conforms to above specification.
 Coating : All Pipes are coated with rust preventive from outside surface only.
 N.D.T. : Not Applicable
 Heat Treatment : Not applicable
 Raw material : Fully killed
 Marking/Stencilling : MAHA NSL ASTM A 106-2014 GR.B/ASME SA 106-2013 GR.B/ASTM A 53-2012 GR.B/ASME SA 53-2015 GR.B/API 5L GR.B PSL-1, CSA Z245.1 GR.290 CAT-1-2014 SOUR SERVICE NACE MR-0175/ISO 15156-2-2015 AND MR-0103-2012 OD 2.375 INCH X WT 0.218 INCH X LENGTH (IN FEET) HPS
 HEAT NO. 2090 PSI WEIGHT 5.03 LB/FT MADE IN INDIA CCTF CORP. DEMONSTRATION PO#4899263-00-PIPE NO. 1

Remarks : Material conforms to NACE MR-0175/ISO15156/NACE MR-0103 restricted to Sulphur contents 0.01% & Hardness 22 HRC max.
 CERTIFY THAT THE MATERIAL CONFORMS TO ABOVE SPECIFICATION.
 FOR MAHARASHTRA SEAMLESS LIMITED
 R.K. SRIVASTAVA Asst. ENGINEER



Signature of R.K. Srivastava

7-GEN-548

**BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT**

INSPECTED BY: MICHAEL QUINN

DATE: DECEMBER 20/2017

P.O.#: PO-88202

SUPPLIER: BHD TUBULAR LIMITED

PART ID#: SPI 50943

REQ. MIN TK: _____

GRADE: SA 333 GR6

HEADS 2:1
 HEMI
 WELD CAP
 OTHER

SHELL

PIPE NDE BY MANUFACTURER

PLATE HYDRO YES NDE NO

REPAD NO YES

STRUCT. NO NO

OTHER YES YES

DIA SIZE OR WITH: 3"

NPS OD ID

LENGTH 40'

THICKNESS 40

PIPE PUBLISHED NO 0.216"

PLATE NOM _____

Weight per foot for pipe over 4"

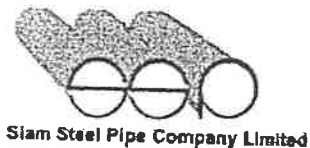
7.58

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35912	116'	17-310467	0.210"	0.212"	0.215"	0.215"	0.220"	ok	ok	ok	mf
				0.215"	0.216"	0.210"	0.219"	ok	ok	ok	mf
				0.226"	0.211"	0.216"	0.217"	ok	ok	ok	mf

W/O# _____ RECEIVED & ACCEPTED BY: *Quinn* REQUIRED CODE MARKINGS: _____

CUSTOMER: STOCK DATE: 1/19/18

**SIAM STEEL PIPE COMPANY LIMITED-MADE IN THAILAND
ALL MARKINGS STENCILED ON TO PIPE BY MANUFACTURE**



SIAM STEEL PIPE COMPANY LIMITED

บริษัท สยาม สตีล ไพป์ จำกัด
MILL TEST CERTIFICATE

NO:SSP/QR 17-25

ใบรับประกันคุณภาพสินค้า
EN10204 3.1

CONTRACT NO.	2017THWM031	PRODUCT	CARBON STEEL SEAMLESS PIPE				SPECIFICATION	ASME(B36.10M)/ASTM A333 GR.6/API 5L X52 PLS-2 /CSA Z245.1 CAT II	DELIVERY CONDITION	N	Forming Method	HOT ROLLING									
CUSTOMER	BHD TUBULAR LTD				DATE OF ISSUE	16/05/2017	LICENCE	5L-0971		NO.	8404										
NO.	HEAT NO.	STEEL GRADE	SIZE	QUANTITY	LENGTH (M)	TENSILE TEST			(%)Per cent Shear area	IMPACT TEST -45°C			Hardness								
				PIECES		Y.S Mpa	T.S Mpa	E.L.(%)		Or.	SIZE(mm)	AKV(J)		BHN							
1	17-310467	GR.359	3"SCH40	201	2371.8	385	515	35	80/80	L	3.3*10*55	39/41/45	160								
2	17-310469	GR.359	3"SCH40	370	2257	390	510	36	80/85	L	3.3*10*55	37/39/42	160								
3	17-310523	GR.359	3"SCH80	138	1628.4	375	500	34	80/80	L	5*10*55	56/61/65	170								
4	17-310525	GR.359	3"SCH80	244	1488.4	380	520	34	80/85	L	5*10*55	58/60/63	160								
TOTAL				953	7745.6																
NO.	Analysis	CHEMICAL COMPOSITION (%)														NDT	STRAIGHTNESS	HYDROSTATIC PRESSURE (≥SS)	VISUAL TEST	Flattening	DIMENSION & WEIGHT TEST
		C	Si	Mn	P	S	Cr	Ni	Cu	Ti	Mo	V	B	Nb	CE						
1	HEAT	0.13	0.25	1.07	0.018	0.008	0.050	0.018	0.018	0.001	0.007	0.004	0.001	0.002	0.297	OK	OK	20.7Mpa	OK	OK	OK
2	HEAT	0.14	0.26	1.08	0.017	0.008	0.030	0.026	0.015	0.001	0.007	0.003	0.001	0.002	0.313	OK	OK	20.7Mpa	OK	OK	OK
3	HEAT	0.15	0.23	1.1	0.018	0.009	0.050	0.018	0.018	0.001	0.008	0.002	0.001	0.002	0.337	OK	OK	20.7Mpa	OK	OK	OK
4	HEAT	0.15	0.24	1.1	0.017	0.009	0.030	0.026	0.015	0.001	0.008	0.002	0.001	0.002	0.332	OK	OK	20.7Mpa	OK	OK	OK

RESULT: ALL TEST RESULTS ABOVE COMPLY WITH THE REQUIREMENTS IN ASME(B36.10M)-07/ASTM A333 GR.6/API 5L X52 PLS-2 /CSA Z245.1 GR. 359 CAT II SS. HARDNESS ACCORDING TO NACE MR-0175/ISO 15156/0103. THIS IS CERTIFY THAT IN ACCORDANCE WITH THE RELEVANT SPECIFICATION AND CONTRACTS, THE STEEL PIPES WERE TESTED QUALIFIED BY OUR QUALITY CONTROL DEPARTMENT AND ARE IN ACCEPTANCE CONDITIONS. CERTIFY THAT GOODS ARE SUPPLIED AS PER PURCHASE ORDER AND SPECIFICATION REQUIREMENTS. IMPACT TEST TEMPERATURE REDUCTION ACCORDING ASTM A333 STANDARD. 5*10*55 AT -56°C, 6.67*10*55 AT -50°C, 7.5*10*55 AT -48°C. MANUFACTURED FROM FULL KILLED CARBON STEEL. COUNTRY OF ORIGIN: THAILAND.

Address:210/17 Moo 12, Tungskula, Sriracha, Chonburi,20230, Thailand

BROMLEY MECHANICAL SERVICES
Checked to ASME

Sect. IIA 2015 Ed. m/m 0.210"
SA 530 *[Signature]* 1/19/18
US 35912 Date

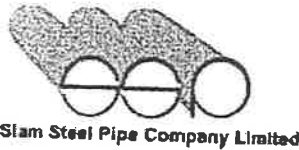
35548

BROMLEY MECHANICAL SERVICES MATERIAL INSPECTION REPORT

INSPECTED BY: MICHAEL QUINN	GRADE: SA 333 GR6	DIA SIZE OR WITH: 3" <input checked="" type="checkbox"/> NPS <input type="checkbox"/> OD <input type="checkbox"/> ID
DATE: DECEMBER 20/2017	HEADS <input type="checkbox"/> 2:1 <input type="checkbox"/> HEMI <input type="checkbox"/> WELD CAP <input type="checkbox"/> OTHER	LENGTH: 40'
P.O.#: PO-88202	SHELL <input type="checkbox"/>	THICKNESS: 80
SUPPLIER: BHD TUBULAR LIMITED	PIPE <input checked="" type="checkbox"/> → NDE BY MANUFACTURER	PIPE PUBLISHED NO: 0.300"
PART ID#: SPI 61927	PLATE <input type="checkbox"/> <u>HYDRO</u> YES <u>NDE</u> NO <input type="checkbox"/>	PLATE NOM: _____
REQ. MIN TK: _____	REPAD <input type="checkbox"/> NO YES <input type="checkbox"/>	Weight per foot for pipe over 4" 10.25
	STRUCT. <input type="checkbox"/> NO NO <input type="checkbox"/>	
	OTHER <input type="checkbox"/> YES YES <input checked="" type="checkbox"/>	

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35911	116'	17-310523	0.291"	0.292"	0.295"	0.295"	0.300"	ok	ok	ok	ml
				0.295"	0.296"	0.300"	0.299"	ok	ok	ok	ml
				0.296"	0.291"	0.296"	0.297"	ok	ok	ok	ml

W/O#	RECEIVED & ACCEPTED BY: <i>[Signature]</i>	REQUIRED CODE MARKINGS:
CUSTOMER: STOCK	DATE: 1/19/18	SIAM STEEL PIPE COMPANY LIMITED-MADE IN THAILAND
		ALL MARKINGS STENCILED ON TO PIPE BY MANUFACTURE



SIAM STEEL PIPE COMPANY LIMITED

**บริษัท สยาม สตีล ไพป์ จำกัด
MILL TEST CERTIFICATE**

NO:SSP/QR 17-25

**ใบรับประกันคุณภาพสินค้า
EN10204 3.1**

CONTRACT NO.	2017THWM031	PRODUCT	CARBON STEEL SEAMLESS PIPE				SPECIFICATION	ASME(B36.10M)/ASTM A333 GR.6/API 5L X52 PLS-2/CSA Z245.1 CAT II	DELIVERY CONDITION	N	Forming Method	HOT ROLLING									
CUSTOMER	BHD TUBULAR LTD				DATE OF ISSUE	16/05/2017	LICENCE	5L-0971		NO.	8404										
NO.	HEAT NO.	STEEL GRADE	SIZE	QUANTITY	LENGTH (M)	TENSILE TEST			(%Per cent Shear area	IMPACT TEST -45°C			Hardness								
				PIECES		Y.S Mpa	T.S Mpa	E.L.(%)		Or.	SIZE(mm)	AKV(J)		BHN							
1	17-310467	GR.359	3"SCH40	201	2371.8	385	515	35	80/80	L	3.3*10*55	39/41/45	160								
2	17-310469	GR.359	3"SCH40	370	2257	390	510	36	80/85	L	3.3*10*55	37/39/42	160								
3	17-310523	GR.359	3"SCH80	138	1628.4	375	500	34	80/80	L	5*10*55	56/61/65	170								
4	17-310525	GR.359	3"SCH80	244	1488.4	380	520	34	80/85	L	5*10*55	58/60/63	160								
TOTAL				953	7745.6																
NO.	Analysis	CHEMICAL COMPOSITION (%)														NDT	STRAIGHTNESS	HYDROSTATIC PRESSURE (≥SS)	VISUAL TEST	Flattening	DIMENSION & WEIGHT TEST
		C	Si	Mn	P	S	Cr	Ni	Cu	Ti	Mo	V	B	Nb	CE						
1	HEAT	0.13	0.25	1.07	0.018	0.008	0.050	0.018	0.018	0.001	0.007	0.004	0.001	0.002	0.297	OK	OK	20.7Mpa	OK	OK	OK
2	HEAT	0.14	0.26	1.08	0.017	0.008	0.030	0.026	0.015	0.001	0.007	0.003	0.001	0.002	0.313	OK	OK	20.7Mpa	OK	OK	OK
3	HEAT	0.15	0.23	1.1	0.018	0.009	0.050	0.018	0.018	0.001	0.008	0.002	0.001	0.002	0.337	OK	OK	20.7Mpa	OK	OK	OK
4	HEAT	0.15	0.24	1.1	0.017	0.009	0.030	0.026	0.015	0.001	0.008	0.002	0.001	0.002	0.332	OK	OK	20.7Mpa	OK	OK	OK

RESULT: ALL TEST RESULTS ABOVE COMPLY WITH THE REQUIREMENTS IN ASME(B36.10M)-07/ASTM A333 GR.6/API 5L X52 PLS-2/CSA Z245.1 GR. 359 CAT II SS. HARDNESS ACCORDING TO NACE MR-0175/ISO 15156/0103. THIS IS CERTIFY THAT IN ACCORDANCE WITH THE RELEVANT SPECIFICATION AND CONTRACTS, THE STEEL PIPES WERE TESTED QUALIFIED BY OUR QUALITY CONTROL DEPARTMENT AND ARE IN ACCEPTANCE CONDITIONS. CERTIFY THAT GOODS ARE SUPPLIED AS PER PURCHASE ORDER AND SPECIFICATION REQUIREMENTS. IMPACT TEST TEMPERATURE REDUCTION ACCORDING ASTM A333 STANDARD. 5*10*55 AT -56°C, 6.67*10*55 AT -50°C, 7.5*10*55 AT -48°C. MANUFACTURED FROM FULL KILLED CARBON STEEL. COUNTRY OF ORIGIN: THAILAND.

Address: 210/17 Moo 12, Tungsukla, Sriracha, Chonburi, 20230, Thailand

BROMLEY MECHANICAL SERVICES
Checked to ASME

Sect. IIA 2015 Ed. MIN 0.291"
SA 530 [Signature] 1/19/18
Date
US 35911

35528

BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT

INSPECTED BY: <u>MICHAEL QUINN</u>	GRADE: <u>SA 106B</u>	DIA SIZE OR WITH: <u>3"</u> <input checked="" type="checkbox"/> NPS <input type="checkbox"/> OD <input type="checkbox"/> ID
DATE: <u>DECEMBER 13/2017</u>	HEADS: <input type="checkbox"/> 2:1 <input type="checkbox"/> HEMI <input type="checkbox"/> WELD CAP <input type="checkbox"/> OTHER	LENGTH: <u>40'</u>
P.O.#: <u>PO-88056</u>	SHELL: <input type="checkbox"/>	THICKNESS: <u>40</u>
SUPPLIER: <u>BHD TUBULAR LIMITED</u>	PIPE: <input checked="" type="checkbox"/> <u>NDE BY MANUFACTURER</u>	PIPE PUBLISHED NO: <u>0.216"</u>
PART ID#: <u>SPI 12268</u>	PLATE: <input type="checkbox"/> <u>HYDRO</u> YES <u>NDE</u> NO <input type="checkbox"/> REPAD <input type="checkbox"/> NO YES <input type="checkbox"/> STRUCT. <input type="checkbox"/> NO NO <input type="checkbox"/> OTHER <input type="checkbox"/> YES YES <input checked="" type="checkbox"/>	PLATE NOM:
REQ. MIN TK:		Weight per foot for pipe over 4" 7.58

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35913	304'	A7589	0.202"	0.206"	0.210"	0.210"	0.212"	OK	OK	OK	ml
				0.204"	0.217"	0.219"	0.210"	OK	OK	OK	ml
				0.209"	0.219"	0.219"	0.221"	OK	OK	OK	ml
				0.209"	0.202"	0.218"	0.219"	OK	OK	OK	ml
VS 35914	190'	A7616	0.204"	0.220"	0.212"	0.209"	0.209"	OK	OK	OK	ml
				0.220"	0.219"	0.210"	0.214"	OK	OK	OK	ml
				0.220"	0.210"	0.213"	0.215"	OK	OK	OK	ml

W/O#	RECEIVED & ACCEPTED BY: <i>[Signature]</i>	REQUIRED CODE MARKINGS:
CUSTOMER: BMS STOCK	DATE: <i>1/22/18</i>	MAHARASHTRA SEAMLESS LIMITED-MADE IN INDIA ALL MARKING STENCILED ONTO PIPE BY MANUFACTURE



MAHARASHTRA SEAMLESS LIMITED

QCF.20A

WORKS (MILL) TEST CERTIFICATE

DIN:50049:3.1 B/EN:10204:3.1

QC No : MSL-7/QC/ 0580H/2017 Customer : BHD TUBULAR LTD.
 Date : 21-JUL-17
 Specification : ASME/ASTM SA/A 106 B (2015), API 5L GR.B/X-42
 PSL-1 (2012), CSA Z245.1 GR.290 CAT-I(2014)
 Process/Product: HOT FINISH SEAMLESS Carbon Steel Pipes
 P.O. No : 116530 Dt. 17-MAR-17
 W.O. No : 6160294

Inv. 721 Part A

DESCRIPTION								Hydro Test	Bend	Flattening	Flaring	Drift	Crushing
Sl No	Material/Item Code	SIZE (Inch)	Length Range (Feet/Mtr)	Heat No.	No Of PCS	Length (Feet/Mtr)	End Finish	Pressure at 5 Sec	Test	Test	Test	Test	Test
1		3.500 X 0.216	38	A7589	127	4826	BEVEL	3000 PSI	NA	OK	NA	NA	NA
2		3.500 X 0.216	38	A7615	57	2166	BEVEL	3000 PSI	NA	OK	NA	NA	NA
3		3.500 X 0.216	38	A7616	126	4788	BEVEL	3000 PSI	NA	OK	NA	NA	NA

PHYSICAL PROPERTIES								CHEMICAL COMPOSITION (%)															
Sl No	Heat No	YST (PSI)	UTS (PSI)	El (%)	Hardness HRB	Impact Test Charpy v-notch	LA/PA	C	Mn	Si	P	S	Cr	Mo	Ni	V	Cu	Al	Ti	Nb	CE		
G.L. = 2", G.W. 3/4" - L at room temp																							
Required (Max)								.28	1.06		.03	.03	.4	.15	.4	.08	.4						
Required (Min)	42100	60200							.29	.1													

1	A7589	54656	68806	33.00	73 - 75	--	LA	.150	.670	.230	.019	.002	.011	.002	.006	.001	.005	.031	.003	.006	.265
							PA	.144	.678	.212	.019	.006	.032	.003	.036	.002	.001	.028	.002	.000	.267
							PA	.148	.692	.214	.020	.006	.033	.004	.037	.002	.001	.028	.002	.000	.274
	A7615	53717	68191	35.00	73 - 75	--	LA	.150	.710	.250	.014	.003	.013	.002	.006	.002	.007	.036	.003	.006	.272
							PA	.148	.720	.230	.013	.005	.025	.003	.033	.002	.003	.031	.002	.000	.276
							PA	.149	.725	.229	.014	.005	.030	.003	.037	.002	.002	.032	.002	.000	.279
	A7616	55703	67558	39.00	73 - 75	--	LA	.150	.680	.170	.014	.006	.013	.001	.008	.002	.005	.026	.002	.001	.267
							PA	.153	.676	.207	.018	.006	.020	.003	.032	.001	.004	.025	.002	.000	.273
							PA	.152	.692	.211	.018	.006	.019	.003	.034	.001	.004	.023	.002	.000	.275

Dimensions : Outside diameter, thickness, weight, length conforms to above specification.
 Coating : All Pipes are coated with rust preventive from outside surface only.
 N.D.T. : Not Applicable
 Heat Treatment : Not applicable
 Raw material : Fully Killed
 Marking/Stamping : MSL ASME (B36.10M) ASTM/ASME A/SA 106 B, CSA Z245.1 GR.290 CAT-1 SS, API 5L B/X-42 PSL-1 BE SHLS OD 3.500 INCH X WT 0.216 INCH X LENGTH (IN FEET) WFS HEAT NO....3000 PSI+WEIGHT=7.58 LB/FT+MADE IN INDIA+BHD TUBULAR LTD POW116530+PIPE NO.

Remarks : Material conforms to NACE MR-0175/MR-0103 restricted to Sulphur contents 0.01% max and Hardness 22 HRC max.
 CONFIRMS TO ABOVE SPECIFICATION. FOR MAHARASHTRA SEAMLESS LIMITED
 R.K. SRIVASTAVA - Asst. ENGINEER

Warning: Modification or unauthorized use of this certification is strictly prohibited. Violation calls for criminal prosecution. For authenticity verification, you can contact us at : msltc@mahaseam.com
 W. S. R. C. Pipenagar, Vill. Sukeli, N.H. 17, B. R. O. Road, Dist. Raigad, Maharashtra-402126 Phone: 02194238511, 222010 Fax: 238513 Rev.No: 7, 01.10.2004



MAHARASHTRA SEAMLESS LIMITED

QCF.20A

WORKS (MILL) TEST CERTIFICATE

DIN:50049:3.1. B/EN:10204:3.1

C No : MSL-7/QC/ 0580H/2017 Customer : BHD TUBULAR LTD.
 Date : 21-JUL-17
 Specification : ASME/ASTM SA/A 106 B (2015), API 5L GR.B/X-42
 PSL-1 (2012), CSA Z245.1 GR.290 CAT-I(2014) P.O. No : 116530 Dt. 17-MAR-17
 Process/Product: HOT FINISH SEAMLESS Carbon Steel Pipes W.O. No : 6160294

Inv. 721
 Part A

DESCRIPTION								Hydro Test	Bend	Flattening	Flaring	Drift	Crushing
Sl NO	Material/Item Code	SIZE (Inch)	Length Range (Feet/Mtr)	Heat No.	No Of PCS	Length (Feet/Mtr)	End Finish	Pressure at 5 Sec	Test	Test	Test	Expn. Test	ing Test
1		3.500 X 0.216	38	A7589	127	4826	BEVEL	3000 PSI	NA	OK	NA	NA	NA
2		3.500 X 0.216	38	A7615	57	2166	BEVEL	3000 PSI	NA	OK	NA	NA	NA
3		3.500 X 0.216	38	A7616	126	4788	BEVEL	3000 PSI	NA	OK	NA	NA	NA

PHYSICAL PROPERTIES								CHEMICAL COMPOSITION (%)																
Sl No	Heat No	YST (PSI)	UTS (PSI)	EL (%)	Hardness HRB	Impact Test Charpy v-notch	LA/PA	C	Mn	Si	P	S	Cr	Mo	Ni	V	Cu	Al	Ti	Nb	CE			
G.L. = 2", G.W. 3/4" - L at room temp								.28	1.06		.03	.03	.4	.15	.4	.08	.4							
Required (Max)																								
Required (Min)								42100	60200															

1	A7589	54656	68806	33.00	73 - 75	--	LA	.150	.670	.230	.019	.002	.011	.002	.006	.001	.005	.031	.001	.000	.265
							PA	.144	.678	.212	.019	.006	.032	.003	.036	.002	.001	.028	.002	.000	.267
							PA	.148	.692	.214	.020	.006	.033	.004	.037	.002	.001	.028	.002	.000	.274
	A7615	53717	68191	35.00	73 - 75	--	LA	.150	.710	.250	.014	.003	.013	.002	.006	.002	.007	.036	.001	.000	.272
							PA	.148	.720	.230	.013	.005	.025	.003	.031	.002	.003	.031	.002	.000	.276
							PA	.149	.725	.229	.014	.005	.030	.003	.037	.002	.002	.032	.002	.000	.279
	A7616	55703	67558	39.00	73 - 75	--	LA	.150	.680	.170	.014	.006	.013	.001	.008	.002	.005	.026	.002	.001	.267
							PA	.153	.676	.207	.018	.006	.020	.003	.032	.001	.004	.025	.002	.000	.273
							PA	.152	.692	.211	.019	.006	.019	.003	.034	.001	.004	.028	.002	.000	.275

BROMLEY MECHANICAL SERVICES
Checked to ASME

Sect. IIA 2015 Ed. min 0.202"
 SA 308 [Signature] 13/28
 Date

Dimensions : Outside diameter, thickness, weight, length conforms to above specification.
 Coating : All Pipes are coated with rust preventive from outside surface only.
 N.D.T. : Not Applicable
 Heat Treatment : Not applicable
 Raw material : Fully killed
 Marking/Stamping : MMS (Logo) MSL ASME (B36.10M) ASTM/ASME A/SA 106 B, CSA Z245.1 GR.290 CAT-1 SS, API 5L B/X-42 PSL-1 BE SMLS OD 3.500 INCH X WT 0.216 INCH X LENGTH (IN FEET) RES HEAT NO....3000 PSI+WEIGHT-7.58 LB/FT+MADE IN INDIA+BHD TUBULAR LTD POW116530+PIPE NO.

Remarks : Material conforms to NACE MR-0175/MR-0103 restricted to Sulphur contents 0.01% max and Hardness 22 HRC max.
 ALL THE TESTS CONFORMS TO ABOVE SPECIFICATION. FOR MAHARASHTRA SEAMLESS LIMITED
 R.K. SRIVASTAVA - Asst. ENGINEER

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 W. SR. C: Pipenagar, Vill. Sukeli, N.H. 17, B. K. G. Road, Dist. Raigad, Maharashtra-402126 Phone: 02194238511, 222010 Fax: 238513 Rev.No: 7, 01.10.2004



[Signature]

BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT

INSPECTED BY: MICHAEL QUINN

DATE: NOVEMBER 8/2017

P.O.#: PO-87716

SUPPLIER: BHD TUBULAR LIMITED

PART ID#: SPI 12268

REQ. MIN TK: _____

GRADE: SA 106B

HEADS 2:1
 HEMI
 WELD CAP
 OTHER

SHELL

PIPE NDE BY MANUFACTURER

PLATE HYDRO YES NDE NO

REPAD NO YES

STRUCT. NO NO

OTHER YES YES

DIA SIZE OR WITH: 3"
 NPS OD ID

LENGTH: 40'

THICKNESS: 40

PIPE PUBLISHED NO: 0.216"

PLATE NOM: _____

Weight per foot for pipe over 4"
7.58

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35823	570'	A7615	0.203"	0.208"	0.210"	0.205"	0.203"	OK	OK	OK	ML
				0.203"	0.205"	0.212"	0.216"	OK	OK	OK	ML
				0.220"	0.211"	0.218"	0.215"	OK	OK	OK	ML
				0.220"	0.212"	0.220"	0.216"	OK	OK	OK	ML
				0.218"	0.215"	0.216"	0.210"	OK	OK	OK	ML
				0.210"	0.210"	0.211"	0.218"	OK	OK	OK	ML
				0.207"	0.210"	0.215"	0.217"	OK	OK	OK	ML

W/O# _____ RECEIVED & ACCEPTED BY: PS REQUIRED CODE MARKINGS: _____

CUSTOMER: BMS STOCK DATE: JAN 15 2018

MAHARASHTRA SEAMLESS LIMITED-MADE IN INDIA
ALL MARKING STENCILED ONTO PIPE BY MANUFACTURE



MAHARASHTRA SEAMLESS LIMITED

QCF.20A

WORKS (MILL) TEST CERTIFICATE

DIN:50049:3.1. B/EN:10204:3.1

Roll No	MSL-7/QC/ 0580H/2017	Customer	BHD TUBULAR LTD.
Date	21-JUL-17		
Specification	ASME/ASTM SA/A 106 B (2015), API 5L GR.B/X-42		
	PSL-1 (2012), CSA Z245.1 GR.290 CAT-I(2014)		
Process/Product	HOT FINISH SEAMLESS Carbon Steel Pipes	P.O. No	116530 Dt. 17-MAR-17
		W.O. No	6160294

Inv. 721 b7 part

DESCRIPTION								Hydro Test Pressure at 5 Sec	Bend Test	Flattening Test	Flaring Test	Drift Expn. Test	Crushing Test
Sl NO	Material/Item Code	SIZE (Inch)	Length Range (Feet/Mtr)	Heat No.	No Of PCS	Length (Feet/Mtr)	End Finish						
1		3.500 X 0.216	38	A7589	127	4826	BEVEL	3000 PSI	NA	OK	NA	NA	NA
2		3.500 X 0.216	38	A7615	57	2166	BEVEL	3000 PSI	NA	OK	NA	NA	NA
3		3.500 X 0.216	38	A7616	126	4788	BEVEL	3000 PSI	NA	OK	NA	NA	NA

PHYSICAL PROPERTIES								CHEMICAL COMPOSITION (%)																
Sl No	Heat No	YST (PSI)	UTS (PSI)	El (%)	Hardness HRB	Impact Test charpy v-notch	LA/PA	C	Mn	Si	P	S	Cr	Mo	Ni	V	Cu	Al	Ti	Nb	CE			
G.L. = 2", G.W. 3/4" - L at room temp																								
Required (Max)								.28	1.06		.03	.03	.4	.15	.4	.08	.4							
Required (Min)	42100	60200						.29	.1															
1	A7589	54656	68806	33.00	73 - 75	--	LA	.150	.670	.230	.019	.002	.011	.002	.006	.001	.005	.031	.003	.000	.265			
							PA	.144	.678	.212	.019	.006	.032	.003	.036	.002	.001	.028	.002	.000	.267			
							PA	.148	.692	.214	.020	.006	.033	.004	.037	.002	.001	.028	.002	.000	.274			
	A7615	53717	68191	35.00	73 - 75	--	LA	.150	.710	.250	.014	.003	.013	.002	.006	.002	.007	.036	.003	.000	.272			
							PA	.148	.720	.230	.011	.005	.025	.003	.033	.002	.003	.031	.002	.000	.276			
							PA	.149	.725	.229	.014	.005	.030	.003	.037	.002	.002	.032	.002	.000	.279			
	A7616	55703	67558	39.00	73 - 75	--	LA	.150	.680	.170	.014	.006	.013	.001	.008	.002	.005	.026	.002	.001	.267			
							PA	.153	.676	.207	.018	.006	.020	.003	.032	.001	.004	.025	.002	.000	.273			
							PA	.152	.692	.211	.019	.006	.019	.003	.034	.001	.004	.026	.002	.000	.275			

Dimensions : Outside diameter, thickness, weight, length conforms to above specification.
 Coating : All Pipes are coated with rust preventive from outside surface only.
 N.D.T. : Not Applicable
 Heat Treatment : Not applicable
 Raw material : Fully killed
 Marking/Stamping : MAH MSL ASME (B36.10M) ASTM/ASME A/SA 106 B, CSA Z245.1 GR.290 CAT-1 SS, API 5L B/X-42 PSL-1 BE SMLS OD 3.500 INCH X WT 0.216 INCH X LENGTH (IN FEET) HFS HEAT NO....3000 PSI+WEIGHT=7.58 LB/FT+MADE IN INDIA+BHD TUBULAR LTD POW#116530+PIPE NO.

Remarks : Material conforms to NACE MR-0175/MR-0103 restricted to Sulphur contents 0.01% max and Hardness 22 HRC max.

MAHARASHTRA SEAMLESS LIMITED CONFORMS TO ABOVE SPECIFICATION. FOR MAHARASHTRA SEAMLESS LIMITED
 R.K. SRIVASTAVA - Asst. ENGINEER



[Signature]

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 M.S.R.C: Piponagar, Vill. Sukeli, N.H. 17, B.K.G. Road, Dist. Raigad, Maharashtra-402126 Phone: 02194239511, 222010 Fax: 238513 Rev.No: 7, 01.10.2004

BROWLEY MECHANICAL SERVICES
Checked to ASME

V535823

Serial No 2017 EOM 11/17
 SA 530 08 11/15/18

BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT

INSPECTED BY: MICHAEL QUINN

GRADE: SA 106B

DIA SIZE OR WITH: 3"
 NPS OD ID

DATE: NOVEMBER 8/2017

HEADS 2:1
 HEMI
 WELD CAP
 OTHER

LENGTH: 20'

P.O.#: PO-87716

SHELL

THICKNESS: 40

SUPPLIER: BHD TUBULAR LIMITED

PIPE NDE BY MANUFACTURER

PIPE PUBLISHED NO: 0.216"

PART ID#: SPI 12268

PLATE HYDRO YES NDE NO
 REPAD NO YES
 STRUCT. NO NO
 OTHER YES YES

PLATE NOM

REQ. MIN TK:

Weight per foot for pipe over 4"
7.58

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35853	105'	A7657	0.240"	0.224"	0.220"	0.218"	0.213"	OK	OK	OK	ML
				0.213"	0.215"	0.222"	0.216"	OK	OK	OK	ML
				0.210"	0.211"	0.218"	0.215"	OK	OK	OK	ML
				0.220"	0.222"	0.220"	0.216"	OK	OK	OK	ML
				0.218"	0.225"	0.226"	0.220"	OK	OK	OK	ML

W/O#	RECEIVED & ACCEPTED BY: <i>MS</i>	REQUIRED CODE MARKINGS:
CUSTOMER: BMS STOCK	DATE: JAN 15 2018	MAHARASHTRA SEAMLESS LIMITED-MADE IN INDIA
		ALL MARKING STENCILED ONTO PIPE BY MANUFACTURE



MAHARASHTRA SEAMLESS LIMITED

OCF.20A

WORKS (MILL) TEST CERTIFICATE
DIN:50049:3.1. B/EN:10204:3.1

Tc No : MSL-7/QC/ 1016A/2017 Customer : BHD TUBULAR LTD.
 Date : 29-JUL-17
 Specification : ASTM/ASME A/SA 106B (2015), CSA Z245.1 GR.290
 CAT-1(2014), API 5L GR.B/X42 PSL1(2012) P.O. No : 116911 Dt. 12-JUN-17
 Process/Product: HOT FINISH SEAMLESS Carbon Steel Pipes W.O. No : 6170010

Ins. 086

DESCRIPTION								Hydro Test Pressure at 5 Sec	Bend Test	Flattening Test	Flaring Test	Drift Test	Crushing Test
Sl NO	Material/Item Code	SIZE (Inch)	Length Range (Feet/Mtr)	Heat No.	No Of PCS	Length (Feet/Mtr)	End Finish						
1		3.500 X 0.216	21	A7653	70	1470	BEVEL	3000 PSI	NA	OK	NA	NA	NA
2		3.500 X 0.216	21	A7656	754	15834	BEVEL	3000 PSI	NA	OK	NA	NA	NA
3		3.500 X 0.216	21	A7657	144	3024	BEVEL	3000 PSI	NA	OK	NA	NA	NA

PHYSICAL PROPERTIES							CHEMICAL COMPOSITION (%)																	
Sl No	Heat No	YST (PSi)	UTS (PSi)	El (%)	Hardness HRB	Impact Test Charpy v-notch	LA/PA	C	Mn	Si	P	S	Cr	Mo	Ni	V	Cu	Al	Ti	Nb	CE			
G.L. = 2", G.W. 3/4" - L at room temp								.28	1.06		.03	.03	.4	.15	.4	.08	.4						.4	
Required (Max)																								
Required (Min)								42100	60200															
	A7653	53365	67514	36.00	71 - 73	--	LA	.150	.680	.220	.015	.006	.012	.002	.006	.002	.007	.032	.002	.001	.000	.267		
							PA	.160	.674	.204	.010	.005	.025	.002	.028	.001	.006	.025	.001	.000	.280			
							PA	.160	.687	.206	.011	.005	.027	.002	.032	.002	.006	.025	.001	.000	.281			
2	A7656	65405	82803	40.60	76 - 78	--	LA	.150	.670	.210	.012	.003	.005	.002	.004	.004	.006	.030	.001	.001	.000	.265		
							PA	.159	.660	.216	.015	.005	.035	.003	.031	.002	.006	.023	.002	.000	.000	.279		
		65251	82582	37.00	-	--	PA	.160	.674	.217	.016	.005	.033	.003	.037	.002	.007	.022	.002	.000	.000	.283		
3	A7657	56623	69690	36.00	72 - 74	--	LA	.140	.680	.220	.012	.002	.007	.002	.006	.002	.006	.028	.002	.002	.000	.256		
							PA	.160	.679	.200	.011	.005	.032	.003	.036	.002	.007	.028	.001	.000	.000	.283		
							PA	.160	.679	.196	.011	.005	.030	.002	.035	.002	.007	.027	.001	.000	.000	.283		

BROWLEY MECHANICAL SERVICES
Checked to ASME

Sect. IIA 2017 Edd. *mid 0-210"*
SA 530 *08* 11/5/18
Date

US 35853

Dimensions : Outside diameter, thickness, weight, length conforms to above specification.
 Coating : All Pipes are coated with rust preventive from outside surface only.
 N.D.T. : Not Applicable
 Heat Treatment : Not applicable
 Raw material : Fully killed
 Marking/Stencilling : MAHA MSL ASME (B36.10M) ASME/ASTM SA/A 106 GR.B, CSA Z245.1 GR.290 CAT-1 SS, API 5L GR. B/X-42 PSL-1 BE SHLS OD 3.500 INCH X WT 0.216 INCH X LENGTH (IN FEET) HFS HEAT NO....3000 PSI WEIGHT=7.58 PPF MADE IN INDIA BHD TUBULAR LTD. PO#116911+PIPE NO.

Remarks : Material conforms to NACE MR-0175/ISO15156/NACE MR-0103 restricted to Sulphur contents 0.01% & Hardness 22 HRC max.

CERTIFY THAT THE MATERIAL CONFORMS TO ABOVE SPECIFICATION.
 FOR MAHARASHTRA SEAMLESS LIMITED
 R.K. SRIVASTAVA Asstt. ENGINEER



[Signature]

BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT

INSPECTED BY: **MICHAEL QUINN**

DATE: **NOVEMBER 8/2017**

P.O.#: **PO-87716**

SUPPLIER: **BHD TUBULAR LIMITED**

PART ID#: **SPI 72157**

REQ. MIN TK:

GRADE: **SA 106B**

HEADS 2:1
 HEMI
 WELD CAP
 OTHER

SHELL

PIPE **NDE BY MANUFACTURER**

PLATE **HYDRO** YES **NDE** NO

REPAD NO YES

STRUCT. NO NO

OTHER YES YES

DIA SIZE OR WITH: **3"**
 NPS OD ID

LENGTH: **40'**

THICKNESS: **80**

PIPE PUBLISHED NO: **0.300"**

PLATE NOM:

Weight per foot for pipe over 4"

10.25

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35831	503'	1525158V	0.295"	0.300"	0.300"	0.300"	0.302"	OK	OK	OK	mf
				0.304"	0.305"	0.299"	0.300"	OK	OK	OK	mf
				0.299"	0.299"	0.301"	0.301"	OK	OK	OK	mf
				0.297"	0.299"	0.301"	0.297"	OK	OK	OK	mf
				0.298"	0.299"	0.305"	0.297"	OK	OK	OK	mf
				0.296"	0.300"	0.304"	0.298"	OK	OK	OK	mf
				0.297"	0.301"	0.305"	0.295"	OK	OK	OK	mf

W/O#

RECEIVED & ACCEPTED BY: *[Signature]*

REQUIRED CODE MARKINGS:

CUSTOMER: **BMS STOCK**

DATE: **1/19/18**

HENGYANG VALIN STEEL TUBE CO.,LTD-MADE IN CHINA
ALL MARKING STENCILED ONTO PIPE BY MANUFACTURE

HENGYANG VALIN
STEEL TUBE CO.,LTD

MILL TEST CERTIFICATE

Add: 10 Dalixincun, Hengyang City, Hunan, P.R.China P.C. 421001

Tel and Fax: +86 734 8873739

E-mail: hstec@hysteeltube.com

(ACCORDING TO EN10204 3.2)

CUSTOMER				CERTIFICATE NO.	C201535920-1				
CONTRACT-ITEM NO.	2111001865-4	P.O.NO.		DATE	2015-10-28	PAGE	1/3		
PRODUCT	Seamless Steel Line Pipe			DELIVERY CONDITION	NR				
SPECIFICATION	SEE SPECIFICATION NOTE		HEAT TREATMENT						
GRADE	B/X42 B,Gr290			DIMENSIONS	NPS 3 XH 38.7II				
TOTAL BUNDLES:	13	TOTAL PIECES:	126	TOTAL LENGTH:	4877.951	ft	TOTAL WEIGHT	22.705	mt

NO.	BATCH No.	HEAT No.	BUNDLES	PIECES	LENGTH	WEIGHT	TENSILE TEST ASTM A370						FLATTENING TEST
					ft	mt	SAMPLE TYPE/ ORIENTATION / SIZE(mm):GAUGE LENGTH(mm):S/L:19:50						
							TS(psi)	YS(psi)	RT0.5	EL(%)	R.A. (%)	YS/TS	
1	9EX153080	1525158V	13	126	4877.951	22.705	67425	52200		34.0		0.77	ACCEPTABLE

NO	IMPACT TEST								NON METALIC INCLUSION	GRAIN SIZE	HARDNESS TEST	
	NOTCH TYPE/ORIENTATION/TEMPERATURE(°C)SIZE (mm):										NACE MR0175	
	///										HV10	
	AK1 (J)	Av(J)	% SHEAR AREA	LE	AK2 (J)	Av(J)	% SHEAR AREA	LE				
1	/				/						1163 3///////	

NOTES:

W1--THEORETICAL WEIGHT	SAMPLE ORIENTATION : L--LONGITUDINAL T--TRANSVERSE	N--NORMALIZING	HE--HOT EXPANDED
W2--ACTUAL WEIGHT	SAMPLE TYPE: S--STRIP C-- CLUBBED F--FULL-SECTION	A--ANNEALING	HR--HOT ROLLED
NR--NORMALIZING ROLLED	Q&T--QUENCHING AND TEMPERING	Av--AVERAGE	N&T--NORMALIZING AND TEMPERING
AK1--ABSORB ENERGY FOR THE FIRST SET	AK2--ABSORB ENERGY FOR THE SECOND SET	LE--SIDE EXPANSION	

Jim Mao

HENGYANG VALIN
STEEL TUBE CO.,LTD

MILL TEST CERTIFICATE

Add: 10 Dalixincun, Hengyang City, Hunan, P.R. China P.C. 421001

Tel and Fax: +86 734 8873729

E-mail: hsecc@hysteeltube.com

(ACCORDING TO EN10204 3.2)

CUSTOMER				CERTIFICATE NO.	C201535920-1				
CONTRACT-ITEM NO.	2111001865-4	P.O.NO.		DATE	2015-10-28	PAGE	2/3		
PRODUCT	Seamless Steel Line Pipe			DELIVERY CONDITION	NR				
SPECIFICATION	SEE SPECIFICATION NOTE		HEAT TREATMENT						
GRADE	B:X42 B,Gr290			DIMENSIONS	NPS 3 XH 38.7it				
TOTAL BUNDLES:	13	TOTAL PIECES:	126	TOTAL LENGTH:	4877.951	ft	TOTAL WEIGHT:	22 705	mt

NO	HEAT No. BATCH No.	Type	CHEMICAL COMPOSITION (%)																															
			C	Si	Mn	Cr	Mo	W	Cu	Ni	P	Al	Sn	As	Pb	Sb	Nb	Ti	Zr	N	Bi	S	V	B	Ca	CE	SUM1	SUM2	SUM3	R1	R2	R3		
			*100			*1000																		*10000			*100	*1000						
		P																																
1	1525158V	H	10	32	106	50	21		53	22	10							29	28				23	60	1	17	152	35	63					
	9EX153080	P	10	32	101	44	18		37	17	9							27	30				21	58	1	17	121.8	32.8	62.8					
	9EX153080	P	10	31	100	44	19		37	17	9							27	29				19	59	1	17	122.9	32.9	61.9					
		H																																
		P																																
		P																																
		H																																
		P																																
		P																																
		H																																
		P																																
		P																																
		H																																
		P																																
		P																																

NON-DESTRUCTIVE TEST				BEVELLING	
POSITION	PIPE BODY	PIPE END	END SURFACE(GROOVE)		
NDT Type(Level)	ET/L2	UT/L2		ACCEPTABLE	
	EMI/L3			VISUAL & DIMENSION	
LAMINAR				ACCEPTABLE	
TEST RESULT	ACCEPTABLE	ACCEPTABLE	N/A	COATING	
RESIDUAL MAGNETISM		ACCEPTABLE			
UT THICKNESS MEASUREMENT		N/A			
HYDROSTATIC TEST	Min(psi/s)	3000/6	ACCEPTABLE	ACCEPTABLE	

NOTES: H-HEAT ANALYSIS P-PRODUCT ANALYSIS CE-EQUIVALENT CARBON R-RATIO R1=Ca /S R2=Al/N R3=Mn/C
 CEIIW=C+Mn/6+(Cr+Mo+V)/5+(Cu+Ni)/15 CEPCM=C+Si/30+(Mn+Cr+Cu)/20+Ni/60+Mo/15+V/10+S*8 SUM1=Cr+Cu+Mo+Ni+V SUM2=Nb+V SUM3=Al+Ti
 ET-ISO10893-2-2011, UT-ISO10893-10-2011, MPI-ISO10893-5-2011, EMI-ISO10893-3-2011, WT-ISO10893-12-2011, LaminationT-ISO-10893-8-2011
 L4/L3/L2--ACCEPT LEVEL L4/L3/L2,NOTCH DEPTH IS 12.5%/10%/5% THE SPECIFIED WALL THICKNESS.

Jim Mao. ✓

Sect IIA 2015 Ed. MIN 0.275"
 SA 530 Date 11/9/18
 US 35831

BROMLEY MECHANICAL SERVICES
 Checked to ASME

HENGYANG VALIN
STEEL TUBE CO.,LTD

MILL TEST CERTIFICATE



Add: 10 Dahxincun, Hengyang
City, Hunan, P.R China P.C. 421001
Tel and Fax: +86 734 8873739
E-mail: hsiicc@hysteeltube.com

(ACCORDING TO EN10204 3.2)

CUSTOMER				CERTIFICATE NO	C201535920-1				
CONTRACT-ITEM NO.	2111001865-4	P.O.NO		DATE	2015-10-28	PAGE	3/3		
PRODUCT	Seamless Steel Line Pipe			DELIVERY CONDITION	NR				
SPECIFICATION	SEE SPECIFICATION NOTE		HEAT TREATMENT						
GRADE	B/X42.B,Gr290			DIMENSIONS	NPS 3 XH 38 7#				
TOTAL BUNDLES:	13	TOTAL PIECES:	126	TOTAL LENGTH:	4877.951	ft	TOTAL WEIGHT	22 705	mt

		REMARK: 1. ORIGIN: MADE IN CHINA ; 2. ALL ELEMENTS TO BE LISTED
--	--	---

SPECIFICATION NOTE	ASTM A53 GrB/A106 GrB(2010) ASME SA53 GrB/SA106 GrB(2007) API 5L(45th) GrB/X42 PSL1 CSA Z245.1 Gr290 CATI/NACE MR0175(only for hardness)	
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We hereby certify that material herein described has been manufactured in accordance with the standards and specifications required in your order and satisfies the corresponding requirements.		Quality Manager: 
This certificate is issued by a computerized system and it is valid with electronic signature. In case the owner of the certificate would release a copy of it ,he must attest its conformity to the original one taking upon himself the responsibility for any unlawful or not allowed use.		
Any alteration and/or falsification will be subject to the law.		
If you need to assure the authenticity of this certificate ,please do not hesitate to contact Hengyang Valin Steel Tube CO.,LTD, E-mail: hsiicc@hysteeltube.com		
CUSTOMER THIRD PARTY  ✓ ✓		Certificate-maker: 唐姣娜

BROMLEY MECHANICAL SERVICES

MATERIAL INSPECTION REPORT

 INSPECTED BY: MICHAEL QUINN

 GRADE: SA 106B

 DIA SIZE OR WITH: 4"
 NPS OD ID

 DATE: NOVEMBER 8/2017

- HEADS
-
- 2:1
-
-
- HEMI
-
-
- WELD CAP
-
-
- OTHER

 LENGTH: 20'

 P.O.#: PO-87716

 THICKNESS: 40

 PIPE PUBLISHED NO 0.237"

 SUPPLIER: BHD TUBULAR LIMITED

 SHELL:

PLATE NOM: _____

 PART ID#: SPI 92278

 PIPE: → NDE BY MANUFACTURER

- | | | | | | | |
|---------|--------------------------|--------------|-----|------------|-----|-------------------------------------|
| PLATE | <input type="checkbox"/> | <u>HYDRO</u> | YES | <u>NDE</u> | NO | <input type="checkbox"/> |
| REPAD | <input type="checkbox"/> | | NO | | YES | <input type="checkbox"/> |
| STRUCT. | <input type="checkbox"/> | | NO | | NO | <input type="checkbox"/> |
| OTHER | <input type="checkbox"/> | | YES | | YES | <input checked="" type="checkbox"/> |

Weight per foot for pipe over 4"

10.79

REQ. MIN TK: _____

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35835	38'	A7617	0.223"	0.238"	0.230"	0.228"	0.223"	OK	OK	OK	MJ
				0.233"	0.235"	0.232"	0.226"	OK	OK	OK	MJ
VS 35836	63'	A7810	0.226"	0.230"	0.231"	0.228"	0.235"	OK	OK	OK	MJ
				0.230"	0.232"	0.230"	0.236"	OK	OK	OK	MJ
				0.228"	0.235"	0.226"	0.220"	OK	OK	OK	MJ

W/O#	RECEIVED & ACCEPTED BY: <i>OS</i>	REQUIRED CODE MARKINGS:
CUSTOMER: <u>BMS STOCK</u>	DATE: JAN 19 2018	MAHARASHTRA SEAMLESS LIMITED-MADE IN INDIA
		ALL MARKING STENCILED ONTO PIPE BY MANUFACTURE



MAHARASHTRA SEAMLESS LIMITED

OCF.20A

WORKS (MILL) TEST CERTIFICATE

DIN:50049:3.1, B/EN:10204:3.1

Tc No : MSL-7/QC/ 0580K/2017 Customer : BHD TUBULAR LTD.
 Date : 12-AUG-17
 Specification : ASME/ASTM SA/A 106 B (2015), API 5L GR.B/X-42
 PSL-1. (2012), CSA Z245.1 GR.290 CAT-I(2014) *Inv. 67172 Part*
 Process/Product: HOT FINISH SEAMLESS Carbon Steel Pipes P.O. No : 116530 Dt. 17-MAR-17
 W.O. No : 6160294

DESCRIPTION								Hydro Test	Bend	Flatt-	Flaring	Drift	Crush
Sl NO	Material/Item Code	SIZE (Inch)	Length Range (Feet/Mtr)	Heat No.	No Of PCS	Length (Feet/Mtr)	End Finish	Pressure at 5 Sec	Test	ening Test	Test	Expn. Test	ing Test
1		4.500 X 0.237	38	A7593	285	10830	BEVEL	3000 PSI	NA	OK	NA	NA	NA
2		4.500 X 0.237	38	A7616	24	912	BEVEL	3000 PSI	NA	OK	NA	NA	NA
3		4.500 X 0.237	38	A7617	90	3420	BEVEL	3000 PSI	NA	OK	NA	NA	NA

PHYSICAL PROPERTIES								CHEMICAL COMPOSITION (%)																		
Sl No	Heat No	YST (PSi)	UTS (PSi)	EL (%)	Hardness HRB	Impact Test Charpy V-notch	LA/PA	C	Mn	Si	P	S	Cr	Mo	Ni	V	Cu	Al	Ti	Nb	CE					
G.L. = 2", G.W.1 -L at room temp																										
Required (Max)								.28	1.06		.03	.03	.4	.15	.4	.08	.4									
Required (Min)								42100	60200																	
1	A7593	49801	67183	40.00	71 - 73		LA	.150	.690	.200	.017	.003	.012	.001	.006	.002	.005	.029	.002	.000	.000	.269				
							PA	.150	.675	.186	.016	.005	.033	.003	.026	.002	.006	.024	.002	.000	.000	.273				
							PA	.153	.679	.182	.016	.005	.029	.003	.030	.002	.007	.026	.002	.000	.000	.276				
2	A7616	51303	67595	36.00	71 - 73		LA	.150	.680	.170	.014	.006	.013	.001	.008	.002	.005	.026	.002	.001	.000	.267				
							PA	.160	.660	.180	.015	.005	.022	.003	.029	.002	.006	.022	.001	.000	.000	.278				
							PA	.160	.680	.184	.016	.005	.029	.004	.030	.002	.007	.023	.001	.000	.000	.283				
3	A7617	51793	66406	38.00	71 - 73		LA	.140	.680	.220	.012	.005	.013	.002	.006	.002	.006	.027	.003	.001	.001	.255				
							PA	.150	.672	.190	.015	.005	.030	.003	.023	.002	.007	.024	.002	.000	.000	.27				
							PA	.152	.685	.183	.016	.005	.029	.003	.030	.002	.006	.023	.002	.000	.000	.279				

BROMLEY MECHANICAL SERVICES
Checked to ASME

V535835

Sect. HA 2017 Edd. min. C-223"
 SA 530 AS 11/18/18
 Date

Dimensions : Outside diameter, thickness, weight, length conforms to above specification.
 Coating : All Pipes are coated with rust preventive from outside surface only.
 M.D.T. : Not Applicable
 Heat Treatment : Not applicable
 Raw material : Fully killed
 Marking/Stencilling : MAHA MSL ASME (B36.10M) ASTM/ASME A/SA 106 B, CSA Z245.1 GR.290 CAT-1 SS, API 5L B/X-42 PSL-1 BE SMLS OD 4.500 INCH X WT 0.237 INCH X LENGTH (IN FEET) HPS HEAT NO.3000 PSI+WEIGHT-10.80 LB/FT+MADE IN INDIA+BHD TUBULAR LTD PO#116530+PIPE NO.

Remarks : Material conforms to NACE MR-0175/MR-0103 restricted to Sulphur contents 0.01% max and Hardness 22 HRC max.

CERTIFY THAT THE MATERIAL CONFORMS TO ABOVE SPECIFICATION. FOR MAHARASHTRA SEAMLESS LIMITED



R.K. SRIVASTAVA - Chief Engineer



MAHARASHTRA SEAMLESS LIMITED

WORKS (MILL) TEST CERTIFICATE

DIN:50049:3.1. B/EN:10204:3.1

QCF.20A

Tc No : MSL-7/QC/ 0580Q/2017 Customer : BHD TUBULAR LTD. 077
 Date : 16-AUG-17
 Specification : ASME/ASTM SA/A 106 B (2015), API 5L GR.B/X-42
 PSL-1 (2012), CSA 2245.1 GR.290 CAT-I(2014)
 Process/Product: HOT FINISH SEAMLESS Carbon Steel Pipes P.O. No : 116530 Dt. 17-MAR-17
 W.O. No : 6160294

DESCRIPTION

Sl NO	Material/Item Code	SIZE (Inch)	Length Range (Feet/Mtr)	Heat No.	No Of PCS	Length (Feet/Mtr)	End Finish	Hydro Test Pressure at 5 Sec	Bend Test	Flattening Test	Flaring Test	Drift Expn. Test	Crushing Test
1		4.500 X 0.237	21	A7700	532	11172	BEVEL	3000 PSI	NA	OK	NA	NA	NA
2		4.500 X 0.237	21	A7810	247	5187	BEVEL	3000 PSI	NA	OK	NA	NA	NA

PHYSICAL PROPERTIES

CHEMICAL COMPOSITION (%)

Sl No	Heat No	YST (PSi)	UTS (PSi)	El (%)	Hardness HRB	Impact Test Charpy v-notch	LA/PA	C	Mn	Si	P	S	Cr	Mo	Ni	V	Cu	Al	Ti	Nb	CE			
G.L. = 2*G.W.1 - L at room temp																								
Required (Max)								.28	1.06		.03	.03	.4	.15	.4	.08	.4							
Required (Min)									.29	.1														
	A7700	56197	76003	39.00	74 - 76		LA	.170	1.030	.260	.018	.004	.004	.002	.003	.002	.005	.027	.002	.001	.344			
		56005	75737	35.40			PA	.165	1.023	.252	.016	.004	.005	.004	.032	.003	.005	.028	.002	.000	.340			
							PA	.160	1.019	.260	.015	.004	.005	.004	.031	.003	.005	.029	.002	.000	.335			
	A7810	57137	74481	35.60	74 - 76		LA	.180	1.000	.200	.014	.003	.012	.002	.006	.002	.006	.029	.003	.001	.351			
							PA	.175	1.010	.200	.014	.004	.011	.003	.032	.002	.005	.028	.002	.000	.349			
							PA	.169	1.011	.211	.014	.004	.012	.003	.034	.002	.005	.027	.002	.000	.344			

BROMLEY MECHANICAL SERVICES
Checked to ASME

Sect. II A 2017 Edd. Min 0.220"
 SA 530 ps 11/8/18
 Date

VS35836

Dimensions : Outside diameter, thickness, weight, length conforms to above specification.
 Coating : All Pipes are coated with rust preventive from outside surface only.
 N.D.T. : Not Applicable
 Heat Treatment : Not applicable
 Raw material : Fully killed
 Marking/Stencilling : MAHA MSL ASME (B16.10M) ASTM/ASME A/SA 106 B, CSA 2245.1 GR.290 CAT-1 SS, API 5L B/X-42 PSL-1 BE SMLS CD 4.500 INCH X WT 0.237 INCH X LENGTH (1N FEET) HFG HEAT NO. 3000 PSI+WEIGHT-10.00 LB/FT-MADE IN INDIA-BHD TUBULAR LTD FOB116530-PIPE NO.

Remarks : Material conforms to NACE MR-0175/MR-0103 restricted to Sulphur contents 0.01% max and Hardness 22 HRC max.

CERTIFY THAT THE MATERIAL CONFORMS TO ABOVE SPECIFICATION.
 SEAL FOR MAHARASHTRA SEAMLESS LIMITED
 R. K. SRIVASTAVA Asst. ENGINEER

BROMLEY MECHANICAL SERVICES

MATERIAL INSPECTION REPORT

INSPECTED BY: **MICHAEL QUINN**

DATE: **OCTOBER 26/2015**

P.O.#: **PO-83658**

SUPPLIER: **MRC CANADA ULC**

PART ID#: **SPI 66805**

REQ. MIN TK:

GRADE: **SA 333 GR6**

HEADS 2:1
 HEMI
 WELD CAP
 OTHER

SHELL

PIPE **NDE BY MANUFACTURER**

PLATE **HYDRO** YES **NDE** NO

REPAD NO YES

STRUCT. NO NO

OTHER YES YES

DIA SIZE OR WITH: **4"**
 NPS OD ID

LENGTH: **20'**

THICKNESS: **40**

PIPE PUBLISHED NO: **0.237"**

PLATE NOM:

Weight per foot for pipe over 4"

10.80

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 34342	40'	332606	0.227"	0.227"	0.226"	0.230"	0.231"	ok	ok	ok	ml
				0.230"	0.228"	0.227"	0.227"	ok	ok	ok	ml

Customer: **BMS STOCK**

RECEIVED & ACCEPTED BY: *[Signature]*

DATE: **11/10/13**

REQUIRED CODE MARKINGS:

VALLOUREC-MADE IN FRANCE

ALL MARKINGS STENCILED ON TO PIPE BY MANUFACTURE

Invoice: 2184129-00 PO#: C7164135310B1 Line# 1 Product: 2530090 Heat: 332606

Vallourec Tubes France (A01) TUBERIE SAINT SAULVE ZONE INDUSTRIELLE 59880 SAINT SAULVE		INSPECTION CERTIFICATE (A02) CERTIFICAT DE RECEPTION 3.1 EN 10 204: 2004 No. / N° : 4952SV15 (A03) Page/Page: 1 6 Date/Date: 08.06.2015
--	--	--

4 STD A333

(A01) Vallourec Tubes France	(A08.1) Vallourec-Order-No. / N° de Cde Vallourec/ 224082 (A08.2) Suborder / Suborder
(A06.1) Customer / Client CCTF CORPORATION 5407 -53RD AVENUE EDMONTON AB T6B 3G2 T6B 3G2	(A07.1) Customer Order-No. / N° de Cde Client 4696601
(A06.2) Orderer / Emetteur VALLOUREC CANADA INC. / BURLINGTON ON L7L 6G4	(A07.2) Orderer Order-No. / N° de Cde Emetteur VM3745 Date / Date 19.01.2015
(B01, B02, B04) Description of the product Description du produit	Hot finished seamless pipes for low-temperature service Sour service normalized Ends bevelled, angle 30° (+5 °/-0), root face 1.6 mm (± 0.8 mm) Outside with dry varnish without inside rust protection Tube ends closed by plastic plugs Tubes sans soudure finis à chaud pour service basse température Service H2S normalisé Extrémités chanfreinées, angle 30° (+5° / -0), méplat 1.6 mm (±0.8 mm) vernis sec extérieur sans protection intérieure Extrémités des tubes obturées par bouchons plastique Grade 290, CSA-Z245.1, Cat. II Grade 1, ASTM A333 - ASME SA 333 Grade 6, ASTM A333 - ASME SA 333 ASTM A333, 2013 ASME SA-333, 2013 CSA Z245.1, March 2014 ASTM A 999, 2013 ASME SA 999, 2013 ASME Boiler and pressure vessel code, Section II, Part A, 2013 Nace MR 0175/ISO 15156-2 : 2009 / EN ISO 15156-2 : 2009, ANNEX A.2.1.2 / Nace MR 0103 : 2010 paragraphe 2.1 CCTF, CCTF-6, Rev. 3, May 2014
(B03) The Vallourec company guarantees that the products described in this certificate are fully in compliance with the prescriptions of the Article 15 of the Departmental Order dated March, 24, 1978 modified C ≤ 0,25 ; P ≤ 0,05 ; S ≤ 0,05 ; RM N/mm ² ≤ 700 ; RP ≤ 0,9 RM ; A%(5,65V) min, 16% long et RM(A-2) ≥ 10500 ; A%(5,65V) min, 14% transv, RxA ≥ 10500 La société Vallourec garantit que les tubes objet du présent certificat respectent en leur totalité les prescriptions de l'Article 15 de l'Arrêté Ministériel du 24 Mars 1978 modifié, C ≤ 0,25 ; P ≤ 0,05 ; S ≤ 0,05 ; RM N/mm ² ≤ 700 ; RP ≤ 0,9 RM ; A%(5,65V) min, 16% long et RM(A-2) ≥ 10500 ; A%(5,65V) min, 14% transv, RxA ≥ 10500	

Invoice: 2184129-00 PO#: C7164135310B1 Line# 1 Product: 2530090 Heat: 332606

Vallourec Tubes France (A01) TUBERIE SAINT SAULVE ZONE INDUSTRIELLE 59880 SAINT SAULVE		INSPECTION CERTIFICATE (A02) CERTIFICAT DE RECEPTION 3.1 EN 10 204: 2004
		No. / N° : 4952Sv15 (A03) Page/Page: 2 / 6 Date/Date: 08.06.2015

(A13) Vallourec Item Poste	(A09) Cust. Item Poste	(B14) Item text Texte du poste	(B06) Dimensions Dimensions	(B10) Single length Long. indiv.
4		ARTICLE NUMBER 2530090 ARTICLE NO. 2530090	NPS 4 SCH 40 NPS 4 SCH 40	fixed length 20 Foot 0 + 4 Inches Short Lengths : max. 10 % not shorter than 17 Foot longueur fixe 20 FT tubes courts : max. 10 % de longueur supérieure à 17 FT

(A13) Vallourec Item Poste	(A09) Cust. Item Poste	(B07.1) Heat Coulée	(B08) Quantity Nombre	(B11) Total length Long. totale ft	(B13) Weight Poids lb
4		332606	80	1.601,610	17.571

(C71)

HEAT CHEMICAL ANALYSIS / ANALYSE CHIMIQUE COULEE

For each reduction of 0,01% below the specified carbon maximum, can increase of 0,05% manganese above the specified maximum will be permitted up to a maximum of 1,35%


Pour chaque réduction de 0.01 % de la teneur en carbone en dessous de la valeur maximale spécifiée, il est permis d'augmenter la teneur en manganèse de 0.05 % au dessus de la valeur maximale spécifiée, avec un maximum de 1.35 %

(B07.1) Heat Coulée	(B15) Process Procédé	C %	Si %	Mn %	P %	S %	Cr %	Mo %	Ni %	Cu %	Ti %
min	-	-	0,10	0,40	-	-	-	-	-	-	-
max	-	0,26	0,50	1,26	0,025	0,025	0,30	0,12	0,40	0,40	0,11
332606	Oxygen (BOF)	0,11	0,20	1,32	0,017	0,004	0,04	0,01	0,05	0,02	0,02

(B07.1) Heat Coulée	Nb(Cb) %	V %	B %	Nb(Cb) %	2528	1099	BROWLEY MECHANICAL SERVICES Checked to ASME				
min	-	-	-	-	3,00	-	Sect. IIA	2/13	Edt	MN 0.227"	
max	-	0,08	0,001	0,02	-	0,40	SA 530			11/10/15	
332606	0,008	0,01	0,0004	0,01	12,00	0,28				Date	

2528	Mn/C
1099	C+F(Mn/6+Si/24+Cu/15+Ni/20+((Cr+Mo+V+Nb)/5)+5*B)

Heats fully killed
Acier Calmé

Vallourec Tubes France TUBERIE SAINT SAULVE ZONE INDUSTRIELLE 59880 SAINT SAULVE		INSPECTION CERTIFICATE (A02) CERTIFICAT DE RECEPTION 3.1 EN 10 204: 2004
		No. / N° : 4952Sv15 (A03) Page/Page: 3 / 6 Date/Date: 08.06.2015

(C72)

PRODUCT CHEMICAL ANALYSIS / ANALYSE CHIMIQUE PRODUIT

For each reduction of 0,01% below the specified carbon maximum, an increase of 0,05% manganese above the specified maximum will be permitted up to a maximum of 1,35%

Pour chaque réduction de 0.01 % de la teneur en carbone en dessous de la valeur maximale spécifiée, il est permis d'augmenter la teneur en manganèse de 0.05 % au dessus de la valeur maximale spécifiée, avec un maximum de 1.35 %

(B07.1) Heat Coulée	(C00.1) Test Piece Eprovette	C %	Si %	Mn %	P %	S %	Cr %	Mo %	Ni %	Cu %	Ti %
min		-	0,10	0,40	-	-	-	-	-	-	-
max		0,26	0,50	1,26	0,025	0,025	0,30	0,12	0,40	0,40	0,11
332606	01AE719	0,12	0,19	1,27	0,017	0,004	0,04	0,01	0,05	0,02	0,01

(B07.1) Heat Coulée	(C00.1) Test Piece Eprovette	Nb(Cb) %	V %	B %	Nb(Cb) %	2528 %	1099 %				
min		-	-	-	-	3,00	-				
max		-	0,08	0,001	0,02	-	0,40				
332606	01AE719	0,008	0,01	0,0002	0,000	10,86	0,28				

2528	Mn/C
1099	C+F(Mn/6+Si/24+Cu/15+Ni/20+((Cr+Mo+V+Nb)/5)+5*B)

(B04)

HEAT TREATMENT / TRAITEMENT THERMIQUE

NORMALIZED CONDITION MIN 920°C (1688 F) COOLING AIR

ETAT NORMALISE MIN 920°C (1688 F) REFROIDISSEMENT AIR

TENSILE TEST RESULTS / RESULTATS D'ESSAI DE TRACTION

Type / Type (C10.1)	Tube strip specimen / Eprovette prismatique
Test temperature / Température d'essai (C03)	Room temperature / Température ambiante
Direction / Orientation (C02)	longitudinal / longitudinal

DOUBLE LENGTH

Vallourec Tubes France (A01) TUBERIE SAINT SAULVE ZONE INDUSTRIELLE 59880 SAINT SAULVE		INSPECTION CERTIFICATE (A02) CERTIFICAT DE RECEPTION 3.1 EN 10 204: 2004
		No. / N° : 4952Sv15 (A03) Page/Page: 4 / 6 Date/Date: 08.08.2015

TENSILE TEST RESULTS / RESULTATS D'ESSAI DE TRACTION

(B07.1) Heat Coulée	(C00.1) Test Piece Eprouvette	(C10.2) Dimension Dimension	(C11) YS LimElast	(C12) TS Résist.	(C13.2) Elong. Allong.						
		in / sq in	R _{10,5} psi	R _m psi	2" %						
min		-	42000	60000	33,0						
max		-	-	90675	-						
332606	01AE719	0,98x0,24 0,24	47731	68768	37,1						
332606	02AE719	0,98x0,24 0,23	48021	69348	36,0						

(C10.2) Dimension / Dimension	Test pièce dimensions / Dimension de l'éprouvette Test pièce area / Section de l'éprouvette
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IMPACT TEST RESULTS / RESULTATS D'ESSAI DE RESILIENCE


Type / Type (C40)	Charpy V
Test temperature / Température d'essai (C03)	-49 °F
Direction / Orientation (C02)	longitudinal / longitudinal

(B07.1) Heat Coulée	(C00.1) Test Piece Eprouvette	(C41) Dimension Dimension	(C42.1) Impact1 E1	(C42.1) Impact2 E2	(C42.1) Impact3 E3	(C43.1) Mean Moyenne					
		in / sq in	ft-lbf	ft-lbf	ft-lbf	ft-lbf					
min		-	8,1	8,1	8,1	10,3					
max		-	-	-	-	-					
332606	01AE719	0,20x0,39 0,06	98,8	109,1	87,8	98,5					

(C41) Dimension / Dimension	Test pièce dimensions / Dimension de l'éprouvette Test pièce area / Section de l'éprouvette
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HARDNESS TEST RESULTS / RESULTATS D'ESSAI DE DURETE QUADRANTS

Method of test / Méthode d'essai (C30)	Rockwell B
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Vallourec Tubes France (A01) TUBERIE SAINT SAULVE ZONE INDUSTRIELLE 59880 SAINT SAULVE		INSPECTION CERTIFICATE (A02) CERTIFICAT DE RECEPTION 3.1 EN 10 204: 2004
		No. / N° : 4952Sv15 (A03) Page/Page: 5 / 6 Date/Date: 08.06.2015

HARDNESS TEST RESULTS / RESULTATS D'ESSAI DE DURETE QUADRANTS

(B07.1) Heat Coulée	(C00.1) Test Piece Eprouvette	(C01.5) Orientation Orientation	(C31.3) Readings HRB	Min HRB	Max HRB	(C32.3) Value HRB					
min			-	-	-	-					
max			99,0	-	-	99,0					
332606	1AE719 I	M/M O/E I/I	74,5 75,2 71,8	71,8	75,2	74,5					

(C01.5) Orientation / Orientation	M/M : Middle / Milieu O/E : Outside / Extérieur I/I : Inside / Intérieur
(C31.3) Readings	Hardness impressions
(C32.3) Value	Average of readings each quadrant-orientation

(C50)

TECHNOLOGICAL AND OTHER TESTS ON SPECIMENS / ESSAIS TECHNOLOGIQUES ET AUTRES ESSAIS SUR ECHANTILLON

Test Nature d'essai	Conditions Conditions	Test rate Ampleur du contrôle	Result Résultat
Flattening test Essai d'aplatissement	Flattening test (specific)		Satisfactory Satisfaisant


(D55)

OTHER TESTS ON PIPE / AUTRES ESSAIS SUR TUBE


Test Nature d'essai	Conditions Conditions	Test rate Ampleur du contrôle	Result Résultat
Hydrostatic test Epreuve hydrostatique	2700 PSI 5 SEC	100% each lot 100% Lot	Satisfactory Satisfaisant
Appearance & Dimensions Aspect & Dimensions	Aspect & Dimensions (specification)	100% each lot 100% Lot	Satisfactory Satisfaisant
Eddy Current test Courants de Foucault	CSA Z245-1	100% each lot 100% Lot	Satisfactory Satisfaisant

(A04, B06)

MARKING, IDENTIFICATION / MARQUAGE, IDENTIFICATION

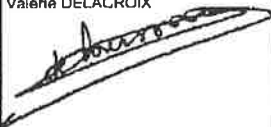
4	Paint stenciled on one side Marquage peinture 1 extrémité	 VALLOUREC	VALLOUREC VTFR26 Z245.1-14 114.3 6.02 290CAT2 SS S LENGTH 18.4MPA HTHEAT NUMBER A/SA333 NPS4 STD/SCH40 1/6 HFS LENGTH2700PSI L T-50F K VM3745 4896601 FRANCE
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Invoice: 2184129-00 PO#: C7164135310B1 Line# 1 Product: 2530090 Heat: 332606

Vallourec Tubes France TUBERIE SAINT SAULVE ZONE INDUSTRIELLE 59880 SAINT SAULVE		INSPECTION CERTIFICATE CERTIFICAT DE RECEPTION 3.1 EN 10 204: 2004 No. / N° : 4952Sv15 Page/Page: 6 / 6 Date/Date: 08.06.2015
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(201)
The supplied products are in compliance with the requirements of the order
Les produits livrés sont conformes aux stipulations de la commande

(A05, Z02, Z03)

Date / Date	08.06.2015
Validated by Validé par	Inspection Representative Agent Réceptionnaire
	Valérie DELACROIX 
☎	+ (33) 3 27 23 14 56
☎	+ (33) 3 27 23 15 25
@	valerie.delacroix@vallourec.com
Stamp / Cachet	

Indication in parentheses correspond to attributes according to EN 10168
Les indications entre parenthèses correspondent aux repères selon EN 10168

This testimonial and certification respectively may neither be modified nor used for other products. Offences are regarded as falsification of documents and will be subject to criminal prosecution.
Ce certificat, ou cette attestation ne doit être ni modifié ni appliqué pour d'autres produits. Tous changements ou application pour d'autres produits seront considérés comme falsification de documents et fraude et seront sujet à la juridiction pénale.

BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT

INSPECTED BY: MICHAEL QUINN	GRADE: SA 106B	DIA SIZE OR WITH: 4" <input checked="" type="checkbox"/> NPS <input type="checkbox"/> OD <input type="checkbox"/> ID	
DATE: FEBRUARY 21/2017	HEADS: <input type="checkbox"/> 2:1	LENGTH: 40'	
P.O.#: PO-86148	<input type="checkbox"/> HEMI	THICKNESS: 80	
SUPPLIER: VAN LEEUWEN PIPE & TUBE	<input type="checkbox"/> WELD CAP	PIPE PUBLISHED NO: 0.337"	
PART ID#: SPI 71061	<input type="checkbox"/> OTHER	PLATE NOM: _____	
REQ. MIN TK: _____	SHELL: <input type="checkbox"/>		
	PIPE: <input checked="" type="checkbox"/> NDE BY MANUFACTURER		
	PLATE: <input type="checkbox"/> HYDRO YES NDE NO <input type="checkbox"/>		<u>Weight per foot for pipe over 4"</u> <div style="font-size: 2em; text-align: center;">14.98</div>
	REPAD: <input type="checkbox"/> NO YES <input type="checkbox"/>		
	STRUCT.: <input type="checkbox"/> NO YES <input type="checkbox"/>		
	OTHER: <input type="checkbox"/> YES YES <input checked="" type="checkbox"/>		

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35361	170'	9989	0.320"	0.320"	0.326"	0.332"	0.329"	ok	ok	ok	mf
				0.331"	0.330"	0.332"	0.337"	ok	ok	ok	mf
				0.334"	0.332"	0.334"	0.334"	ok	ok	ok	mf
				0.330"	0.332"	0.334"	0.338"	ok	ok	ok	mf

W/O#	RECEIVED & ACCEPTED BY: <i>Quinn</i>	REQUIRED CODE MARKINGS:
CUSTOMER: BMS STOCK	DATE: <i>Feb 21</i>	TENARIS-MADE IN MEXICO
		ALL MARKING STENCILED ONTO PIPE BY MANUFACTURE



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INSPECTION CERTIFICATE 3.1
CERTIFICADO DE INSPECCIÓN 3.1
EN 10204 3.1: 2004

Number / Número
15044562

Page / Página:
1 / 6

Date / Día: **November 27, 2016**

For more information please contact:
 Tenaris Inspection Department
 P.O. Box 100000
 Houston, TX 77200-0000
 USA
 Tel: +1 281 280 1000
 Fax: +1 281 280 1001

Customer / Cliente: VAN LEEUWEN PIPE & TUBE (CANADA) INC		Customer's Order Item / Orden Cliente - Item 45001723 ITEM 6	Customer's Reference / Ref. del Cliente N/A	Manufacturer's Work Order N° / Continuación de Venta 238267/06
Manufacturing Process / Proceso de Manufactura: SEAMLESS HOT ROLLED LAMINADO EN CALIENTE SIN COSTURA		Product Type / Tipo de Producto: LINE PIPE SEAMLESS CONDUCCION SIN COSTURA		Surface / Superficie: VARNISHED BARNIZADO
Standard or Specification / Normas o Especificaciones: CSA Z245.1-14/MARZO 2014, ASTM A106/14, ASME SA106/2013		Steel Grade / Grado de acero: GR B/290		Ends / Extremos: NORMAL BEVEL BISELADO NORMAL
Dimensions / Dimensiones: 4.600 X 0.337 INCH 114.3 X 8.6 MM	Schedule / Cédula: SCH 80 / W.C XS	Length / Longitud: 36.09 / 44.00 FT 11.00 / 13.41 MTS	Quantity / Cantidad: 106 Pcs/Pz 4424.442 FT 1348.570 MTS	Weight / Peso: 66036.116 LB 29963.000 KG

TENSILE TEST / ENSAYO DE TENSION

Heat N° Caldera N°	Sample N° Muestra N°	Specimen condition Condición de la probeta				Specimen dimensions Dimensiones de la probeta		Test temp. Temp. ensayo °C	Y.S. Est 0.60 %		U.T.S Req.		Elongation / Alargamiento		
		Ls	Sc	Type Tipo	Ori	Size Tamaño mm	Area Sección mm ²		Temp.	Min: 42 000 Max: -- psi	Min: 60 000 Max: 90 000 psi	Req. Max.	Lo	Min	Tot.
9989	15332	0	AM	Sp	L	25.45 X 05.50	220.54	RT	49 638	75 524	0.65	2	25.3	38.0	
9989	15333	0	AM	Sp	L	25.44 X 05.50	218.39	RT	50 707	77 544	0.65	2	25.2	38.0	

AM: As manufactured / Según proceso de fabricación	Ls: Location of sample / Ubicación de la muestra	Ori: Orientation / Orientación	Sc: Specimen condition / Condición de la probeta
B: Body / Cuerpo	Max: Maximum / Máximo	Req. Max: Required minimum / Mínimo requerido	Sp: Strip specimen / Muestra rectangular
L: Longitudinal / Longitudinal	Min: Minimum / Mínimo	Req. Required / Requerido	U.T.S: Ultimate tensile strength / Resistencia
Lo: Initial length / Longitud inicial	Obt: Obtained / Obtenido	RT: Room temperature / Temperatura ambiente	Y.S: Yield strength / Fluencia

CHEMICAL COMPOSITION / COMPOSICION QUIMICA

Heat N° Caldera N°	Sample N° Muestra N°	Composition % / Composición %																						
		x 100						x 1000						x 10000			x 100							
		C	Mn	Si	Mo	Cr	P	S	V	Nb	Ni	Cu	Sn	Al	Ti	As	B	Ca	N	Ce 2	Col. 1	Col. 2		
9989	00001	H	Max	25	135	60	15	40	30	38	80	110	400	400	--	--	110	--	10	--	--	40	--	99.99
		Min	--	28	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9989	00001	P	Max	25	136	60	15	40	30	38	80	110	400	400	--	--	110	--	10	--	--	40	--	99.99
		Min	--	28	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

This certificate is issued by a computerized system and is valid with electronic signature. On the original certificate the trade-mark green colored Tenaris is stamped. In case the owner of the original certificate would release a copy of it, he must assert its conformity to the original one taking upon himself the responsibility for any falsified or not allowed use. Any alteration and/or falsification will be subjected to the law.

Este certificado se emite mediante sistema computarizado y es válido con firma electrónica. El certificado original posee el sello verde Tenaris. En caso de que el poseedor del certificado entregue una copia, deberá garantizar la conformidad con el original asumiendo responsable por cualquier uso ilegítimo o no autorizado. Cualquier alteración en su falsificación estará sujeta a la ley.



INSPECTION CERTIFICATE 3.1
CERTIFICADO DE INSPECCIÓN 3.1
EN 10204 3.1: 2004

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 Date / Día: **November 27, 2015**

Tenaris de México S.A.
 Carretera México Veracruz Km 433.7 SM
 Distrito Yehucueh Tejería, Veracruz, Veracruz
 C.P. 91697 MEXICO
 (52) 229 689 1100 (L)
 (52) 229 689 1000 (E)

Customer / Cliente: VAN LEEUWEN PIPE & TUBE (CANADA) IN		Customer's Order Item / Orden Cliente - Item: 45601723 (ITEM 6)		Customer's Reference / Ref. del Cliente: N/A		Manufacturer's Works Order N° / Confirmación de Venta: 238267/05	
Manufacturing Process / Proceso de Manufactura: SEAMLESS HOT ROLLED LAMINADO EN CALIENTE SIN COSTURA		Product Type / Tipo de Producto: LINE PIPE SEAMLESS CONDUCCION SIN COSTURA		Surface / Superficie: VARNISHED BARNIZADO		Ends / Extremos: NORMAL BEVEL BISELADO NORMAL	
Standard of Specification / Normas o Especificaciones: CSA Z245.1-14/MARZO 2014, ASTM A106/14, ASME SA106/2013				Steel Grade / Grado de acero: GR B/280		Nominal Weight / Peso Nominal: 16.00 LB/FT 22.32 KG/M	
Dimensions / Dimensiones: 4.500 X 0.337 INCH 114.3 X 8.6 MM		Schedule / Código: SCH 080 / W.C X3		Length / Longitud: 36.09 / 44.00 FT 11.00 / 13.41 MTS		Quantity / Cantidad: 105 Pcs/Pz 4424.442 FT 1348.570 MTS 66035.116 LB 29963.000 KG	

CHEMICAL COMPOSITION / COMPOSICIÓN QUÍMICA

BROMI EY GERMANIAL SERVICES

		Composition % / Composición %																					
		A 100						A 1000						A 10000						A 105			
		C	Mn	Si	Mo	Cr	P	S	V	Nb	NI	Cu	Sn	Al	Ti	As	B	Ca	N	Co. 2	Col. 1	Col. 7	
Heat N° / Colada N°	Max	25	135	50	18	40	30	38	80	110	400	400	-	-	110	-	10	-	-	40	-	80.85	
	Min	-	29	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Sample N° / Muestra N°	Max	25	138	50	16	40	30	38	80	110	400	400	-	-	110	-	10	-	-	40	-	89.81	
	Min	-	26	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
9089	15332	P	22	90	20	0.6	2	7	2.4	0	0	10	23	2	20	0	1	0	10	63	39	100.00	5.6
9089	15333	P	22	90	20	0.6	2	7	2.8	0	0	10	25	2	22	0	1	0	10	62	39	100.00	6

Checked to ASME

Sect. IIA 2015 Ed. _____ MIN 0.320"
SA 530 *[Signature]* 5/11/15
US 35361 Date

Co. 2: Carbon equivalent (Canadian) / Carbono equivalente (Canadiense)	Col. 1: REL Mn/C	H. Heat / Colada	Min: Minimum / Mínimo
	Col. 2: SUMA Mo+Cr+Ni+Cu+V	Max: Maximum / Máximo	P: Product / Producto

HERDOWAN HARDNESS / DUREZA EN EL ESPESOR

Heat N° / Colada N°	Sample N° / Muestra N°	Individuals / Individuales			Average / Promedio			Hardness type / Tipo de dureza HRC														
		Min	Max	22.0	Min	Max	Var	Quad.			Scale			DD			MW			ID		
9089	15332							1			1	2	3	Avg.	1	2	3	Avg.	1	2	3	Avg.
								HRBW			78.4	78.5	78.1	78.3	78.6	78.6	77.0	78.3	78.5	78.1	78.4	78.3

AM: As manufactured / Según proceso de fabricación	ID: Internal diameter / Diámetro interno	Min: Minimum / Mínimo	Quad: Quadrant / Cuadrante
Avg: Average / Promedio	La: Location of sample / Ubicación de la muestra	MW: Middle wall / Centro	Sc: Specimen condition / Condición de la probeta

This certificate is issued by a computerized system and it is valid with electronic signature. On the original certificate the USDC-mark green colored Tenaris' is stamped. In case the owner of the original certificate would release a copy of it, the must state its conformity to the original one (stating upon him and the responsibility for any alteration or not allowed use. Any alteration under fabrication will be subjected to the law.

Este certificado se emite mediante sistema automatizado y es válido con firma electrónica. El certificado original posee el sello impreso al logo Tenaris color verde. En caso de que el poseedor del certificado entregue una copia, deberá garantizarla con conformidad con el original (haciéndose responsable por cualquier uso no autorizado o no permitido. Cualquier alteración y/o falsificación estará sujeta a la ley.



INSPECTION CERTIFICATE 3.1
CERTIFICADO DE INSPECCIÓN 3.1
EN 10204 3.1: 2004

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15044562

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Date / Día: **November 27, 2015**

Tubos de Acero de Ulucon S.A.
 Carretera Mexico Veracruz KM 433.7 SM
 Carretera Veracruz Tuxtla Gutierrez Veracruz Veracruz
 C.P. 51601 MEXICO
 (52) 229 980 1100 ext.
 (52) 229 580 1603 fax

Customer / Cliente: VAN LEEUWEN PIPE & TUBE (CANADA) IH		Customer's Order Item / Orden Cliente - Item: 45001723 ITEM 6		Customer's Reference / Ref. del Cliente: N/A	Manufacturer's Works Order N° / Confirmación de Venta: 238257/08
Manufacturing Process / Proceso de Manufactura: SEAMLESS HOT ROLLED LAMINADO EN CALIENTE SIN COSTURA		Product Type / Tipo de Producto: LINE PIPE SEAMLESS CONDUCCION SIN COSTURA		Surface / Superficie: VARNISHED BARNIZADO	
Standard or Specification / Normas o Especificaciones: CSA Z245.1-14/MARZO 2014, ASTM A106/14, ASME SA106/2013		Steel Grade / Grado de acero: GR B7290		Ends / Extremos: NORMAL BEVEL BISELADO NORMAL	
Dimensions / Dimensiones: 4.600 X 0.337 INCH 114.3 X 8.6 MM	Schedule / Espesor: SCH 080 / W.C XS	Length / Longitud: 36.00 / 44.00 FT 11.00 / 13.41 MTS	Quantity / Cantidad: 105 Pcs/Pz 4424.442 FT 1348.670 MTS	88035.116 LB 29963.000 KG	Nominal Weight / Peso Nominal: 15.00 LB/FT 22.32 KG/M

THROUGH WALL HARDNESS / DUREZA EN EL ESPESOR

B: Body / Cuerpo	Max: Maximum / Máximo	OD: Outside diameter / Diámetro externo	Var: Variation / Variación
------------------	-----------------------	---	----------------------------

FLATTENING TEST / ENSAYO DE APLASTAMIENTO

Standard / Norma:		
Heat N° Colada N°	Sample N° Muestra N°	Result Resultado
9989	15133	Good / Bueno

HYDROSTATIC TEST / PRUEBA HIDRAULICA

Pressure / Presión		Time / Tiempo	Result / Resultado
Unit / Unidad	Value / Valor	Seconds / Segundos	
MPa	20.7	5	Satisfactory / Satisfactorio

This certificate is issued by a computerized system and it is valid with electronic signature. On the original certificate the trade-mark green colored "Tenaris" is stamped. In case the owner of the original certificate would request a copy of it, he must attend its conformity to the original one taking upon himself the responsibility for any unlawful or not allowed use. Any alteration and/or falsification will be subjected to the law.

Este certificado se emite mediante sistema computarizado y es válido con firma electrónica. El certificado original posee impreso al tipo "Tenaris" color verde. En caso de que el poseedor del certificado, entregue una copia, deberá garantizar la conformidad con el original asumiendo la responsabilidad por cualquier uso ilegal o no autorizado. Cualquier alteración y/o falsificación estará sujeta a la ley.

FOR03171



INSPECTION CERTIFICATE 3.1
CERTIFICADO DE INSPECCIÓN 3.1
EN 10204 3.1: 2004

Number / Número: **15044562**
 Page / Página: **4 / 6**
 Date / Día: **November 27, 2015**

Tenaris de México, S.A.
 Carretera México-Toluca KM 433 / 518
 Colinas Valenciana Tepepa, México, Veracruz
 C.P. 81627, MEXICO
 (52) 229 969 1103 Int.
 (52) 229 969 1600 Fax

Customer / Cliente: VAN LEEUWEN PIPE & TUBE (CANADA) IN		Customer's Order Item / Orden Cliente - Item: 45001723 ITEM 6		Customer's Reference / Ref. del Cliente: N/A	Manufacturer's Works Order N° / Confirmación de Venta: 23825706
Manufacturing Process / Proceso de Manufactura: SEAMLESS HOT ROLLED LAMINADO EN CALIENTE SIN COSTURA		Product Type / Tipo de Producto: LINE PIPE SEAMLESS CONDUCCION SIN COSTURA		Surface / Superficie: VARNISHED BARNIZADO	
Standard or Specification / Normas o Especificaciones: CSA Z245.1-14/MARZO 2014, ASTM A106/14, ASME SA 106/2013			Steel Grade / Grado de acero: GR B7290		Ends / Extremos: NORMAL BEVEL BISELADO NORMAL
Dimensions / Dimensiones: 4.600 X 0.337 INCH 114.3 X 8.6 MM	Schedule / Cédula: 3CH 080 / W.C XS	Length / Longitud: 36.09 / 44.00 FT 11.00 / 13.41 MTS	Quantity / Cantidad: 106 Pcs/Pz	4424.442 FT 1348.670 MTS	Nominal Weight / Peso Nominal: 86036.116 LB 29963.000 KG 15.00 LB/FT 22.32 KG/M

HEAT TREATMENT / TRATAMIENTO TERMICO

Heat treatment / Tratamiento térmico: Pipe / Tubo	Type
Quench media of heat treatment process / Medio de enfriamiento del tratamiento térmico: n/a	Type
Temperature Scale / Escala de Temperatura: n/a	as noted

SUPPLEMENTARY INFORMATION / INFORMACIÓN SUPLEMENTARIA

Supplementary Information / Información Suplementaria	
Manufactured by Tenaris/Tenaris	Fabricación por Tenaris/Tenaris
Steel making process: Electric Arc Furnace-Ladle Furnace-Continuous Casting Machine.	Fabricación del acero: Horno de Arco Eléctrico-Horno de Aluación-Máquina de Colada Continua.
Fully Killed Steel	Acero calmado con aluminio
Material free from Mercury contamination	Material libre de contaminación de Mercurio
Not repaired by welding	No reparado por soldadura
Non destructive test: Satisfactory	Control no destructivo: Satisfactorio
Inspection method: - EMI - FLM -	Método de Inspección: - EMI - FLM -
MATERIAL ACCORDING TO NACE MR0175 / ISO 15156-2, 2009 AND NACE MR0103, 2010 ONLY FOR HARDNESS	MATERIAL DE ACUERDO A NACE MR0175 / ISO 15156-2, 2009 Y NACE MR0103, 2010 SOLO DUREZA MAX. 22
32 HRC MAX.	HRC
MATERIAL ACCORDING TO CSA Z245.1 GR.290 CAT1 6S	MATERIAL DE ACUERDO A CSA Z245.1 GR.290 CAT1 6S

This certificate is issued by a computerized system and it is valid with electronic signature. On the original certificate the three-mark green color of Tenaris is stamped. In case the owner of the original certificate would release a copy of it, he must attest its conformity to the original one being upon himself the responsibility for any unlawful or not allowed use. Any alteration and/or falsification will be subjected to the law.

Este certificado es emitido mediante sistema computarizado y es válido con firma electrónica. El certificado original posee impreso el logo Tenaris color verde. En caso de que el poseedor del certificado entregue una copia, deberá garantizar la conformidad con el original haciéndose responsable por cualquier uso ilegal e indebido. Cualquier alteración y/o falsificación estará sujeta a la ley.



INSPECTION CERTIFICATE 3.1
CERTIFICADO DE INSPECCIÓN 3.1
EN 10204 3.1: 2004

Number / Número:
15044562

Page / Página:
5 / 6

Date / Día: **November 27, 2015**

Tubos de Acero de México, S.A.
 Carretera México Veracruz Km 433.7.51
 Hefeph Veracruz Veracruz Veracruz
 C.P. 91697 MEXICO
 (52) 229 989 1100 ext
 (52) 229 899 1602 fax

Customer / Cliente: VAN LEEUWEN PIPE & TUBE (CANADA) IN		Customer's Order Item / Orden Cliente - Item: 45001723 (ITEM 6)	Customer's Reference / Ref. del Cliente: N/A	Manufacturer's Works Order N° / Confirmación de Venta: 238257/06
Manufacturing Process / Proceso de Manufactura: SEAMLESS HOT ROLLED LAMINADO EN CALIENTE SIN COSTURA		Product Type / Tipo de Producto: LINE PIPE SEAMLESS CONDUCCION SIN COSTURA		Surface / Superficie: VARNISHED BARNIZADO
Standard or Specification / Normas o Especificaciones: CSA Z245.1-14/MARZO 2014, ASTM A106/14, ASME SA106/2013		Steel Grade / Grado de acero: GR B290		Ends / Extremos: NORMAL BEVEL BISELADO NORMAL
Dimensions / Dimensiones: 4.500 X 0.337 INCH 114.3 X 8.6 MM	Schedule / Cálida: SCH 80 / W.C X5	Length / Longitud: 36.09 / 44.00 FT 11.00 / 13.41 MTS	Quantity / Cantidad: 105 Pcs/Pz 4424.442 FT 1348.670 MTS	Nominal Weight / Peso Nominal: 86036.116 LB 29853.000 KG 22.32 KG/M

MARKING / MARCACION

Marking Marcación	
PIPE STENCIL: #N**** TENARIS TM ASTM A106/ASME SA106 / CSA Z245.1 #FE1 114.3 8.60 22.32 X5 SCH 80 GR B290 CAT 1 SS 9 TEST PRESSURE/NDE #M**** MT #K**** KG HEAT #C**** O.P. 269760 / #N**** MADE IN MEXICO WHERE Heat number #C****: Manufacturing Date #FE1: Net weight of pipe in Kgs #K****: Length in Mts #M****: Pipe number #N****:	MASCARILLA DE TUBO ESTAMPADO: #N**** TENARIS TM ASTM A106/ASME SA106 / CSA Z245.1 #FE1 114.3 8.60 22.32 X5 SCH 80 GR B290 CAT 1 SS 9 TEST PRESSURE/NDE #M**** MT #K**** KG HEAT #C**** O.P. 269760 / #N**** MADE IN MEXICO DONDE Número de calada #C****: Fecha de Fabricación #FE1: Peso real de tubo en Kgs #K****: Longitud del tubo en Mts #M****: Número de acruente #N****:

SUMMARY REPORT / REPORTE RESUMEN

Heat N° Calada N°	Quantity Cantidad (Pieces)	Length Longitud		Weight Peso (Tons)
		(ft)	(m)	
9989	105	4,424.44	1,348.57	29,953

Average length per pipe Longitud promedio por tubo		Nominal weight per pipe Peso nominal por tubo	
(ft)	(m)	(lbs)	(kg/m)
42.138	12.844	14.925	22.211

This certificate is issued by a computerized system and it is valid with electronic signature. On the original certificate the trace-back green colored "Tenaris" is stamped. In case the owner of the original certificate would release a copy of it, he must attest its conformity to the original one and taking upon himself the responsibility for any use, legal or not, allowed. Any alteration and/or falsification will be subjected to the law.

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FOR03171



INSPECTION CERTIFICATE 3.1
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Number / Número
15044562

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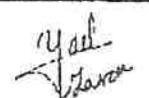
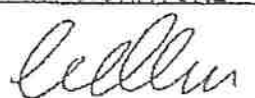
Date / Día: November 27, 2016

Tenaris de Acero de México, S.A.
 Canal, Alcazar Veracruz KM 433 T. St.
 Oficio Veracruz Tlaxiela, Veracruz Veracruz
 C.P. 81687 MEXICO
 (52) 229 925 1100 tel
 (52) 229 928 1900 fax

Customer / Cliente: VAN LEEUWEN PIPE & TUBE (CANADA) IN		Customer's Order Item / Orden Cliente - Item 46001723 ITEM 6		Customer's Reference / Ref. del Cliente: N/A	Manufacturer's Work Order N° / Confirmación de Venta 23825708
Manufacturing Process / Proceso de Manufactura: SEAMLESS HOT ROLLED LAMINADO EN CALIENTE SIN COSTURA		Product Type / Tipo de Producto: LINE PIPE SEAMLESS CONDUCCION SIN COSTURA		Surface / Superficie: VARNISHED BARNIZADO	
Standard or Specification / Normas o Especificaciones: CSA Z245.1-14/MARZO 2014, ASTM A106/H4, ASME SA106/2013			Steel Grade / Grado de acero: GR B/290		Ends / Extremos: NORMAL BEVEL BISELADO NORMAL
Dimensions / Dimensiones: 4.500 X 0.337 INCH 114.3 X 8.6 MM	Schedule / Cálula: 8CH 080 / W.C XS	Length / Longitud: 36.09 / 44.00 FT 11.00 / 13.41 MTS	Quantity / Cantidad: 105 Pcs/Pz 4424.442 FT 1348.670 MTS		Nominal Weight / Peso Nominal 88036.116 LB 28963.000 KG 15.00 LB/FT 22.32 KG/M

This is to certify that the product described here has been manufactured, sampled, tested, and inspected in accordance with purchaser order requirements. This certificate is not a declaration of origin nor may it be used as a declaration of origin.

Por el presente certificamos que el material aquí descrito ha sido fabricado, muestreado, ensayado e inspeccionado de acuerdo a los requisitos de su orden de compra. Este certificado no es, ni puede ser usado, como una declaración de origen.

CUSTOMER . THIRD PARTY		TENARIS QUALITY DEPARTMENT SIGNATURE	
INSPECTION COMPANY COMPAÑIA DE INSPECCIÓN NO APLICA Employee Name: N/A		 QUALITY CERTIFICATION DEPT. DEPTO. DE CERTIFICACIÓN DE CALIDAD Yael García Hernández	 CHIEF OF QUALITY CERTIFICATION DEPT. RESPONSABLE DEL DEPTO. DE CERTIFICACIÓN DE CALIDAD Angel César Aleán Gil

This certificate is issued by a computerized system and is valid with electronic signature. On the original certificate the trade-mark green colored "Tenaris" is stamped. In case the owner of the original certificate would release a copy of it, he must attest its conformity to the original one taking upon himself the responsibility for any unlawful or not allowed use. Any alteration and/or falsification will be subjected to the law.

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FOR03171

35528

**BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT**

INSPECTED BY: MICHAEL QUINN

GRADE: SA 333 GR6

DIA SIZE OR WITH: 4"
 NPS OD ID

DATE: JANUARY 4/2017

HEADS 2:1
 HEMI
 WELD CAP
 OTHER

LENGTH: 20'
 THICKNESS: 80
 PIPE PUBLISHED NO: 0.337"
 PLATE NOM:

P.O.#: PO-88342

SUPPLIER: APEX DISTRIBUTION INC.

SHELL
 PIPE → NDE BY MANUFACTURER

PART ID#: SPI 51297

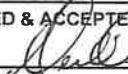
PLATE HYDRO YES NDE NO
 REPAD NO YES
 STRUCT. NO NO
 OTHER YES YES

Weight per foot for pipe over 4"

15.00

REQ. MIN TK:

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35926	60'	88279K	0.320"	0.380"	0.362"	0.348"	0.320"	OK	OK	OK	MJ
				0.373"	0.360"	0.350"	0.349"	OK	OK	OK	MJ
				0.341"	0.345"	0.344"	0.345"	OK	OK	OK	MJ

W/O#	RECEIVED & ACCEPTED BY: 	REQUIRED CODE MARKINGS:
CUSTOMER:	DATE: <u>2/28/18</u>	
STOCK		ARCELOR MITTAL-MADE IN CZECH REPUBLIC ALL MARKINGS STENCILED ON TO PIPE BY MANUFACTURE

A02 Inspection certificate "3.1" (EN 10 204)

A03 Document No.: 32227/17

A07	Customer's Order (P.O.) No./Item No.: 3200052066	A08	Manufacturer's Works Order No.: 40574/0/17								
A11	Supplier's Order No.: 3151004187	A10	Advice - Note No.: 8150019820								
B08, B12/13	Quantity delivered: <table border="1"> <tr> <td>pcs</td> <td>mtrs</td> <td>kgs</td> </tr> <tr> <td>bcls</td> <td>feet</td> <td>lbs</td> </tr> <tr> <td>59</td> <td>2322.835</td> <td>16155</td> </tr> </table>	pcs	mtrs	kgs	bcls	feet	lbs	59	2322.835	16155	A06 Customer / Consignee: ArcelorMittal Projects Europe BV MANNESMANNWEG 5 4794 SL HEIJNINGEN Netherlands
pcs	mtrs	kgs									
bcls	feet	lbs									
59	2322.835	16155									
B09-11	Dimensions: 4.500 x 0.337"										
B02	Steel designation: Grade 6 Grade290Cat.II										

B01, B03, B04 Product, conditions and terms of delivery:
 Seamless steel pipes acc. to ASME B36.10M-15, / ASTM A333/A333M-16 / ASME SA333/SA333M-15 / ANSI/NACE MR0175/ISO 15156-15 / NACE MR0103-12, with beveled ends acc. to API 5L, protected with plastic caps, surface lacquered.
 Normalized. Spec. CSA Z245.1-2014.
 Certified acc. to EN 10204/3.1-2004.

A04, B06 Marking: Manufacturer's mark, mill inspector's stamp
 AMTP OSTRAVA 1

C71-92	Heat (H) and product (P) chemical analyses (%)	C70	Steel made by basic oxygen process, fully killed, strand cast.													
B07	Heat No.: 88279K H P	C	MN	SI	P	S	CU	NI	CR	MO	V	TI	NB	B	CEQ	CE
		0.12	1.18	0.292	0.013	0.004	0.07	0.03	0.06	0.002	0.063	0.003	0.002	<0.0005	0.35	0.30
		0.13	1.14	0.289	0.013	0.005	0.07	0.03	0.05	0.003	0.061	0.003	0.001	0.0000	0.34	0.31

B07	Test results:	psi	psi	% (2")	YP/TS	C40-43 Impact test			HRB	
C04	Heat No. 88279K Specimen No. 530 Requirements: Grade 6 Grade 290	C11 Yield Point min. 35000 min. 42100	C12 Tensile Strength min. 60000 min. 60100	C13 Elongation min. 30.0 min. 25.0	max. 0.93	L-7.5-15ft-lb / - 49°F			C30-32 Hardness max. 99	
		Longitudinal strip specimen - 1"				Ø	min			
		50473 51778 51343	70198 71068 71504	39.7 37.0 37.7	0.72 0.73 0.72	145	161	142	131	78.0

D01	Visual and dimensional inspection with satisfactory results	X	D51	Hydrostatic test - min. test pressure	psi / sec	2760 / 5
C50	Flattening test - satisfactory	X	D52	The pipes tested on tightness by NDT		
C51	Expanding test - satisfactory			In acc. to		
C52	Bending test - satisfactory		D03	Nondestructive Testing Ultrasonic examination		
C53	Ring expanding test - satisfactory			acc.to EN ISO 10893-10/11 (U3C) longitudinal +		
C54	Ring tensile test - satisfactory			transversal imperfections - satisfactory		
add. D03) Nondestructive Testing Ultrasonic examination acc. to Sour - API 5L (15x8) laminarity -- satisfactory Pipe ends: MPI method acc.to ASTM E709 longitudinal + transversal imperfections - satisfactory MANUFACTURES OF BILLETS: AM OSTRAVA, Czech Republic PRESENTED DATA WAS CONVERTED FROM SI UNIT SYSTEM. Residual magnetic field [mT] max.3 - satisfactory 22 HRC = 99 HRB max. Min:C ≥ 3:1						

Z01 All pipes conform to the above mentioned standards and ordering requirements and agreements.

Z02 Date of issue 31.8.2017/CE

BROWLEY MECHANICAL SERVICES
Checked to ASME

ArcelorMittal

A01 ArcelorMittal Tubular Products Ostrava a.s.
A05 QA Department
Vratimovská 689
707 02 Ostrava-Kunčice
Czech Republic

530
2017
Edd.
MIN 0.33"
2/28/18
Data
US 35926

ArcelorMittal Tubular Products Ostrava a.s.
Vratimovská 689, 707 02 Ostrava 7
řízení jakosti
Bc. Petr Pastucha
Work's Inspector
z02 Validation

BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT

DIA SIZE OR WITH: 4"
 NPS OD ID

INSPECTED BY: MICHAEL QUINN

GRADE: SA 106B

DATE: JUNE 12/2017

HEADS 2:1
 HEMI
 WELD CAP
 OTHER

LENGTH: 40'
 THICKNESS: 80
 PIPE PUBLISHED NO: 0.337"
 PLATE NOM

P.O.#: PO-86980

SUPPLIER: BHD TUBULAR LTD.

SHELL:
 PIPE: → NDE BY MANUFACTURER

PART ID#: SPI 71081

PLATE: HYDRO YES NDE NO
 REPAD: NO YES
 STRUCT.: NO NO
 OTHER: YES YES

Weight per foot for pipe over 4"
14.98

REQ. MIN TK:

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35639	165'	657698	0.321"	0.331"	0.358"	0.327" *	0.330"	OK	OK	OK	ml
				0.339"	0.339"	0.338"	0.339"	OK	OK	OK	ml
				0.330"	0.334"	0.330"	0.337"	OK	OK	OK	ml
				0.340"	0.335"	0.333"	0.338"	OK	OK	OK	ml

W/O#	RECEIVED & ACCEPTED BY: <i>[Signature]</i>	REQUIRED CODE MARKINGS:
CUSTOMER: BMS STOCK	DATE: <u>7/24/17</u>	TIANJIN PIPE(GROUP)CORPORATION-MADE IN CHINA ALL MARKING STENCILED ONTO PIPE BY MANUFACTURE



MANUFACTURER: TIANJIN PIPE (GROUP) CORPORATION
 ADD: JINTANG ROAD DONGLI DISTRICT, TIANJIN, CHINA
 TEL: 86-22-24801073
 FAX: 86-22-24801291

QUALITY CERTIFICATE

QR-11-8.2.4-19

Licence No.:

No.: 15081130

Contract No.	TPCO-15255E		L/C No.			O.D.*W.T.	4 XS(114.30MM*8.56MM)		Packing	IN BUNDLES											
Order			Product	SEAMLESS STEEL LINE PIPE		Steel grade	Cat I Gr.290 SS /B/X42/Gr.B		Total pieces	114											
P.O. No.			Port of desti.			Man. Method	HOT ROLLING SEAMLESS		Total metres												
Standard	CSA Z245.1-14 /API SPEC 5L 45th/ASTM A106 -2014/ASME SA106 -2013				Length range	38-44FT		Total Tons	32.158												
Heat No.	Lot No.	Quantity		Delivery condition	Sample No.	Tensile test(MPa)		Impact test(J)													
		Pieces	Meters	Bundles	Tons	1* Tem °C	T.S.	Type	Y.S.	Elong.%	Shrink %	2* Tem °C	Size	AK1	Shear %	AK2	Shear %	AK3	Shear %	AVE	Shear %
657698	71	114			32.158	As rolled	71-07-2010	A	23	520	Rt0.5	375	36.0								

2

Total	114		32.158		Note:	A:strip,L.bo=25.4mm Lo=50mm															
Heat No.	Lot No.	Sample No.	Hardness test (inside)				Hardness test (middle)				Hardness test (outside)				Checked to ASME		Fla.		Fla.		
			1	2	3	4	AVE	1	2	3	4	AVE	1	2	3	4	AVE	test(1)	test(2)		
657698	71	71-07-2010	171.0	170.0	172.0	172.0	171.0	169.0	169.0	169.0	171.0	170.0	163.0	164.0	165.0	163.0	164.0	163.0	164.0	165.0	

BROMLEY MECHANICAL SERVICES
 NDE
 Sect. IIA 2015 Edd. min 0.32"
 SA 530
 US 35639
 Date 7/24/14

3

Heat No.	Material	Chemical composition % (L: Ladle analysis P: Product analysis)																	Hydro. Test			
		C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Al	V	Nb	Ti	B	Ca	N	H		O	CE(CSA)	CE(IIW)
657698	L	0.16	0.26	1.09	0.013	0.003	0.03	0.06	0.02	0.06	0.037	0.04	<0.01	<0.01	<0.0005	0.0007				0.37	0.37	3010PSI/8S
	P	0.13	0.26	1.05	0.008	0.003	0.03	0.06	0.03	0.07	0.041	0.04	<0.01	<0.01	<0.0005	0.0024				0.31	0.34	
	P	0.14	0.26	1.07	0.011	0.003	0.03	0.06	0.02	0.06	0.039	0.04	<0.01	<0.01	<0.0005	0.0014				0.33	0.35	

4

NDE (100%)	Visual and Dimension	Hydro. Test	Pipe End NDE	Pipe End Beveling	Residual Mag. Test	SSC	III C	We hereby state that all pipes are manufactured and inspected according to above standards and order.	Seal for certification:
G	G	G	G	G	G				

Note: NACE MR 0103-2010/NACE MR 0175-2009/ISO 15156-2:2009/CF(CSA) -C-I-1 Mn6-Sr24-Cu15-Ni20+ (C-Mn-V-Nb) /5+5B) .CE (I W)
 C-Mn5-(Cr+Mo+V)15+(Cu+Ni)15;ALUMINUM KILLED STEEL. EAF-LE-CONTINUOUS CASTING;ISO10474/EN10204-3 1.Silicon and calcium treated for inclusion morphology control in Steel
 Melting: Visual inspection and Dimensional inspection & dimension controls as per ASME B31.10M

No. _____ Date 2015-8-18
 Page (1)

Remark: desti.=destination; Tem.=Temperature; speci.= specification; Man.=Manufacture; Fla.=Flare; G=Good; Hydro.=Hydrostatic; Mag=Magnetic (FOR EXPORT ONLY)

BROMLEY MECHANICAL SERVICES

MATERIAL INSPECTION REPORT

INSPECTED BY: **MICHAEL QUINN**

GRADE: **SA 333 GR6**

DIA SIZE OR WITH: **4"**

NPS OD ID

DATE: **JUNE 9/2017**

HEADS 2:1

LENGTH: **20'**

P.O.#: **PO-86922**

HEMI

THICKNESS: **80**

SUPPLIER: **MRC CANADA ULC.**

WELD CAP

PIPE PUBLISHED NO: **0.337"**

PART ID#: **SPI 51297**

OTHER

PLATE NOM

REQ. MIN TK:

SHELL

PIPE **NDE BY MANUFACTURER**

PLATE HYDRO YES NDE NO

REPAD NO YES

STRUCT. NO NO

OTHER YES YES

Weight per foot for pipe over 4"

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35599	315'	A7172	0.330"	0.335"	0.336"	0.340"	0.366"	OK	OK	OK	ML
				0.335"	0.344"	0.334"	0.331"	OK	OK	OK	ML
				0.338"	0.337"	0.338"	0.344"	OK	OK	OK	ML
				0.337"	0.338"	0.339"	0.341"	OK	OK	OK	ML
				0.332"	0.332"	0.333"	0.336"	OK	OK	OK	ML
				0.337"	0.337"	0.339"	0.334"	OK	OK	OK	ML
				0.330"	0.334"	0.342"	0.341"	OK	OK	OK	ML

W/O# _____ RECEIVED & ACCEPTED BY: *[Signature]*

REQUIRED CODE MARKINGS: _____

CUSTOMER: **STOCK** DATE: **7/6/17**

MAHARASHTRA SEAMLESS LIMITED-MADE IN INDIA
ALL MARKINGS STENCILED ON TO PIPE BY MANUFACTURE



MAHARASHTRA SEAMLESS LIMITED

OCF.20A

WORKS (MILL) TEST CERTIFICATE
DIN:50049:3.1, B/EN:10204:3.1

PO# 4899263

Page 1 of 1

HEAT: a7172 CCTF Sku: 2860085 4 E A333-6 XH BLK SMLS SRL Invoice: 2243018-00 PO: C7704772688B1 6/8/2017 3:12:04 PM

Date : 03-MAR-17
Specification : ASTM/ASME A/SA 333 GR.6(13), CSA Z245.1 GR.290
CAT-II M46C(14), API 5L B/X-42 PSL2(12)
Process/Product: HOT FINISH SEAMLESS Carbon Steel Pipes

P.O. No : GVN/G/SC/16-17/1133 Dt. 16-DEC-16
W.O. No : 6160206

Inv. 539

DESCRIPTION

Sl No	Material/Item Code	SIZE (Inch)	Length Range (Feet/Mtr)	Heat No.	No Of PCS	Length (Feet/Mtr)	End Finish	Hydro Test Pressure at 5 Sec	Bend Test	Flattening Test	Flaring Test	Drift Expn. Test	Crushing Test
1	2860085	4 1/2 X 0.337 X80 PPF	21	A7172	60	1260	BEVEL	2970 PSI	NA	OK	NA	NA	NA

PHYSICAL PROPERTIES

CHEMICAL COMPOSITION (%)

Sl No	Heat No	YST (PSI)	UTS (PSI)	El (%)	Hardness HRB	Impact Test Charpy V-notch Joule	LA/PA	CHEMICAL COMPOSITION (%)															
								C	Mn	Si	P	S	Cr	Mo	Ni	V	Cu	Al	Ti	Nb	CE		
		U.L. 2", G.W.1" L at room temp				10x6.7x55 Minus 56 Deg.C																	
Required (Max)		42100	60200	30				.28	1.06	.1	.025	.025	.3	.12	.4	.08	.4						
Required (Min)		42100	60200	30				.28	1.06	.1	.025	.025	.3	.12	.4	.08	.4						
1	7172	54563	72684	42.40	74 - 76	218, 234, 245 Av. 232.3	LA	.13	1.270	.310	.014	.004	.015	.002	.006	.008	.005	.033	.004	.001	.347		
		54473	72558	40.00			PA	.142	1.282	.290	.013	.004	.016	.004	.035	.007	.005	.032	.003	.001	.364		
								PA	.142	1.272	.302	.014	.005	.019	.004	.034	.006	.005	.033	.003	.001	.363	

BROWLEY MECHANICAL SERVICES
Checked to ASME

Sect. 1A 2015 Ed. MIN 0.330"
SA 530
US 35599
Date 7/6/17

Dimensions : Outside diameter, thickness, weight, length conforms to above specification.

Coating : All Pipes are coated with rust preventive from outside surface only.

N.D.T. : All Pipes are tested by Eddy Current method as per practice E-309.

Heat Treatment : Normalized

Raw material : Full Killed

Marking/Stencilling : MAHA
API SPEC 5L 0135.1 (API LOGO) M/Y ASTM/ASME A/SA 333 GR.6-2013 API 5L GR.B/X-42 PSL-2 BE CSA Z245.1 GR.290 CAT-II M46C
2014 HOUR SERVICE SRL NACE MR-0175/ISO 15156-2 (REGION-1) 2015 AND MR-0103-2012-SMLS OD 4.500 INCH X WT 0.337 INCH X LENGTH (IN

Remarks : Material conforms to NACE MR-0175/ISO15156/NACE MR-0103 restricted to Sulphur contents 0.01% & Hardness 22 HRC max.
Impact at - 45 DEG.C. Specimen size(mm):10X7.50X55, Charpy V-Notch LONGITUDINAL For each reduction of 0.01% Carbon below 0.30%, an increase of 0.05% Manganese above 1.06% would be permitted to a Maximum of 1.35% Mn.

CERTIFY THAT THE MATERIAL CONFORMS TO ABOVE SPECIFICATION.

FOR MAHARASHTRA SEAMLESS LIMITED

R.K. SRIVASTAVA Asst. ENGINEER



Warning: Modification or unauthorized use of this certification is strictly prohibited. Violation calls for criminal prosecution. For authenticity verification, you can contact us at info@mahaseam.com
W.R.O: Pipenagar, Vill. Sukeli, P.H. 17, D.K.G. Road, Dist. Raigad, Maharashtra-402126 Phone: 02194216511, 222010 Fax: 236513 Rev.No: 7.01.10-2004

BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT

INSPECTED BY: MICHAEL QUINN

GRADE: SA 106B

DIA SIZE OR WITH: 4"
 NPS OD ID

DATE: OCTOBER 12/2017

HEADS 2:1
 HEMI
 WELD CAP
 OTHER

LENGTH: 20'

P.O.#: PO-87541

SHELL

THICKNESS: 80

SUPPLIER: APEX DISTRIBUTION INC.

PIPE → NDE BY MANUFACTURER

PIPE PUBLISHED NO: 0.337"

PART ID#: SPI 71081

PLATE HYDRO YES NDE NO

PLATE NOM

REQ. MIN TK:

REPAD NO YES

STRUCT. NO NO

OTHER YES YES

Weight per foot for pipe over 4"

14.98

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35778	207'	E66514	0.323"	0.332"	0.320"	0.328"	0.327"	ok	ok	ok	ml
				0.330"	0.328"	0.322"	0.336"	ok	ok	ok	ml
				0.323"	0.324"	0.328"	0.331"	ok	ok	ok	ml
				0.339"	0.338"	0.335"	0.334"	ok	ok	ok	ml
				0.334"	0.333"	0.330"	0.329"	ok	ok	ok	ml
				0.332"	0.340"	0.329"	0.331"	ok	ok	ok	ml
				0.333"	0.324"	0.330"	0.333"	ok	ok	ok	ml

W/O#
CUSTOMER: **BMS STOCK**

RECEIVED & ACCEPTED BY: *[Signature]*
DATE: 11/14/17

REQUIRED CODE MARKINGS:
ISMT LIMITED-MADE IN INDIA
ALL MARKING STENCILED ONTO PIPE BY MANUFACTURE

P4X1

75390 936

ISMT LIMITED
Solutions You Can Trust

TEST CERTIFICATE ACC TO EN: 10204: 3.1		Formal No. QFD-QU-148-01																																							
Customer : BRI-STEEL DISTRIBUTION		Test Certificate No. : RQ3-1752	Date: 11-MAR-2017																																						
Consignee : BRI-STEEL DISTRIBUTION		W.O. No. : QFSO153718																																							
		Invoice No. : DAO1644953	Date: 11-MAR-2017																																						
P.O.No : E-88903		Date: 12-JAN-2017																																							
Customer Item: ITEM NO. 49 PART NO. 03394 4 XII SRL ORD A SA 108																																									
Specification : ASTM A 106 A 106M-15 Grade B/ASME BPVC SA-106/SA-106M Grade B SECTION II, PART A Edition 2015/NACE MR 0175/NACE MR 0103																																									
Product : HOT FINISHED SEAMLESS STEEL PIPE		Bearing No. / Part No.: 4XH																																							
Ends : BEVELLED ENDS		Batch Number : BOC55																																							
Heat Number : E66514		Steel Grade : SAE 1019																																							
Steel Supplier: JSW		Manufacturing Route : BF-EOF-LRF-VD-CCM-EMS																																							
<table border="1"> <thead> <tr> <th rowspan="2"></th> <th colspan="2">Dimensions</th> <th colspan="3">Tolerance</th> </tr> <tr> <th>MM</th> <th>Inch</th> <th>+Ve</th> <th>-Ve</th> <th>JOM</th> </tr> </thead> <tbody> <tr> <td>OD</td> <td>114.300</td> <td>4.500</td> <td>0.800</td> <td>-0.800</td> <td>MM</td> </tr> <tr> <td>ID</td> <td>97.180</td> <td>3.826</td> <td>0.000</td> <td>0.000</td> <td>MM</td> </tr> <tr> <td>WT</td> <td>8.560</td> <td>0.337</td> <td>10.000</td> <td>-10.000</td> <td>P</td> </tr> </tbody> </table>			Dimensions		Tolerance			MM	Inch	+Ve	-Ve	JOM	OD	114.300	4.500	0.800	-0.800	MM	ID	97.180	3.826	0.000	0.000	MM	WT	8.560	0.337	10.000	-10.000	P	<table border="1"> <thead> <tr> <th colspan="3">Quantity</th> </tr> <tr> <th>Number</th> <th>Meter / Feet</th> <th>Weight</th> </tr> </thead> <tbody> <tr> <td>84</td> <td>529.650 / 1737.782</td> <td>12.070 Ton</td> </tr> </tbody> </table>		Quantity			Number	Meter / Feet	Weight	84	529.650 / 1737.782	12.070 Ton
	Dimensions		Tolerance																																						
	MM	Inch	+Ve	-Ve	JOM																																				
OD	114.300	4.500	0.800	-0.800	MM																																				
ID	97.180	3.826	0.000	0.000	MM																																				
WT	8.560	0.337	10.000	-10.000	P																																				
Quantity																																									
Number	Meter / Feet	Weight																																							
84	529.650 / 1737.782	12.070 Ton																																							
		Length: R/ 6096.000- 6400.800 MM, R/20.001 -21.001 Feet																																							
Chemical Analysis :																																									
Elements	UOM	Min	Max	Mill	Product1	Product2																																			
C	%	0.1000	0.3000	0.1850	0.1850	0.1800																																			
Si	%		0.0350	0.0240	0.2400	0.2300																																			
Mn	%	0.2900	1.3500	0.0060	0.0060	0.0050																																			
P	%		0.0350	0.0150	0.0140	0.0130																																			
Ni	%		0.4000	0.8100	0.8100	0.8000																																			
Cr	%		0.4000	0.0170	0.0170	0.0160																																			
Mo	%		0.4000	0.0600	0.0600	0.0500																																			
Cu	%		0.1500	0.0080	0.0070	0.0080																																			
Al	%		0.4000	0.0120	0.0110	0.0100																																			
Sn	%			0.0080	0.0080	0.0070																																			
Al	%			0.0300	0.0300	0.0200																																			
Ti	%		0.0800	0.0027	0.0026	0.0027																																			
S	%			0.0010	0.0010	0.0010																																			
P	%			0.0020	0.0020	0.0020																																			
As	%			0.0010	0.0010	0.0010																																			
Sb	%			0.0003	0.0002	0.0003																																			
Nb	%			0.0010	0.0010	0.0010																																			
Cl	%			0.3357	0.3355	0.3269																																			
Mechanical Properties : ASTM A 370																																									
	YS (ReH) MPa 0.2%	U.T.S.(Rm) MPa	% E (A) 50.00MM	Hardness HBW																																					
Min	240.00	415.00	25.00																																						
Max				237.00																																					
1	310.78	466.56	37.20	131 - 133																																					
Sample Orientation : Longitudinal				Tensile Specimen Type : Strip Gauge Width(mm) 25.4																																					
Flattening Test (As Per Specn.)				:Ok																																					
Ultrasonic Test (As Per ASTM E213)				:Ok																																					
Hydraulic Test (As Per Specn.)				:Ok 20 MPa																																					
HOLDING TIME 5 SEC. MINIMUM																																									
Remarks :																																									
1. NO WELD REPAIR PERFORMED, COLOUR CODE : GREEN BAND AT BOTH ENDS.																																									
We hereby Certify that the material described above conforms to specifications & Purchase Order																																									

Sect. IIA PDS Edd. mm D.32"
 9A 530
 US 35-778
 Date 11/1/17

Checked to ASME



160.75 16940 : 2009

ISMT Tube Plant B
 B-13, MIDC, Baramali - 413 133, Maharashtra, India
 Phone : +91 2112 243861 - 65 | Fax : +91 2112 243873
 www.ismt.com

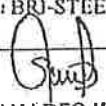
CIN : L27109PN1999PLC016417



BS OHSAS 18001:2007
 ISO 14001:2004
 OHS 560515
 EMS 560513

bristeel
 MTR Reviewed
Kesh
 2017 May 8

ISMT LIMITED
Solution's You Can Trust

TEST CERTIFICATE ACC TO EN: 10204: 3.1		Format No. QFB-QU-14R-01	
Customer : BRI-STEEL DISTRIBUTION	Test Certificate No. : RQ341752	Date: 11-MAR-2017	
Consignee : BRI-STEEL DISTRIBUTION	W.O. No. : QFSO153718	Date: 11-MAR-2017	
	Invoice No. : DAO1644953		
 SUNIL MAHADEO KHARTODE JUNIOR SUPERVISOR-QA Authorized signatory			



ISD/TB 16949 : 2009

ISMT Tube Plant B
B-13, MIDC, Boramall - 413 133, Maharashtra, India.
Phone : +91 2112 243861 - 65 | Fax : +91 2112 243873
www.ismt.com

CIN : L27109PN1999PLC016417



BSI SAS 18001:2007 OHS 560515
ISO 14001:2004 EMS 660513

BROMLEY MECHANICAL SERVICES
MATERIAL INSPECTION REPORT

INSPECTED BY: **MICHAEL QUINN**

GRADE: **SA 106B**

DIA SIZE OR WITH: **4"**
 NPS OD ID

DATE: **JULY 25/2017**

HEADS 2:1
 HEMI
 WELD CAP
 OTHER

LENGTH: **40'**

P.O.#: **PO-87184**

THICKNESS: **80**

PIPE PUBLISHED NO: **0.337"**

SUPPLIER: **MRC CANADA ULC.**

SHELL
 PIPE → **NDE BY MANUFACTURER**

PLATE NOM

PART ID#: **SPI 71081**

PLATE HYDRO YES NDE NO
 REPAD NO YES
 STRUCT. NO NO
 OTHER YES YES

Weight per foot for pipe over 4"
14.98

REQ. MIN TK:

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35699	252'	046686	0.330" ⁴¹	0.330"	0.339"	0.335"	0.342"	ok	ok	ok	ml
				0.334"	0.335"	0.330"	0.337"	ok	ok	ok	ml
				0.333"	0.336"	0.340"	0.336"	ok	ok	ok	ml
				0.340"	0.333"	0.335"	0.338"	ok	ok	ok	ml
				0.339"	0.331"	0.332"	0.333"	ok	ok	ok	ml
				0.336"	0.330"	0.335"	0.336"	ok	ok	ok	ml

W/O#	RECEIVED & ACCEPTED BY: <i>as.</i>	REQUIRED CODE MARKINGS:
CUSTOMER: BMS STOCK	DATE: SEP 05 2017	TIANJIN PIPE(GROUP)CORPORATION-MADE IN CHINA ALL MARKING STENCILED ONTO PIPE BY MANUFACTURE

Heat Number: 046686, Customer PO Number: PO-87184, PO Line: 0001-00000
MRC Global Part Number: 03C33092, Sales Order Number: 4820469, Sales Line: 0001-00000
MRC Global Part Description: 4 XH CS SWLS PIPE BE DRL ASTM A/ASME SA106B CSAZ245.1 GR.290C1 TPCO

		MANUFACTURER: FLANEN PIPE (BEIJING) CORPORATION ADD: JINTANG ROAD DONGLEI DISTRICT, FLANEN, CHINA										QUALITY CERTIFICATE										Licence No.: No.: 14112505						
Order No. TPCO-14656E		L/C No.		O.D. x W.T. 4IN SCH80 114.30x8.56MM										Packing IN BUNDLES														
Order: WID Tubular Limited		Product: SEAMLESS STEEL LINE PIPE		Steel grade: Cat 1 Gr.290 Sour Service B/N42 Gr.B										Total pieces: 114														
P.O. No. WID P/O# 113769		Port of dest.		Man. Method: HOT ROLLING SEAMLESS										Total metres: 32.711														
Standard: CSA Z245.1-14 JAPI SPEC 5L 450/ASTM A 106/A 53-2013/ASME SA 106/SA 53-2013		Length range: 40-44FT																										
Heat No. 046686		Lot No. 71		Quantity: 114 Pieces, 32.711 Meters		Delivery condition: As rolled		Sample No. 71-11-0788		Tensile test (MPa): T _{0.2} 22, T _S 485, R _{0.5} 350, Elong. 39.0		Impact test (J): AK1, AK2, AK3, AVE																
Total		114		32.711		Note: A-strip, L _{bo} =25.4mm, L _o =50mm																						
Heat No. 046686		Lot No. 71		Sample No. 71-11-0788		HVT0		Hardness test (inside): 1 151.0, 2 162.0, 3 163.0, 4 161.0, AVE 162.0					Hardness test (middle): 1 159.0, 2 158.0, 3 158.0, 4 157.0, AVE 158.0					Hardness test (outside): 1 160.0, 2 159.0, 3 160.0, 4 159.0, AVE 160.0					NDE: ET+UT/Ø2.2+L3		Fla. test(1): G		Fla. test(2): G	
Heat No. 046686		Chemical composition % (L: Ladle analysis, P: Product analysis)																		Hydro Test								
Material 12MnSV		C: 0.13, Si: 0.23, Mn: 1.02, P: 0.008, S: 0.004, Ni: 0.06, Cr: 0.07, Mo: 0.02, Cu: 0.06, Al: 0.034, V: 0.04, Nb: 0.01, Ti: 0.00, B: 0.0005, Ca: 0.0008, N: 0.30, H: 0.33, O: 0.30, CE(HW): 0.32																		3010PS/BS								
NDE (100%)		Visual and Dimension		Hydro. Test		Pipe End NDE		Pipe End Beveling		Residual Mag. Test		SSC		HIC		We hereby state that all pipes are manufactured and inspected according to above standards and order.												
G		G		G		G		G		G		G		G		No. _____ Date: 2015-2-15												
Page: (1)																				(FOR EXPORT ONLY)								

BROMLEY MECHANICAL SERVICES
Checked to ASME

VS35699

Sect. IIA 2015-2017 Edd. min 330"

SA 530 08 9/5/17

Date

BROMLEY MECHANICAL SERVICES

MATERIAL INSPECTION REPORT

DIA SIZE OR WITH: _____

6"

NPS OD ID

INSPECTED BY: **MICHAEL QUINN**

GRADE: SA 333 GR6

LENGTH: **20'**

DATE: **MARCH 2/2017**

- HEADS 2:1
 HEMI
 WELD CAP
 OTHER

THICKNESS: **80**

P.O.#: **PO-85996**

PIPE PUBLISHED NO: **0.432"**

PLATE NOM _____

SUPPLIER: **BHD TUBULAR LIMITED**

SHELL

PIPE → **NDE BY MANUFACTURER**

Weight per foot for pipe over 4"

PART ID#: **SPI 58919**

- PLATE HYDRO YES NDE NO
 REPAD NO YES
 STRUCT. NO NO
 OTHER YES YES

28.57

REQ. MIN TK: _____

MATERIAL TRACKING NUMBER	QTY	ACTUAL MATERIAL IDENTIFICATION MARKINGS	MIN. THK.	THICKNESS & LOG				VISUAL EDGE	INSP. SURF.	REQ. MARKINGS VERIFIED	PREPARED BY
				A	B	C	D				
VS 35366	501'	A6286	0.424"	0.424"	0.430"	0.438"	0.445"	ok	ok	ok	ml
				0.429"	0.433"	0.438	0.434"	ok	ok	ok	ml
				0.425"	0.437"	0.431"	0.445"	ok	ok	ok	ml
				0.424"	0.438"	0.430"	0.449"	ok	ok	ok	ml
				0.430"	0.430"	0.442"	0.443"	ok	ok	ok	ml
				0.425"	0.438"	0.440"	0.448"	ok	ok	ok	ml
				0.425"	0.439"	0.440"	0.446"	ok	ok	ok	ml

W/O# _____

CUSTOMER: **STOCK**

RECEIVED & ACCEPTED BY: _____

DATE: *5/19/17*

REQUIRED CODE MARKINGS: _____

MAHARASHTRA SEAMLESS LIMITED-MADE IN INDIA
ALL MARKINGS STENCILED ON TO PIPE BY MANUFACTURE



MAHARASHTRA SEAMLESS LIMITED
WORKS (MIDL) TEST CERTIFICATE
 DIN:50049:3.1. B/EN:10204:3.1

QCF.20A

Tc No : MSL-7/QC/2171P/2016 Customer :
 Date : 10-DEC-16
 Specification : ASTM/ASME A/SA 333 GR.6 (2015) , CSA Z245.1 GR.290
 CAT-II M45C(2014)
 Process/Product: HOT FINISH SEAMLESS Carbon Steel Pipes P.O. No: Dt. 07-SEP-16
 W.O. No: 6160109

DESCRIPTION													
Sl NO	Material/Item Code	Size (Inch)	Length Range (Mtr/Ft)	Heat No.	No Of DCS	Length Mtr/Feet	End Finish	Hydrostatic Test	Bend Test	Flattening Test	Flaring Test	Drift Exp. Test	Crossing Test
1		6.625 X 0.432	38-39	A6286			BEVEL	2970 PSI	NA	OK	NA	NA	NA

PHYSICAL PROPERTIES							CHEMICAL COMPOSITION (%)																
Heat No	YST (PSI)	UTS (PSI)	El (%)	Hardness HRB	Impact Test Joule	LA/PA	C	Mn	Si	P	S	Cr	Mo	Ni	V	Cu	Al	Ti	Nb	CR			
G.L. = 2*, G.W.1 T/L-(L)																							
Required (Max)	42100	60200	30	99	27		.26	1.06	.5	.025	.01	.3	.12	.4	.06	.4		.11			.4		
Required (Min)								.29	.1														

1	A6286	47619	73531	43.60	75 - 77	260,235,235 Av. 243.3	LA PA PA	.140 .135 .140	1.290 1.298 1.310	.320 .301 .302	.020 .017 .015	.005 .008 .008	.010 .048 .049	.000 .006 .006	.013 .037 .034	.002 .003 .003	.030 .035 .036	.030 .027 .026	.000 .002 .003	.000 .000 .000	.360 .368 .375
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BROMLEY MECHANICAL SERVICES
 Checked to ASME

Sect. IIA 2015 Ed. MIN 0.424"
 SA 530
 US 35366
 Date 5/19/17

Dimensions : Outside diameter, thickness, weight, length conforms to above specification.
 Coating : All Pipes are coated with rust preventive from outside surface only.
 N.D.T. : Not Applicable
 Heat Treatment : Normalized
 Marking/Stencilling : MAHA MSL ASTM A 333 GR.6, ASME SA 333 GR.6, CSA Z245.1 GR.290 CAT-II M45C-2014 88 NPS 6 (6.625 INCH) X 0.432 INCH X LENGTH (IN FBHT) HPS HEAT NO...2970 PSI NORM+LT - 45 DEG.C+WEIGHT=28.60 PPP+MADE IN INDIA+POSCI-16-478-PIPE NO.

Remarks : Material Conforms to NACE MR-0175/ISO15156, NACE MR-0103. Pipes are according to ANSI B36.10. Material is free from mercury contamination. Mfg. Process BOP/BAF ; Fully Killed & Fine Grained ; VD route. Ca value-> 0.0006% & B->0.0003%. Shear area: 85% to 90%, Normalising Temp. 910-950 Deg.C & cycle time 30-40 minutes. For each reduction of 0.01% Carbon below 0.30%, an increase of 0.05% Manganese above 1.06% would be permitted to a Maximum of 1.35% Mn. Hydro Pressure at 05 Sec. Impact at - 48 Deg.C. Specimen size (mm): 10X7.5X55, Charpy V-Notch LONGITUDINAL


CERTIFY THAT THE MATERIAL CONFORMS TO ABOVE SPECIFICATION. FOR MAHARASHTRA SEAMLESS LIMITED
 R.K. SRIVASTAVA - Asst. ENGINEER

Warning: Modification or unauthorized use of this certification is strictly prohibited. Violation calls for criminal prosecution. For authenticity verification, you can contact us at malco@mahaseam.com
 W.A.R.O: Pipenagar, Vill. Suketi, N.B.17, B.K.G. Road, Dist. Raigad, Maharashtra-402126 Phone: 02194238511, 222010 Fax: 238513 Rev.No: 7, 01.10.2004



Tuboscope Vetco (D) GmbH
 Vendor Services
 REVIEWED BY INSPECTOR: P. Mahadule
 APPROVED SIGNATURE: [Signature]
 WITNESSED DATE: 11/12/2016

35527/35528

	METALFAR PRODOTTI INDUSTRIALI SPA 23861 CESANA BRIANZA (LC) - ITALY VIA G. PARINI, 28 PHONE + 39 031 655441 - FAX +39 031 655149 certificate@metalfaritaly.com	A01	COMPANY WITH MANAGEMENT SYSTEM CERTIFIED BY DNV = ISO 9001 = = ISO 14001 =
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INSPECTION CERTIFICATE EN 10204:2004 / 3.1	A02	Nr ^{A03} 2016-C_MFF-00610	Data / Dated 12.02.2016 ²⁰²
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TRANS AM PIPING PRODUCTS LTD 9335 ENDEAVOR DRIVE S.E. T3S 0A1 CALGARY, ALBERTA	A06 CA	Ordine / PO CI-16-117 Item 016 DDT / Delivery note 2016-3E301-0000543 Packing List 2016-3E401-0000441 Fattura / Invoice 2016-3E401-0000441 Ns. rif. / Our ref. 2016-3E201-0000106-0016	A07 A08
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Dest. TRANS AM PIPING PRODUCTS LTD 9335 - Endeavor Drive S.E. T3S 0A1 Calgary, ALBERTA	A06 CA
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Cod. colata ^{B07} Heat Code	Nr. colata ^{B07} Heat Nr	B09 W/N: 600 RF 1" 160 A105N	Descrizione ^{B01 - (B09 - B11)} Description
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Mat. in acc. a / Mat. in acc. to ^{B07} ASTM A105M - 14 ASME SA105M-15 ASME CODE SECT. II, PART A, ED. 2015
 NACE MR-0175/2009 ISO 15156 - SOUR SERVICE
 NACE MR-0103/2012 - SOUR SERVICE
 CSA Z245.12 GRADE 248 CAT. I SOUR SERVICE
 Q A S IN ACCORD WITH PRESS. EQUIPM. DIRECT. 97/23/EC (PED) ANNEX I, PARAGRAPH 4.3
 CERT. 4687-2014-CE-ITA-ACCREDIA

Elementi / Elements ^(C1, C2)	C	Si	Mn	S	P	Cr	Ni	Mo	Ti	Cu	V	Nb	N
LADLE ANALYSIS	0,185	0,240	0,940	0,010	0,015	0,090	0,070	0,010	0,020	0,200	0,002	0,002	0,000
PRODUCT ANALYSIS	0,187	0,246	0,948	0,008	0,013	0,095	0,074	0,013	0,017	0,196	0,003	0,001	0,002
LADLE ANALYSIS	0,025												
PRODUCT ANALYSIS	0,028												

CE LF=C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15	CE SF=C+(Mn/6)	F1=Cu+Ni+Cr+Mo+V	F2=Cr+Mo
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Provetta ^{C10}	Forma ^{C10}	Snervamento > 0,2% ^{C11}	Snervamento > 1,0% ^{C11}	Rottura ^{C12}	Allungamento ^{C13}	Contrazione ^{C15}
Test specimen	Shape	Yield Strength > 0,2%	Yield Strength > 1,0%	Tensile	Elongation	Reduction of area
Sez/Sect mm ² : L mm	1=0 - 2=□	MPa	MPa	MPa	%	%
126,60 50,80	1 20	341,0	-	530,0	33,0	60,0

DUREZZA / HARDNESS ^{C22}							RESILIENZA / IMPACT TEST			
HBW	Tipo/Type ^{C40}	Provetta / Test Specimen	°C ^{C03}	1-Joule ^{C42}	2-Joule ^{C42}	3-Joule ^{C42}	Media/Average ^{C43}			
150,0 - 156,0	KV	10x10 mm	20	81	89	86	85,3			

Tratt. Term. / Heat treatment ^{C70}	NORMALIZED AT 920 °C - COOLED IN STILL AIR	ELECTRIC FURNACE
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Dim in acc. a / Dim. acc. to ^{B14}	ASME/ANSI B16.5 -2013 ASME/ANSI B36.10M -2015
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Finitura / Roughness	125/250 MICRORINCH AARH
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Marcatura in acc. ^{B06} Marking in acc. to	MSS SP25-Ed. 2013	Vis. & Dim.	SATISFACTORY	Origine ^{B06} Origin of Steel	EUROPEAN UNION
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Note / Notes: 100% MANUFACTURED IN ITALY
 MANUFACTURING IN ACCORDANCE WITH ORDER AND SPECIFICATION

UFFICIO CONTROLLO QUALITA' ^{A05} QUALITY CONTROL DEPARTMENT 	ENTE UFFICIALE DI COLLAUDO ^{Z03} INSPECTION AUTHORITY	MARCHIO PRODUZIONE ^{A04} MANUFACTURER'S SYMBOL 
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35527/3528

COMPANY WITH MANAGEMENT SYSTEM CERTIFIED BY DNV GL = ISO 9001 = = ISO 14001 =		METALFAR PRODOTTI INDUSTRIALI SPA 23861 CESANA BRIANZA (LC) - ITALY VIA G. PARINI, 28 PHONE + 39 031 855441 - FAX +39 031 656149 certificate@metalfaritaly.com	A01	COMPANY WITH MANAGEMENT SYSTEM CERTIFIED BY DNV GL = ISO 9001 = = ISO 14001 =
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INSPECTION CERTIFICATE EN 10204:2004 / 3.1	A02	Nr ^{A03} 2017-C_MFF-02672	Data / Dated 21.07.2017	Z02
TRANS AM PIPING PRODUCTS LTD 9335 ENDEAVOR DRIVE S.E. T3S 0A1 CALGARY, ALBERTA	A08	Ordine / PO Item DDT / Delivery note Packing List Fattura / Invoice No. rif. / Our ref.	CI-17-492 054 2017-3E301-0002706 2017-3E401-0002517 2017-3E401-0002517 2017-3E201-0002027-0054	A07 A08

Dest. TRANS AM PIPING PRODUCTS LTD 9335 - Endeavor Drive S.E. T3S 0A1 Calgary, ALBERTA	CA
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Cod. colore Heat Code	Nr. colore Heat Nr	W/N: 600 RF	180	A105N	Descrizione Description	B01 - (B00 - B11)
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Mat. in acc. a / Mat. in acc. to
 ASTM A105M 14 - ASME SA 105M 15 - ASME CODE SECT. II, PART 1, EDITION 2015
 NACE MR-0175/2015 - ISO 15156 - SOUR SERVICE
 NACE MR-0103/2015 - SOUR SERVICE
 CSA Z245.12-13 - GRADE 248 CAT. 1 SOUR SERVICE
 Q.A.S IN ACCORD WITH PRESS EQUIP DIRECT 2010/68/EU (RED) ANNEX PARAGRAPH 1-3
 CERT 4687-2014 - CEITA - DNV GL

Elementi / Elements	C	Si	Mn	S	P	Cr	Ni	Mo	ti	Cu	V	Nb	N
LADLE ANALYSIS	0,200	0,220	0,50	0,007	0,010	0,080	0,050	0,010	0,017	0,100	0,002	0,002	0,000
PRODUCT ANALYSIS	0,198	0,225	0,54	0,009	0,008	0,083	0,054	0,019	0,315	0,105	0,003	0,003	0,001
LADLE ANALYSIS			Ca						CE LF	CE SF	F1	F2	PREN
PRODUCT ANALYSIS			0,000						0,403	0,375	0,242	0,090	
			0,000						0,404	0,374	0,258	0,095	

Provetta / Test specimen	Forma / Shape	Snervamento > 0,2% / Yield Strength > 0,2%	Snervamento > 1,0% / Yield Strength > 1,0%	Rottura / Tensile	Allungamento / Elongation	Contrazione / Reduction of area
126160	50180	348,0	-	545,0	32,0	57,0

DUREZZA / HARDNESS	RESILLENZA / IMPACT TEST
HBW 148,0 - 154,0	Tipo / Type KV Provetta / Test Specimen 10x10 mm °C C03 20 1-Joule C42 81 2-Joule C42 76 3-Joule C42 87 Media / Average C43 81,3

Treat. Term. / Heat treatment: NORMALIZED AT 920 °C - COOLED IN STILL AIR / ELECTRIC FURNACE

Dim in acc. a / Dim. acc. to: ASME/ANSI B16.5-2013 / ASME/ANSI B36.10M-2015 / ASME/ANSI B16.25-2012


Finitura / Roughness: 125/250 MICRORINCH AARH

Marcature in acc. Marking in acc. to	MSS SP25 Ed. 2013	Vis. & Dim.	SATISFACTORY	Origine Origin of Steel	EUROPEAN UNION
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Note / Notes: 100% MANUFACTURED IN ITALY / MANUFACTURING IN ACCORDANCE WITH ORDER AND SPECIFICATION

UFFICIO CONTROLLO QUALITA' QUALITY CONTROL DEPARTMENT 	ENTE UFFICIALE DI COLLAUDO INSPECTION AUTHORITY	MARCHIO PRODUZIONE MANUFACTURER'S SYMBOL 
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35527/35528

 METALFAR PRODOTTI INDUSTRIALI SPA 23861 CESANA BRIANZA (LC) - ITALY VIA G. PARINI, 28 PHONE + 39 031 655441 - FAX +39 031 655149 certificate@metalfaritaly.com		A01 COMPANY WITH MANAGEMENT SYSTEM CERTIFIED BY DNV = ISO 9001 = = ISO 14001 =																																																																											
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Note / Notes
 100% MANUFACTURED IN ITALY
 MANUFACTURING IN ACCORDANCE WITH ORDER AND SPECIFICATION

UFFICIO CONTROLLO QUALITA' ^{A05} QUALITY CONTROL DEPARTMENT 	ENTE UFFICIALE DI COLLAUDO ^{Z03} INSPECTION AUTHORITY	MARCHIO PRODUZIONE ^{A04} MANUFACTURER'S SYMBOL 
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PO# 110-001379-00 Item# 2
 Heat Number: 4803135
 Trans Am Piping Products Ltd. Rev'd By: SB
 1.1/2" CL 600 W/N FLANGE RF
 SCH 160 BORE A350-LF2 CL 1
 Shipment/Seq #: 1408



SAN ENG STEEL FORGING CO LTD
 311, Jen Hsin Road, Jen Wu District
 Kaohsiung, Taiwan, R.O.C.
 TEL:07-3724249; FAX:07-3712923
 URL: www.saneng.com.tw
 e-mail: saneng@ksts.seed.net.tw

MILL TEST CERTIFICATE

EN10204-3.1.B(DIN50049/3.1.B)
 Customer: TRANS AM PIPING PRODUCTS LTD.
 Order No.: 7008017(1)-T/A

Certificate No.: SE-8017A
 Date: 06/11/2014
 Page: 2 OF 5

PRODUCT		MATERIAL SPECIFICATIONS										DIMENSIONAL SPECIFICATIONS					
FORGED CARBON STEEL FLANGES		ASTM A-350 LF2-13 CL.1/ASME SA-350 LF2-13 CL.1										ASME B16.5-13 CSA Z245.12					
Item No.	CODE NO	DESCRIPTION	QUANTITY	CHEMICAL COMPOSITION (%)													
				C	Si	Mn	P	S	Cu	Cr	Ni	Mo	V	Nb	N	CE(*)	
11		300 WNRF S160 1" LF2		0.190	0.210	1.160	0.021	0.007	0.007	0.020	0.010	0.004	0.004	0.001	0.005	0.390	
12		300 WNRF S160 1" LF2		0.220	0.230	1.190	0.018	0.004	0.008	0.020	0.010	0.003	0.006	0.001	0.007	0.425	
13		300 WNRF S160 1 1/2" LF2		0.220	0.230	1.190	0.018	0.004	0.008	0.020	0.010	0.003	0.006	0.001	0.007	0.425	
14		300 WNRF S160 1 1/2" LF2		0.209	0.270	1.050	0.009	0.009	0.009	0.039	0.045	0.005	0.029	0.005	0.004	0.402	
15		300 WNRF XXS 1" LF2		0.220	0.230	1.190	0.018	0.004	0.008	0.020	0.010	0.003	0.006	0.001	0.007	0.425	
16		600 WNRF XS 3/4" LF2		0.190	0.210	1.160	0.021	0.007	0.007	0.020	0.010	0.004	0.004	0.001	0.005	0.390	
17		600 WNRF XS 3/4" LF2		0.200	0.200	1.000	0.007	0.012	0.120	0.070	0.070	0.005	0.003	0.005	0.009	0.395	
18		600 WNRF XS 1 1/2" LF2		0.210	0.210	1.180	0.023	0.006	0.010	0.020	0.010	0.002	0.004	0.001	0.008	0.410	
19		600 WNRF S80 12" LF2		0.190	0.220	1.050	0.018	0.005	0.090	0.110	0.030	0.020	0.001	0.001	0.007	0.399	
20		600 WNRF S160 1 1/2" LF2		0.210	0.210	1.160	0.023	0.006	0.010	0.020	0.010	0.002	0.004	0.001	0.008	0.410	

Item No.	Heat No.	T.S.(*)	Y.S.(*)	E.L.(*)	Hardness (HB)	R.A.(*)	Impact Test Temp: -46°C			Material Supplier	HEAT TREATMENT(*)
		(MPA)	(MPA)	(%)			1	2	3		<input checked="" type="checkbox"/> N
		Min: 486.0	250.0	22.0	-	30.0	Minimum: 20.0 Joule				<input checked="" type="checkbox"/> N
		Max: 655.0	-	-	197	-	1	2	3		REMARKS
11	4573144	522.0	372.0	34.0	153/151	69.5	82.0	93.0	76.0	ACOMINAS	890°CX4HRS CONFORMS WITH NACE MR0103-12 AND NACE MR0175/ISO15156-2-09 CLAUSE 7.2.1.4 REGION 3 AND ANNEX A. CONFORMS WITH Z245.12 CAT II GR248 SOUR SERVICE-09 (FOR USE AS WELDING NECK AND BLIND FLANGES ONLY) TEST SPECIMEN SIZE: 10X10 TEST SPECIMEN ORIENTATION: TRANSVERSE IMPACT TEST TEMP.: -46°C MN TO C RATIO IS GREATER THAN 3.0*
12	4703606	529.0	372.0	36.2	154/151	69.5	99.0	109.0	80.0	ACOMINAS	
13	4703606	529.0	372.0	36.2	154/151	69.5	99.0	109.0	80.0	ACOMINAS	
14	21380	509.9	354.0	32.4	153/151	70.4	50.0	43.0	66.0	NTMK	
15	4703606	529.0	372.0	36.2	154/151	69.5	99.0	109.0	80.0	ACOMINAS	
16	4573144	522.0	372.0	34.0	153/151	69.5	82.0	93.0	76.0	ACOMINAS	
17	10939	499.2	296.2	40.0	153/150	67.7	25.0	29.0	21.0	OEMK	
18	4803135	533.0	368.0	34.2	153/151	68.6	114.0	106.0	115.0	ACOMINAS	
19	Y300289	518.0	376.0	36.6	152/150	72.1	106.0	123.0	111.0	KOTOBUKI	
20	4803135	533.0	368.0	34.2	153/151	68.6	114.0	106.0	115.0	ACOMINAS	

*1: T.S. = Tensile Strength, Y.S.=Yield Strength, E.L.=Elongation, R.A.=Reduction of Area
 *2: N=Normalized, A=Annealed, Q=Quenched, T=Tempered, S T=Solution Treated, S.R=Stress Relieved, A.C=Air Cooled, F.C=Furnace Cooled, W.C=Water Cooled, O.C=Oil Cooled.
 *3: C.E Value = C + (Mn /5) + (Cr + Mo +V) / 5 + (Ni + Cu) / 15



We hereby certify that the material has been tested in accordance with the above specification and also with the requirements called for by the above order. Manager of Quality Assurance Dept



ISO 9001:2008

TRILAD Flanges and Fittings, Inc.

172 Turbo Drive
Sherwood Park, AB, CANADA T8H 2J6
(PHONE) 780-464-7774
(FAX) 780-464-0044
www.tri-lad.com

CERTIFIED MATERIAL TEST REPORT

Certificate No. 15217237	EN 10204 3.1	Date of Report 7/06/2015
Customer ALLIÉD EDMONTON - CAD\$ 172 TURBO DRIVE SHERWOOD PARK AB T8H 2J6	Customer Order No. AR.184	Quantity 50
	Tri-Lad Order No. 780525	Line No. 11

Specification A350-LF2-CL 1 STOCK	Heat Treatment NORMALISED
Item Description 1.5 600 WN S160 RF (909907)	Temperature Init 1706 F 930 C
Shop Order/Trace No.	Time N = .56HRS
Lot No.	Lot Definition
Heat Code TL10010754	
C.E. .41	Melt Practice EF

	Chemical Composition									
	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	V
Heat Product	.18	1.20	.016	.015	.28	.02	.06	.12	.02	.007
Heat Product	Nb .01									
Heat Product										

Mechanical Properties								
Yield	Tensile		Elongation	Reduction of Area	Hardness	Impact Test Temperature	Impact Values	Shear Fracture
Ksi 60	Ksi 86				HBW 170		Ft- lbs 103 102 96	
Mpa 414	Mpa 594	31 %	68 %		HBW 170	M50 F	Joules 140 138 130	
Tensile Specimen		STD RD				M46 C		
Lateral Expansion		Impact Type		Impact Orientation		Starting Material		Impact Specimen
		VNOTCH		TANGENTIAL				FULL SIZE

Notes	
Cr+Mo <= 0.32%	0.14
Cr+Cu+Mo+Ni+V <= 1.00%	0.22
Mn/C >= 3.0	6.67
CE = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15	0.41
ASTM A350-12 LF2 CLASS 1	CSA Z245.12-09 GR 248 CAT II M46C SS
ASME SA350 2010 Ed 2011A Addendum LF2 CLASS	ANSI/NACE MR0175/ISO15156:2009(E)
	NACE MR0103 LATEST ED.
	NACE MR0175/ISO15156-09

Material is in accordance with the applicable Standard to which it is ordered including: ASME Sect II, ASME B16.5, B16.9, B16.36, B16.47, CSA, MSS, AWWA C-207.

NO WELD REPAIR

Material conforms to both ASTM (A) and ASME (SA) applicable specifications.

We hereby certify that all information presented on this CMTR conforms to the above specification.

We hereby certify the results to be a true copy of the records of the company.

Troy Gorrell
Q.C. Inspector

COMPANY WITH MANAGEMENT SYSTEM CERTIFIED BY DNV GL = ISO 9001 = = ISO 14001 =		METALFAR PRODOTTI INDUSTRIALI SPA 23861 CESANA BRIANZA (LC) - ITALY VIA G. PARINI, 28 PHONE + 39 031 855441 - FAX +39 031 655149 certificate@metalfaritaly.com	A01
COMPANY WITH MANAGEMENT SYSTEM CERTIFIED BY DNV GL = ISO 9001 = = ISO 14001 =			

INSPECTION CERTIFICATE EN 10204:2004 / 3.1	A02	Nr ^{A03} 2017-C_MFF-02195	Data / Dated 16.06.2017 ^{Z02}
--	-----	------------------------------------	--

TRANS AM PIPING PRODUCTS LTD 9335 ENDEAVOR DRIVE S.E. T3S 0A1 CALGARY, ALBERTA	A06	Ordine / PO CI-17-429 Item 058 DDT / Delivery note 2017-3E301-0002210 Packing List 2017-3E401-0002049 Fattura / Invoice 2017-3E401-0002049 Ns. rif. / Our ref. 2017-3E201-0001618-0058	A07
CA			A08

Dest. TRANS AM "PROJECT" Warehouse 1711 - 66 Avenue T6P 1Y9 Edmonton, ALBERTA	A09		CA
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Cod. colata Heat Code	Nr. colata Heat Nr			Descrizione Description	B01 - (B06 - B11)
	14/32385			W/N 600 RF 1:1/2" 160 LF2CL1	

Mat. in acc. a / Mat. in acc. to^{B02} ASTM A 350M -15, ASME SA 350 M - 15, ASME CODE SECT. II, PART A, ED. 2015
 ASTM A350 LF2 CL1
 NACE MR-0175/2015 ISO 15156 - SOUR SERVICE
 NACE MR-0103/2015 - SOUR SERVICE
 CSA Z245.12-13 GRADE 248 CAT.II SOUR SERVICE
 Q.A.S. IN ACCORD WITH PRESS EQUIPM. DIRECT. 2014/68/UE (PED) ANNEX I, PARAGRAPH 4.3
 CERT. 4687-2014-CE-ITA-DNV GL

Elementi / Elements ^(C71 - C92)	C	Si	Mn	S	P	Cr	Ni	Mo	Ti	Cu	V	Nb	N
LADLE ANALYSIS	0,185	0,230	0,940	0,006	0,007	0,100	0,070	0,020	0,015	0,140	0,001	0,001	0,009
PRODUCT ANALYSIS	0,187	0,220	0,950	0,008	0,010	0,105	0,062	0,016	0,019	0,148	0,002	0,002	0,011
	Al	B	Ca						CE LF	CE SF	F1	F2	PREN
LADLE ANALYSIS	0,030	0,000	0,004						0,380	0,342	0,331	0,120	--
PRODUCT ANALYSIS	0,026	0,000	0,004						0,384	0,345	0,333	0,121	--

CE LF=C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15		CE SF=C+(Mn/6)		F1=Cu+Ni+Cr+Mo+V		F2=Cr+Mo	
Provetta	Forma ^{C10}	*C ^{C03}	Snervamento>0,2% ^{C11}	Snervamento>1,0% ^{C11}	Rottura ^{C12}	Allungamento ^{C13}	Contrazione ^{C16}
Test specimen	Shape		Yield Strength>0,2%	Yield Strength>1,0%	Tensile	Elongation	Reduction of area
Sez/Sect mm2	L. mm	1=O - 2=□	MPa	MPa	MPa	%	%
126,60	50,80	1	335,0	-	512,0	33,0	62,0

DUREZZA / HARDNESS ^{C22}		RESILIENZA / IMPACT TEST					
HBW	Tipo/Type ^{C46}	Provetta / Test Specimen	*C ^{C03}	1-Joule ^{C42}	2-Joule ^{C42}	3-Joule ^{C42}	Media/Average ^{C43}
180,0 - 164,0	KV	10x10 mm	-46	73	70	70	71,0

Treat. Term. / Heat treatment ^{C70}	NORMALIZED AT 930 °C - COOLED IN STILL AIR	ELECTRIC FURNACE
--	--	------------------

Dim in acc. a / Dim. acc. to ^{B11}	ASME/ANSI B16.5 -2013 ASME/ANSI B36.10M -2015 ASME/ANSI B16.25 -2012
---	--

Finitura / Roughness	125/250 MICRINCH AARH
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Marcatura in acc. Marking in acc. to ^{B06}	MSS SP25 Ed. 2013	Vis. & Dim.	SATISFACTORY	Origine Origin of Steel	EUROPEAN UNION
--	-------------------	-------------	--------------	----------------------------	----------------

Note / Notes 100% MANUFACTURED IN ITALY
 MANUFACTURING IN ACCORDANCE WITH ORDER AND SPECIFICATION

UFFICIO CONTROLLO QUALITA' QUALITY CONTROL DEPARTMENT 	ENTE UFFICIALE DI COLLAUDO INSPECTION AUTHORITY	MARCHIO PRODUZIONE MANUFACTURER'S SYMBOL 
---	--	--



R.N. GUPTA & COMPANY LTD., C-55, FOCAL POINT, LUDHIANA -141 010 (INDIA)

F-MTR-01-01

MATERIAL / MILL TEST CERTIFICATE EN 10204 : 2004 - 3.1

CERTIFICATE NO. 11410 DATE 24/08/2017

NAME OF BUYER
ALLIED FTG. CORP.

RAW MATERIAL SPECIFICATION :

SPECIFICATION FOR INSPECTION :

P.O NO. 62117ARG DT. 21/06/2017

INVOICE NO. RNG/EXP/17-2134 DT. 18/08/2017



MECHANICAL REQUIREMENTS

Sr. No.	Description	Qty (PCS)	Heat No.	Supp. Code	Y.S(Psi) Min 36,000	T.S(Psi) Min 70,000	E% Min 22%	R.A% Min 30%	Heat Treatment	Soaking Time (Min.)	Hardness BHN 137-187
1	3 300# WNRF STD FLGS L3WRS3-RG	2000	H 5965	2	52169	76807	32.50	72.23	NORMALISED	50	150 - 152
2	2 150# WNRF XH FLGS L1WRX2-RG	231	H 5943	20	52600	75171	33.50	70.23	NORMALISED	30	144 - 146
3	2 150# WNRF XH FLGS L1WRX2-RG	40	H 5936	20	46483	73503	37.12	67.65	NORMALISED	30	146 - 148
4	2 150# WNRF XH FLGS L1WRX2-RG	1497	H 5932	6	48547	74804	32.80	71.78	NORMALISED	30	144 - 146
5	2 150# WNRF XH FLGS L1WRX2-RG	232	H 5962	20	49989	75214	33.16	67.63	NORMALISED	30	144 - 146

CHEMICAL REQUIREMENTS

Sr. No.	Heat No.	SPECIFIED ELEMENTS										
		SPECIFIED ELEMENTS							UNSPECIFIED ELEMENTS			
		C.E. 0.47% Max	C 0.35 Max	Mn 0.60-1.25	P 0.035 Max.	S 0.04 Max.	Si .10 -0.35 Max.	Cu 0.40 Max.	Ni 0.40 Max.	Cr 0.30 Max.	Mo 0.12 Max.	V 0.08 Max.
1	H 5965	0.37	0.20	0.97	0.027	0.005	0.23	0.011	0.029	0.039	0.003	0.003
2	H 5943	0.38	0.20	0.93	0.030	0.014	0.22	0.080	0.040	0.083	0.008	0.003
3	H 5936	0.38	0.20	0.90	0.032	0.017	0.23	0.072	0.070	0.079	0.004	0.003
4	H 5932	0.36	0.20	0.90	0.016	0.009	0.24	0.021	0.014	0.033	0.003	0.003
5	H 5962	0.39	0.19	0.94	0.027	0.007	0.21	0.120	0.071	0.150	0.004	0.003

Certificate that the materials described above are in accordance with the order and specifications.

Material in accordance with NACE MRO 175-2003 and NACE MRO 103

For R.N. GUPTA & COMPANY LTD. Page No : 1

ALL NORMALISED MATERIALS ARE HEAT TREATED AT TEMP. 920 DEGREE CENTIGRADE

Note:- We hereby confirm that our QA system comply with requirements of Annex I, Clause 4.3 of PED 97/93/EU and it is certified by M/s DNV BUSINESS ASSURANCE vide certificate No. 4487-2014-CE-IND-DNV-GL Valid upto 31-03-2020. ISO 9001:2015 certificate No. is 39762-2008- QA-IND-RvA Valid upto 22/07/2020. Products also conform to requirements of ASTM A105/ASME SA105

[Signature]
METALLURGIST

CLIENTE / Customer / Client

CCTF CORPORATION (EDMONTON)
5407 - 53 AVENUE NW
EDMONTON, AB T6B 3G2
CANADA

CERTIFICADO DE INSPECCION
Inspection Certificate - Certificat de Réception

UNE EN 10204:06 / 3.1
ISO 10474:15 / 3.1



FECHA: 22/09/2017 N.º 190005 HOJA: 1
Date: 22/09/2017 No. 190005 Page: 1

SGI 1922164

SGI 6000236

SGI 6009987

ULMA FORJA, S.COOP.

Management Systems certified by LRQAE

Certified acc. PED 97/23/EC+AD2000-W0

PED 14/68/UE

by TÜV Rheinland

N.º 01 202 E/D 02 7443

MARCA DEL FABRICANTE

Mark of factory

Marque du fabricant



Packing List: 134345

DEPARTAMENTO QUALITY ASSURANCE

Section

Département

PRODUCTO FLANGES

NORMAS APLICABLES ASME B16.5-13
Requirements - Normes Applicables

SU PEDIDO N.º 4899800-00
Your Order No. 4899800-00
Votre Cde. N.º

DE 26/04/2017
of. - de 26/04/2017

MATERIAL CORRESPONDIENTE ASME SA350LF2CL1-2-17, ASTM A350LF2CL1-2-17

Material Correspondent - Qualité

MODO DE FUSION (*)

Steel Making - Elaboration de l'acier

E = Elec. Y = Oxígeno básico

NACE MR0175/ISO15156-02/03-15 & MR0103/ISO17495-15

Clause 7.2.1.4, Annex A.2 and SSC Region 3.

CSA-Z245.12-13 GR248 CAT II-SS (WN & BLIND FLANGES ONLY).

PARTIDA Item Poste	CANTIDAD Quantity Quantité	DESCRIPCION Description Description	LOTE	OBSERVACIONES Remarks Observations (*)	COLADA N. Heat No N.ºCoulée	RESISTENCIA T.Strength Resist Rupt N/mm2	LIMITE ELAST. Y.Strength 0.2 % N/mm2	ALARGAM. Elongation Allongement Lo:50mm/4c %	ESTRICCION Red. Area Striction %	RESILIENCIA Impact test Résistance			CHARYP V 10x10mm		DUREZA Hardness Dureté HBW
										Joules	Joules	Joules	MEDIA Average Moyenne	°C	
55 7581008	1.709	WN 2 800LB XS/80 RF A350LF2	08S17	NE	B01A7	490	296	33,00	64,40	45	52	46	47	-50	144 148
55 7581008	124	WN 2 600LB XS/80 RF A350LF2	10S17	NE	B01A7	508	314	26,10	53,90	60	66	60	62	-50	150 154
57 7582500	371	WN 2 800LB S160 RF A350LF2	30G17	NE	B01A7	509	315	25,60	53,20	61	57	51	56	-50	150 154

COLADA N. Heat No N.ºCoulée	COMPOSICION QUIMICA - STEEL MAKER'S LADLE ANALYSIS - ANALYSE CHIMIQUE														
	C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	Nb %	V %	Cu %	Al %	Ti %	CEq %	
B01A7	0,185	0,210	0,990	0,009	0,002	0,122	0,081	0,029	0,002	0,000	0,203	0,036	0,002	0,40	

- Las dimensiones y la condición superficial se hallaron satisfactorias.
- Dimension and surface condition were found acceptable.
- Les dimensions et états de surface sont satisfaisants.

- Los materiales citados cumplen las normas aplicables.
- Manufacturing requirements are satisfied.
- Les normes applicables sont respectées.

EL INSPECTOR
Works Inspector - L'inspecteur



ULMA FORJA S. COOP.
Dpto. de Garantía de calidad
Quality Assurance Dept.

(*) OBSERVACIONES:

Remarks
Observations

FULLY KILLED & FINE GRAIN PRACTICE.
Tensile & Impact: Transverse specimens A370.
N_NORMALIZED AT 900 C AND ALLOWED TO COOL IN STILL AIR.

CLIENTE / Customer / Client

CCTF CORPORATION (EDMONTON)
 5407 - 53 AVENUE NW
 EDMONTON, AB T6B 3G2
 CANADA

CERTIFICADO DE INSPECCION
 Inspection Certificate - Certificat de Réception

UNE EN 10204:06 / 3 1
 ISO 10474:15 / 3 1



FECHA: 22/09/2017 N.º 190001

HOJA: 1

SGI 1922164

SGI 6000235

SGI 6000987

ULMA FORJA, S.COOP

Management Systems certified by LRQAE

Certified acc PED 97/23/EC+AD2000-W0

PED 14/68/UE

by TÜV Rheinland

N.º 01 202 EQ 02 7443

Bº Zubilaga, 3 - Apdo. 14
 20560 ONATI (Gipuzkoa) SPAIN
 Tel.: 34 - 943 780552
 Fax: 34 - 943 781808
 E-mail: ulma@ulmapiping.com

PRODUCTO
 Article - Produit

FLANGES

SU PEDIDO N.º
 Your Order No. 4810667/970-1S0321765
 Votre Cde N.º

DE
 of. - de 05/04/2017

NORMAS APLICABLES
 Requirements - Normas Aplicables

ASME B16.5-13

MATERIAL CORRESPONDIENTE ASME SA105M-17, ASTM A105M-14
 Material Correspondent - Qualité

MODO DE FUSION (*)
 Steel Making - Elaboration de l'acier
 E = Elec. Y = Oxigeno básico

NACE MR0175/ISO15156-02/03-15 & MR0103/ISO17495-15
 Clause 7.2.1.4, Annex A.2 and SSC Region 3.
 CSA-Z245.12-13 GR248 CAT I-SS (WN & BLIND FLANGES ONLY)

MARCA DEL FABRICANTE
 Mark of factory
 Marque du fabricant



Packing List: 134338

DEPARTAMENTO QUALITY ASSURANCE
 Section
 Département

PARTIDA Item Poste	CANTIDAD Quantity Quantité	DESCRIPCION Description Description	OBSERVACIONES Remarks Observations (*)	COLADA N.º Heat No N.ºCoulée	RESISTENCIA	LMITE ELAST.	ALARGAM.	ESTRICCION	RESILIENCIA	CHARPY V 10x10mm		DUREZA
					T.Strength Resist Rupt N/mm2	Y.Strength 0,2 % N/mm2	Elongation Allongement Lo.50mm/4d %	Red. Area Striction %	Impact test Résilience Joules	MEDIA Average Moyenne °C	Hardness Dureté HBW	
7 7530234	300	WN 2 600LB XS/80 RF A105N	NE	B06A7	502	305	30,40	62,40				143 148
9 7530269	72	WN 4 600LB XS/80 RF A105N	NE	A31A7	520	320	29,00	62,00				160 161
9 7530269	72	WN 4 600LB XS/80 RF A105N	NE	B12A7	500	308	30,40	62,40				150 156

COLADA N.º Heat No N.ºCoulée	COMPOSICION QUIMICA - STEEL MAKER'S LADLE ANALYSIS - ANALYSE CHIMIQUE													
	C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	Nb %	V %	Cu %	Al %	Ti %	CEq %
A31A7	0,190	0,260	1,080	0,009	0,005	0,060	0,070	0,010	0,003	0,007	0,160	0,040	0,002	0,40
B06A7	0,186	0,200	1,040	0,010	0,003	0,082	0,087	0,023	0,002	0,000	0,240	0,037	0,002	0,40
B12A7	0,190	0,220	1,060	0,009	0,004	0,080	0,060	0,012	0,003	0,003	0,170	0,037	0,011	0,40

- Las dimensiones y la condición superficial se hallaron satisfactorias.
 - Dimension and surface condition were found acceptable
 - Les dimensions et états de surface sont satisfaisants

- Los materiales citados cumplen las normas aplicables.
 - Manufacturing requirements are satisfied.
 - Les normes applicables sont respectées.

EL INSPECTOR
 Works inspector - L'inspecteur



ULMA FORJA S. COOP.
 Dpto. de Garantía de calidad
 Quality Assurance Dept.

(*) OBSERVACIONES:
 Remarks
 Observations
 FULLY KILLED & FINE GRAIN PRACTICE.
 Tensile & Impact: Transverse specimens A370.
 N_NORMALIZED AT 900 C AND ALLOWED TO COOL IN STILL AIR.

35527/35528



SAN ENG STEEL FORGING CO LTD
 311, Jen Hsin Road, Jen Wu District
 Kaohsiung, Taiwan, R.O.C.
 TEL:07-3724249 ; FAX:07-3712923
 URL: www.saneng.com.tw
 e-mail: saneng@ksts.seed.net.tw

MILL TEST CERTIFICATE

EN10204-3.1

Customer: SEYBOLD INTERNATIONAL CORP.

Order No.: 7013782(4)-DNOW

Certificate No.: SE13782D

Date: 09/14/2017

Page: 1 OF 1

PRODUCT			MATERIAL SPECIFICATIONS										DIMENSIONAL SPECIFICATIONS						
FORGED CARBON STEEL FLANGES			ASTM A105-15/ASME SA105-2015										ASME B16.5-13 CSA Z245.12						
Item No.	CODE NO	DESCRIPTION	QUANTITY	CHEMICAL COMPOSITION (%)															
				C	Si	Mn	P	S	Cu	Cr	Ni	Mo	V	Nb	N	Ti	B	CE(*3)	
				Min	0.350	0.100	0.600	-	-	-	-	-	-	-	-	-	-	-	
				Max	0.350	0.350	1.050	0.035	0.040	0.400	0.300	0.400	0.120	0.080	0.020	-	-	-	
1	780468	600 WNRF S160 2" A105N	161 PCE		0.211	0.240	1.070	0.012	0.012	0.008	0.029	0.049	0.005	0.005	0.005	0.003	0.002	4.000	0.401
2	780468	600 WNRF S160 2" A105N	439 PCE		0.217	0.230	1.180	0.013	0.013	0.009	0.025	0.050	0.005	0.007	0.005	0.004	0.002	4.000	0.425
Item No.	Heat No.	T.S.(*1) (MPA)	Y.S.(*1) (MPA)	E.L.(*1) (%)	Hardness (HB)	R.A.(*1) (%)	Impact Test Temp:			Material Supplier	HEAT TREATMENT(*2)								
							Min	Max	1		2	3	<input checked="" type="checkbox"/> N	REMARKS					
		485.0	250.0	22.0	-	30.0													
		Min			187														
		Max																	
1	731387	518.0	366.0	36.2	152/149	69.5				NTMK	880°CX4HRS CONFORMS WITH NACE MR0103/ISO17495-1:2016 AND NACE MR0175/ISO15156.2015 CLAUSE 7.2.1.4 REGION 3 AND ANNEX A. CONFORMS WITH Z245.12 CAT I GR248 SOUR SERVICE-13(FOR USE AS WELDING NECK AND BLIND FLANGES ONLY) MN TO C RATIO IS GREATER THAN 3.0" B/10000 COUNTRY OF ORIGIN: TAIWAN								
2	721428	529.0	366.0	34.6	154/151	69.5				NTMK									

*1: T.S. = Tensile Strength, Y.S.=Yield Strength, E.L.=Elongation, R.A.=Reduction of Area.

*2: N=Normalized, A=Annealed, Q=Quenched, T=Tempered, S.T=Solution Treated, S.R=Stress Relieved, A.C=Air Cooled, F.C=Furnace Cooled, W.C=Water Cooled, O.C=Oil Cooled.

*3: C.E. Value = C + (Mn /6) + (Cr + Mo +V) / 5 + (Ni + Cu) / 15

We hereby certify that the material has been tested in accordance with the above specification and also with the requirements called for by the above order.



Manager of Quality Assurance Dept



SAN ENG STEEL FORGING CO LTD
 311, Jen Hsin Road, Jen Wu District
 Kaohsiung, Taiwan, R.O.C.
 TEL:07-3724249 ; FAX:07-3712923
 URL: www.saneng.com.tw
 e-mail: saneng@ksts.seed.net.tw

MILL TEST CERTIFICATE

EN10204-3.1.B(DIN50049/3.1.B)
 Customer: **SEYBOLD INTERNATIONAL CORP.**
 Order No.: **7010585-CCTF**

PO# 4897461

Certificate No.: **SE10585A**
 Date: **08/05/2015**
 Page: **3 OF 4**

PRODUCT			MATERIAL SPECIFICATIONS				DIMENSIONAL SPECIFICATIONS											
FORGED CARBON STEEL FLANGES			ASTM A105-14/ASME SA-105-14				ASME B16.5-13 CSA Z245.12											
Item No.	CODE NO	DESCRIPTION	QUANTITY	CHEMICAL COMPOSITION (%)													CE(*3)	
				Min	C	Si	Mn	P	S	Cu	Cr	Ni	Mo	V	Nb	N		
21	7530008	150 SWRF XS 1" A105N	126 PCE	0.350	0.200	0.190	1.130	0.014	0.006	0.007	0.010	0.010	0.004	0.004	0.001	0.006		0.393
22	7530010	150 SWRF XS 2" A105N	100 PCE	0.350	0.200	0.240	1.100	0.010	0.009	0.070	0.110	0.040	0.010	0.001	0.001	0.007		0.415
23	7536194	300 SORF 2" A105N	25 PCE	0.350	0.220	0.220	1.140	0.021	0.006	0.007	0.020	0.010	0.003	0.004	0.001	0.007		0.417
24	7535546	300 THRF 1/2" A105N	30 PCE	0.350	0.210	0.230	1.120	0.011	0.005	0.120	0.070	0.050	0.011	0.011	0.001	0.006		0.426
25	7535582	300 THRF 1 1/2" A105N	6 PCE	0.350	0.227	0.260	1.010	0.018	0.016	0.017	0.035	0.059	0.002	0.011	0.005	0.005		0.410
26	7535582	300 THRF 1 1/2" A105N	19 PCE	0.350	0.210	0.210	1.190	0.015	0.005	0.008	0.020	0.010	0.002	0.005	0.007	0.001		0.415
27	7530560	600 WNRF S160 2" A105N	300 PCE	0.350	0.211	0.230	1.070	0.010	0.007	0.007	0.034	0.047	0.005	0.008	0.005	0.007		0.402
28	7530560	600 WNRF S160 2" A105N	300 PCE	0.350	0.203	0.270	1.130	0.011	0.006	0.012	0.035	0.048	0.005	0.007	0.005	0.004		0.405
29	7531450	600 WNRTJ XS 4" A105N	10 PCE	0.350	0.190	0.190	1.040	0.023	0.007	0.160	0.090	0.070	0.014	0.004	0.001	0.008		0.400
30	7530749	600 SORF 3" A105N	10 PCE	0.350	0.210	0.220	1.150	0.017	0.008	0.007	0.010	0.010	0.003	0.006	0.001	0.006		0.407

Item No.	Heat No.	T.S.(*1) (MPA)	Y.S.(*1) (MPA)	E.L.(*1) (%)	Hardness (HB)	R.A.(*1) (%)	Impact Test Temp: Minimum: Joule			Material Supplier	HEAT TREATMENT(*2) <input checked="" type="checkbox"/> N	REMARKS
							1	2	3			
21	2706981303	516.0	356.0	34.6	153/150	71.3				ACOMINAS	880°CX4HRS CONFORMS WITH NACE MRO103-12 AND NACE MRO175/ISO15156.2-09 CLAUSE 7.2.1.4 REGION 3 AND ANNEX A. CONFORMS WITH Z245.12 CAT I GR248 SOUR SERVICE-09(FOR USE AS WELDING NECK AND BLIND FLANGES ONLY) MN TO C RATIO IS GREATER THAN 3.0"	
22	392976	533.0	331.0	32.4	154/152	66.8				UBE STEEL		
23	4603008	524.0	370.0	33.4	154/151	70.4				ACOMINAS		
24	83612	543.3	389.3	34.0	157/155	69.5				WEI CHIH STEEL		
25	921028	519.8	339.3	32.8	159/156	64.0				NTMK		
26	4625118	529.0	352.0	32.6	153/151	65.9				ACOMINAS		
27	522176	514.0	345.0	35.4	152/150	71.3				NTMK		
28	522180	524.0	362.0	35.0	153/150	71.3				NTMK		
29	0102448	518.0	358.0	36.2	153/150	70.4				WEI CHIH STEEL		
30	4573165	531.0	370.0	33.2	154/152	69.5				ACOMINAS		

*1: T.S. = Tensile Strength, Y.S.=Yield Strength, E.L.=Elongation, R.A.=Reduction of Area.
 *2: N=Normalized, A=Annealed, Q=Quenched, T=Tempered, S.T=Solution Treated, S.R=Stress Relieved, A.C=Air Cooled, F.C=Furance Cooled, W.C=Water Cooled, O.C=Oil Cooled.
 *3: C.E. Value = C + (Mn /6) + (Cr + Mo +V) / 5 + (Ni + Cu) / 15

We hereby certify that the material has been tested in accordance with the above specification and also with the requirements called for by the above order.

Manager of Quality Assurance Dep't





ISO 9001:2008

TRILAD Flanges and Fittings, Inc.

172 Turbo Drive
Sherwood Park, AB, CANADA T8H 2J6
(PHONE) 780-464-7774
(FAX) 780-464-0044
www.tri-lad.com

CERTIFIED MATERIAL TEST REPORT

Certificate No. **17271397**

EN 10204 3.1

Date of Report **10/25/2017**

Customer
ALLIED EDMONTON - CADS
172 TURBO DRIVE
SHERWOOD PARK **AB T8H 2J6**

Customer Order No.
102517-STK

Quantity **1200**

Tri-Lad Order No. **111942** Line No. **2**

Specification A105N STOCK	Heat Treatment NORMALISED
Item Description 3 150 WN STD RF . (066070)	Temperature
Shop Order/Trace No.	Time N=1.05HRS Lot Definition
Lot No.	
Heat Code TL10016703	
C.E. .39	Melt Practice EF

Chemical Composition

Heat Product	C .18	Mn 1.22	P .010	S .010	Si .22	Cu .01	Ni .00	Cr .05	Mo .00	V .001
Heat Product	Nb .00									
Heat Product										

Mechanical Properties

Yield Ksi 51 Mpa 350	Tensile Ksi 75 Mpa 514	Elongation 35 %	Reduction of Area 75 %	Hardness HBW 149 HBW 149	Impact Test Temperature	Impact Values	Shear Fracture
Tensile Specimen STD RD							
Lateral Expansion		Impact Type	Impact Orientation	Starting Material		Impact Specimen	

Notes

Cr+Mo <= 0.32%
Cr+Cu+Mo+Ni+V <= 1.00%
Mn/C >= 3.0
CE = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15

0.05
0.07
6.82
0.39

ASTM A105N-14
ASME SA105N 2013 Edition

CSA Z245.12-13 GR 248 CAT I SS
ANSI/NACE MR0175/ISO15156:2009(E)
NACE MR0103 LATEST ED.
NACE MR0175/ISO15156-09

Material is in accordance with the applicable Standard to which it is ordered including:
ASME Sect II, ASME B16.5, B16.9, B16.36, B16.47, CSA, MSS, AWWA C-207.

NO WELD REPAIR

Material conforms to both ASTM (A) and ASME (SA) applicable specifications.
We hereby certify that all information presented on this CMTR conforms to the above specification.

We hereby certify the results to be a true copy of the records of the company.

Troy Gorrell
Q.C. Inspector



ISO 9001:2008

TRILAD Flanges and Fittings, Inc.

172 Turbo Drive
 Sherwood Park, AB, CANADA T8H 2J6
 (PHONE) 780-464-7774
 (FAX) 780-464-0044
 www.tri-lad.com

CERTIFIED MATERIAL TEST REPORT

Certificate No. **17271408**

EN 10204 3.1

Date of Report **10/25/2017**

Customer
ALLIED EDMONTON - CADS
172 TURBO DRIVE
SHERWOOD PARK AB T8H 2J6

Customer Order No.
102517-STK

Quantity
75

Tri-Lad Order No. **111942**
 Line No. **11**

Specification A105N	STOCK	Heat Treatment NORMALISED
Item Description 3 600 WN XH RF	(860166)	Temperature Init 1634 F 890 C
Shop Order/Trace No.		Time N=1.30HRS
Lot No.		Lot Definition
Heat Code TL10015470		
C.E. .38	Melt Practice EF	

Heat Product	Chemical Composition									
	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	V
Heat Product	.19	1.00	.031	.019	.26	.06	.01	.06	.00	.001
Heat Product	Nb .00									
Heat Product										

Mechanical Properties						Impact Values	Shear Fracture
Yield	Tensile		Elongation	Reduction of Area	Hardness		
Ksi 50	Ksi 77		34 %	68 %	HBW 156		
Mpa 345	Mpa 530				HBW 159		
Tensile Specimen		STD RD					
Lateral Expansion		Impact Type		Impact Orientation		Starting Material	
						Impact Specimen	

Notes

Cr+Mo <= 0.32%	0.06
Cr+Cu+Mo+Ni+V <= 1.00%	0.13
Mn/C >= 3.0	5.18
CE = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15	0.38

ASTM A105N-14
 ASME SA105N 2013 Edition

CSA Z245.12-13 GR 248 CAT 1 SS
 ANSI/NACE MR0175/ISO15156:2009(E)
 NACE MR0103 LATEST ED.
 NACE MR0175/ISO15156-09

Material is in accordance with the applicable Standard to which it is ordered including:
 ASME Sect II, ASME B16.5, B16.9, B16.36, B16.47, CSA, MSS, AWWA C-207.
 NO WELD REPAIR
 Material conforms to both ASTM (A) and ASME (SA) applicable specifications.
 We hereby certify that all information presented on this CMTR conforms to the above specification.
 We hereby certify the results to be a true copy of the records of the company.

Troy Gorrell
 Q.C. Inspector

COMPANY WITH MANAGEMENT SYSTEM CERTIFIED BY DNV GL = ISO 9001 = = ISO 14001 =		METALFAR PRODOTTI INDUSTRIALI SPA 23861 CESANA BRIANZA (LC) - ITALY VIA G. PARINI, 28 PHONE + 39 031 655441 - FAX +39 031 655149 certificate@metalfaritaly.com	A01
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INSPECTION CERTIFICATE EN 10204:2004 / 3.1	A02	Nr ^{A03} 2017-C_MFF-03183	Data / Dated 12.09.2017 ^{Z02}
TRANS AM PIPING PRODUCTS LTD 9335 ENDEAVOR DRIVE S.E. T3S 0A1 CALGARY, ALBERTA	A06 CA	Ordine / PO Item DDT / Delivery note Packing List Fattura / Invoice No. rif. / Our ref.	A07 A08

Dest. TRANS AM "PROJECT" Warehouse 1711 - 66 Avenue T6P 1Y9 Edmonton, ALBERTA	A08 CA
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Cod. colata ^{B07}	Nr. colata ^{B07}	B08	Descrizione ^{B01 (B09 - B11)}
Heat Code	Heat Nr		Description
	6640/17		W/N 150 RF 4" STD LF2CL1

Mat. in acc. a / Mat. in acc. to^{B02} ASTM A 350M -15 ,ASME SA 350 M - 15 ,ASME CODE SECT. II, PART A, ED. 2015
 ASTM A350 LF2 CL1
 NACE MR-0175/2015 ISO 15156 - SOUR SERVICE
 NACE MR-0103/2015 - SOUR SERVICE
 GSA Z245.12-13 GRADE 248 CAT.II SOUR SERVICE
 Q.A.S.IN ACCORD WITH PRESS.EQUIPM.DIRECT.2014/68/UE(PED) ANNEX I, PARAGRAPH 4.3
 CERT.4687-2014-CE-ITA-DNV GL

Elementi / Elements ^(C71 - C82)	C	Si	Mn	S	P	Cr	Ni	Mo	Ti	Cu	V	Nb	N
LADLE ANALYSIS	0,180	0,220	1,020	0,002	0,009	0,160	0,170	0,040	0,002	0,160	0,018	0,016	0,010
PRODUCT ANALYSIS	0,181	0,229	1,033	0,003	0,012	0,165	0,163	0,046	0,004	0,155	0,015	0,015	0,009
	Al	B	Ca						CE LF	CE SF	F1	F2	PREN
LADLE ANALYSIS	0,030	0,000	0,001						0,416	0,350	0,548	0,200	-
PRODUCT ANALYSIS	0,033	0,000	0,001						0,420	0,353	0,544	0,211	-

CE LF=C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15	CE SF=C+(Mn/6)	F1=Cu+Ni+Cr+Mo+V	F2=Cr+Mo				
Provetta	Forma ^{C10}	°C ^{C03}	Snervamento>0,2% ^{C11}	Snervamento>1,0% ^{C11}	Rottura ^{C12}	Allungamento ^{C13}	Contrazione ^{C15}
Test specimen	Shape		Yield Strength>0,2%	Yield Strength>1,0%	Tensile	Elongation	Reduction of area
Sez/Sect mm2	L. mm	1=O - 2=□	MPa	MPa	MPa	%	%
126,60	50,80	1	385,0	--	546,0	35,0	66,0

DUREZZA / HARDNESS ^{C22}	RESILIENZA / IMPACT TEST						
HBW	Tipo/Type ^{C40}	Provetta / Test Specimen	°C ^{C03}	1-Joule ^{C42}	2-Joule ^{C42}	3-Joule ^{C42}	Media/Average ^{C43}
166,0 - 171,0	KV	10x10 mm	-46	75	79	80	78,0

Treatt. Term. / Heat treatment ^{C70}	NORMALIZED AT 930 °C - COOLED IN STILL AIR						ELECTRIC FURNACE
Dim in acc. a / Dim. acc. to ^{B14}	ASME/ANSI B16.5 -2013 ASME/ANSI B36.10M -2015 ASME/ANSI B16.25 -2012						

Finitura / Roughness	125/250 MICROINCH AARH						
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Marcatura in acc. ^{B06}	MSS SP25 Ed. 2013	Vis. & Dim.	SATISFACTORY	Origine	EUROPEAN UNION		
Marking in acc. to:				Origin of Steel			

Note / Notes 100% MANUFACTURED IN ITALY
 MANUFACTURING IN ACCORDANCE WITH ORDER AND SPECIFICATION

UFFICIO CONTROLLO QUALITA' ^{A05} QUALITY CONTROL DEPARTMENT 	ENTE UFFICIALE DI COLLAUDO ^{Z03} INSPECTION AUTHORITY	MARCHIO PRODUZIONE ^{A04} MANUFACTURER'S SYMBOL 
--	---	---

CLIENTE / Customer / Client

CCTF CORPORATION (EDMONTON)
 5407 - 53 AVENUE NW
 EDMONTON, AB T6B 3G2
 CANADA

CERTIFICADO DE INSPECCION
 Inspection Certificate - Certificat de Réception

UNE EN 10204:06 / 3.1
 ISO 10474:15 / 3.1



FECHA: 22/09/2017
 Date: 22/09/2017

N.º 189992
 No. 189992

HOJA: 1
 Page: 1

Management Systems certified by LRQA

Certified acc. PED 97/23/EC+AD2000-WO
 PED 14/68/UE
 by TÜV Rheinland
 N.º 01 202 E/Q 02 7443

ULMA FORJA, S COOP
 Bº Zubillaga, 3 - Apdo 14
 20560 Oñati (Gipuzkoa) SPAIN
 Tel.: 34 - 943 780552
 Fax: 34 - 943 781808
 E-mail: ulma@ulmapiping.com

MARCA DEL FABRICANTE
 Mark of factory
 Marque du fabricant



Packing List: 134327

DEPARTAMENTO QUALITY ASSURANCE
 Section
 Département

PRODUCTO
 Article - Produit

FLANGES

SU PEDIDO N.º
 Your Order No 4810666/970-1S0322517
 Votre Cde. N.º

DE
 of - de 05/04/2017

NORMAS APLICABLES
 Requirements - Normes Applicables

ASME B16.5-13

MATERIAL CORRESPONDIENTE ASME SA350LF2CL1-2-17, ASTM A350LF2CL1-2-17

Material Correspondent - Qualité

MODO DE FUSION (*)

Steel Making - Elaboration de l'acier
 E = Elec. Y = Oxígeno básico

NACE MR0175/ISO15156-02/03-15 & MR0103/ISO17495-15
 Clause 7.2.1.4, Annex A.2 and SSC Region 3.

CSA-Z245.12-13 GR248 CAT II-SS (WN & BLIND FLANGES ONLY).

PARTIDA Item Poste	CANTIDAD Quantity Quantité	DESCRIPCION Description Description	LOTE	OBSERVACIONES Remarks Observations (*)	COLADA N.º Heat No N.ºCoulée	RESISTENCIA T.Strength Resist Rupt N/mm2	LIMITE ELAST. Y.Strength 0.2 % N/mm2	ALARGAM. Elongation L:50mm/4d %	ESTRICCION Red. Area Striction %	RESILIENCIA Impact test Résistance Joules			CHARPY V 10x10mm MEDIA Average Moyenne °C		DUREZA Hardness Dureté HBW
										51	50	51	51	-50	
18 7581059	504	WN 4 600LB XS/80 RF A350LF2	29G17	NE	B11A7	517	320	25,00	51,90	51	50	51	51	-50	150 154

COLADA N.º
 Heat No
 N.ºCoulée

COMPOSICION QUIMICA - STEEL MAKER'S LADLE ANALYSIS - ANALYSE CHIMIQUE

	C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	Nb %	V %	Cu %	Al %	Ti %	CEq %
B11A7	0,180	0,180	1,040	0,010	0,006	0,080	0,060	0,012	0,003	0,002	0,170	0,029	0,011	0,39

- Las dimensiones y la condición superficial se hallaron satisfactorias
 - Dimension and surface condition were found acceptable
 - Les dimensions et états de surface sont satisfaisants.

- Los materiales citados cumplen las normas aplicables.
 - Manufacturing requirements are satisfied.
 - Les normes applicables sont respectées.

EL INSPECTOR
 Works Inspector - L'inspecteur



ULMA FORJA S. COOP.
 Dpto. de Garantía de calidad
 Quality Assurance Dept.

(*) OBSERVACIONES:
 Remarks
 Observations

FULLY KILLED & FINE GRAIN PRACTICE.
 Tensile & Impact: Transverse specimens A370.
 N.º NORMALIZED AT 900 C AND ALLOWED TO COOL IN STILL AIR.

CLIENTE / Customer / Client

CCTF CORPORATION (EDMONTON)
5407 - 53 AVENUE NW
EDMONTON, AB T6B 3G2
CANADA

CERTIFICADO DE INSPECCION
Inspection Certificate - Certificat de Réception

UNE EN 10204:06 / 3 1
ISO 10474:15 / 3 1



FECHA: 21/09/2017 N.º 189975 HOJA: 1
Date: 21/09/2017 No. 189975 Page: 1

Management Systems certified by LRQAE

Certified acc. PED 97/23/EC+AD2000-WG
PED 14/68/JE
by TÜV Rheinland
N.º 01 202 EQ 02 7443

ULMA FORJA, S COOP
Bº Zubillaga, 3 - Apdo 14
20560 ONATI (Gipuzkoa) SPAIN
Tel.: 34 - 943 780552
Fax: 34 - 943 781808
E-mail: ulma@ulmapiping.com

MARCA DEL FABRICANTE
Mark of factory
Marque du fabricant



Packing List: 134315

DEPARTAMENTO QUALITY ASSURANCE
Section
Département

PRODUCTO
Article - Produit

FLANGES

SU PEDIDO N.º
Your Order No. 4810666/970-1S0322517
Votre Cde. N.º

DE
cf. - de 05/04/2017

NORMAS APLICABLES
Requirements - Normes Applicables

ASME B16.5-13

MATERIAL CORRESPONDIENTE ASME SA105M-15, ASTM A105M-14

Material Correspondent - Qualité

MODO DE FUSION (*)

Steel Making - Elaboration de l'acier
E = Elec. Y = Oxígeno básico

NACE MR0175/ISO15156-02/03-15 & MR0103/ISO17495-15
Clause 7.2.1.4, Annex A.2 and SSC Region 3.
CSA-Z245.12-13 GR248 CAT I-SS (WN & BLIND FLANGES ONLY)

PARTIDA Item Poste	CANTIDAD Quantity Quantité	DESCRIPCION Description Description	OBSERVACIONES Remarks Observations (*)	COLADA N.º Heat No N.ºCoulée	RESISTENCIA T.Strength Resist Rupt N/mm2	LIMITE ELAST. Y.Strength 0.2 % N/mm2	ALARGAM. Elongation Allongement L:50mm/4d %	ESTRICCION Red. Area Striction %	RESILIENCIA Impact test Résilience Joules	CHARPY V 10x10mm		DUREZA Hardness Dureté HBW
										Average Moyenne	°C	
9 7530269	648	WN 4 600LB XS/80 RF A105N	NE	B12A7	500	308	30,40	62,40				150 156

COLADA N.º Heat No N.ºCoulée	COMPOSICION QUIMICA - STEEL MAKER'S LADLE ANALYSIS - ANALYSE CHIMIQUE														
	C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	Nb %	V %	Cu %	Al %	Ti %	CEq %	
B12A7	0,190	0,220	1,060	0,009	0,004	0,080	0,060	0,012	0,003	0,003	0,170	0,037	0,011	0,40	

- Les dimensions y la condición superficial se hallaron satisfactorias.
- Dimension and surface condition were found acceptable.
- Les dimensions et états de surface sont satisfaisants.

- Los materiales citados cumplen las normas aplicables
- Manufacturing requirements are satisfied.
- Les normes applicables sont respectées

EL INSPECTOR
Works Inspector - L'Inspecteur



(*) OBSERVACIONES:
Remarks
Observations

FULLY KILLED & FINE GRAIN PRACTICE.
Tensile & Impact: Transverse specimens A370.
N NORMALIZED AT 900 C AND ALLOWED TO COOL IN STILL AIR.



SAN ENG STEEL FORGING CO LTD
 311, Jen Hsin Road, Jen Wu District
 Kaohsiung, Taiwan, R.O.C.
 TEL:07-3724249 ; FAX:07-3712923
 URL: www.saneng.com.tw
 e-mail: saneng@ksts.seed.net.tw

MILL TEST CERTIFICATE

EN10204-3.1

Customer: **SEYBOLD INTERNATIONAL CORP.**
 Order No.: **7013335(3)-CCTF**

Certificate No.: **SE3335C1**

Date: **07/26/2017**

Page: **1 OF 1**

PO# 4899889

PRODUCT		MATERIAL SPECIFICATIONS										DIMENSIONAL SPECIFICATIONS							
FORGED CARBON STEEL FLANGES		ASTM A105-15/ASME SA105-2015										ASME B16.5-13 CSA Z245.12							
Item No.	CODE NO	DESCRIPTION	QUANTITY	CHEMICAL COMPOSITION (%)															
				Min	C	Si	Mn	P	S	Cu	Cr	Ni	Mo	V	Nb	N	Ti	B	CE(*3)
			Max	0.350	0.100	0.600	0.035	0.040	0.400	0.300	0.400	0.120	0.080	0.020	-	-	-	-	
1	7535538	150 THRF 8" A105N	15 PCE	0.210	0.200	1.020	0.011	0.009	0.110	0.120	0.040	0.010	0.001	0.001	0.007	0.003	1.000	0.416	
2	7533756	150 LJ 3" A105N	25 PCE	0.204	0.290	1.090	0.014	0.009	0.015	0.047	0.056	0.005	0.008	0.001	0.003	0.002	3.000	0.402	
3	7533543	150 LJ 6" A105N	10 PCE	0.200	0.210	1.030	0.013	0.007	0.120	0.110	0.040	0.010	0.001	0.001	0.007	0.003	1.000	0.407	
4	7530099	600 WNRF STD 4" A105N	8 PCE	0.191	0.280	1.100	0.014	0.012	0.013	0.041	0.051	0.005	0.012	0.005	0.003	0.003	3.000	0.390	
5	7530579	600 WNRF S160 3" A105N	25 PCE	0.196	0.200	1.070	0.009	0.013	0.010	0.030	0.051	0.005	0.002	0.005	0.006	0.002	3.000	0.386	
6	7530587	600 WNRF S160 4" A105N	30 PCE	0.196	0.200	1.070	0.009	0.013	0.010	0.030	0.051	0.005	0.002	0.005	0.006	0.002	3.000	0.386	
7	7531575	900 WNRF S160 3" A105N	12 PCE	0.204	0.250	1.130	0.012	0.011	0.012	0.054	0.048	0.005	0.021	0.005	0.005	0.002	5.000	0.412	
8	7531575	900 WNRF S160 3" A105N	58 PCE	0.207	0.240	1.090	0.009	0.018	0.013	0.025	0.058	0.005	0.002	0.005	0.004	0.003	3.000	0.400	
9	7533042	900/1500 WNRF XXS 1" A105N	20 PCE	0.222	0.320	1.040	0.012	0.017	0.005	0.016	0.053	0.002	0.006	0.005	0.008	0.001	1.000	0.404	

Item No.	Heat No.	T.S.(*) (MPA)	Y.S.(*) (MPA)	E.L.(*) (%)	Hardness (HB)	R.A.(*) (%)	Impact Test Temp: Minimum: Joule			Material Supplier	HEAT TREATMENT(*) <input checked="" type="checkbox"/> N	REMARKS
							1	2	3			
		Min	485.0	250.0	22.0	-	-	-	-			
		Max	-	-	-	187	-	-	-			
1	Y500685	527.0	366.0	34.6	153/151	69.5				KOTOBUKI	880°CX4HRS CONFORMS WITH NACE MR0103/ISO17495-1:2016 AND NACE MR0175/ISO15156:2009 CLAUSE 7.2.1.4 REGION 3 AND ANNEX A CONFORMS WITH Z245.12 CAT 1 GR248 SOUR SERVICE-09(FOR USE AS WELDING NECK AND BLIND FLANGES ONLY) MN TO C RATIO IS GREATER THAN 3.0" B/10000 COUNTRY OF ORIGIN: TAIWAN	
2	616244	520.0	366.0	36.6	152/150	71.3				NTMK		
3	Y500681	522.0	376.0	34.2	153/150	69.5				KOTOBUKI		
4	618019	533.0	385.0	36.6	154/151	69.5				NTMK		
5	536937	516.0	343.0	35.6	152/150	69.5				NTMK		
6	536937	516.0	343.0	35.6	152/150	69.5				NTMK		
7	626170	531.0	370.0	35.0	154/151	70.4				NTMK		
8	517151	512.0	335.0	35.8	151/148	70.4				NTMK		
9	931233	515.8	333.4	34.0	153/152	66.0				NTMK		

*1: T.S. = Tensile Strength, Y.S.=Yield Strength, E.L.=Elongation, R.A.=Reduction of Area.
 *2: N=Normalized, A=Annealed, Q=Quenched, T=Tempered, S.T=Solution Treated, S.R=Stress Relieved,
 A.C=Air Cooled, F.C=Furance Cooled, W.C=Water Cooled, O.C=Oil Cooled.
 *3: C.E. Value = C + (Mn /6) + (Cr + Mo +V) / 5 + (Ni + Cu) / 15

We hereby certify that the material has been tested in accordance with the above specification and also with the requirements called for by the above order.

Quality Assurance Dept.

CLIENTE / Customer / Client

CCTF CORPORATION (EDMONTON)
5407 - 53 AVENUE NW
EDMONTON, AB T6B 3G2
CANADA

CERTIFICADO DE INSPECCION
Inspection Certificate - Certificat de Réception

UNE EN 10204:06 / 3.1
ISO 10474:15 / 3.1



FECHA: 30/08/2017
Date: 30/08/2017

N.º 189390
No. 189390

HOJA: 1
Page: 1

SGI 1922164

SGI 6000235

SGI 6009987

ULMA FORJA, S COOP

Management Systems certified by LRQA

Certified acc. PED 97/23/EC+AD2000-WO

PED 14/68/JE

by TÜV Rheinland

N.º 01 202 EQ 02 7443

Bº Zubillaga, 3 - Apdo. 14

20560 ONATI (Gipuzkoa) SPAIN

Tel.: 34 - 943 780552

Fax: 34 - 943 781808

E-mail: ulma@ulmapiping.com

PRODUCTO
Article - Produit

FLANGES

SU PEDIDO N.º

Your Order No. 4810666/970-1S0322517

Votre Cde. N.º

DE

of. - de 05/04/2017

NORMAS APLICABLES
Requirements - Normes Applicables

ASME B16.5-13

MATERIAL CORRESPONDIENTE ASME SA350LF2CL1-2-15, ASTM A350LF2CL1-2-15

Material Correspondent - Qualité

MODO DE FUSION (*)

Steel Making - Elaboration de l'acier

E = Elec. Y = Oxígeno básico

NACE MR0175/ISO15156-02/03-15 & MR0103/ISO17495-15

Clause 7.2.1.4, Annex A.2 and SSC Region 3.

CSA-Z245.12-13 GR248 CAT II-SS (WN & BLIND FLANGES ONLY).

MARCA DEL FABRICANTE

Mark of factory

Marque du fabricant



Packing List: 133672

DEPARTAMENTO QUALITY ASSURANCE

Section

Département

PARTIDA Item Poste	CANTIDAD Quantity Quantité	DESCRIPCION Description Description	LOTE	OBSERVACIONES Remarks Observations (*)	COLADA N. Heat No N.ºCoulée	RESISTENCIA T.Strength Resist Rupt N/mm2	LIMITE ELAST. Y.Strength 0.2 % N/mm2	ALARGAM. Elongation Allongement Lo:50mm/4r %	ESTRICCION Red. Area Striction %	RESILIENCIA Impact test Résistance Joules	CHARPY V 10x10mm		DUREZA Hardness Dureté HBW		
											MEIA Average Moyenne	°C			
11 7586816	280	WN 3 150LB STD/40 RF A350LF2	21G17	NE	A72A7	521	314	31,00	64,80	64	73	68	68	-50	158 160
11 7586816	280	WN 3 150LB STD/40 RF A350LF2	28L17	NE	A99A7	508	303	31,80	59,00	48	43	49	46	-50	144 147
18 7581059	72	WN 4 600LB XS/80 RF A350LF2	13L17	NE	A04M7	534	370	32,80	57,60	79	85	81	82	-50	155 159
18 7581059	144	WN 4 600LB XS/80 RF A350LF2	13L17	NE	A87A7	506	300	29,20	66,60	79	67	74	73	-50	142 148
19 7581180	36	WN 6 600LB XS/80 RF A350LF2	22L17	NE	A04M7	534	371	28,40	51,20	74	84	83	80	-50	158 162
19 7581180	30	WN 6 600LB XS/80 RF A350LF2	20L17	NE	A95A7	521	322	55,70	52,80	54	59	50	54	-50	149 155
19 7581180	78	WN 6 600LB XS/80 RF A350LF2	21L17	NE	A95A7	508	309	29,20	60,70	43	49	40	44	-50	145 151
19 7581180	36	WN 6 600LB XS/80 RF A350LF2	22L17	NE	A95A7	526	326	54,00	50,30	58	62	35	52	-50	151 157
19 7581180	36	WN 6 600LB XS/80 RF A350LF2	21L17	NE	B00A7	506	309	26,70	54,70	53	48	54	52	-50	143 149
20 7581490	72	WN 8 600LB XS/80 RF A350LF2	03L17	NE	A86A7	515	313	35,10	67,90	49	62	55	55	-50	155 161
20 7581490	24	WN 8 600LB XS/80 RF A350LF2	14L17	NE	A86A7	519	318	33,30	65,20	53	66	59	59	-50	157 163
20 7581490	24	WN 8 600LB XS/80 RF A350LF2	12L17	NE	A87A7	507	301	31,20	64,90	53	60	58	57	-50	141 145

COLADA N. Heat No N.ºCoulée	COMPOSICION QUIMICA - STEEL MAKER'S LADLE ANALYSIS - ANALYSE CHIMIQUE													
	C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	Nb %	V %	Cu %	Al %	Ti %	CEq %
A04M7	0,160	0,220	1,210	0,010	0,003	0,060	0,090	0,017	0,001	0,067	0,180	0,030	0,000	0,41
A72A7	0,200	0,220	1,020	0,011	0,001	0,030	0,070	0,012	0,001	0,005	0,150	0,030	0,004	0,39
A86A7	0,180	0,220	0,990	0,010	0,004	0,050	0,090	0,015	0,001	0,006	0,180	0,030	0,003	0,38
A87A7	0,190	0,240	1,000	0,010	0,006	0,050	0,080	0,013	0,001	0,006	0,160	0,031	0,009	0,39
A95A7	0,180	0,220	1,060	0,014	0,007	0,060	0,080	0,016	0,003	0,006	0,200	0,034	0,008	0,39
A99A7	0,190	0,260	0,990	0,010	0,006	0,050	0,070	0,015	0,003	0,003	0,180	0,036	0,001	0,39
B00A7	0,190	0,220	1,040	0,011	0,006	0,090	0,120	0,017	0,004	0,007	0,220	0,030	0,008	0,41

- Las dimensiones y la condición superficial se hallaron satisfactorias
- Dimension and surface condition were found acceptable
- Les dimensions et états de surface sont satisfaisants

- Los materiales citados cumplen las normas aplicables.
- Manufacturing requirements are satisfied.
- Les normes applicables sont respectées

EL INSPECTOR
Works Inspector - L'inspecteur



ULMA FORJA S. COOP.
Dpto. de Garantía de calidad
Quality Assurance Dept.

(*) OBSERVACIONES:
Remarks
Observations

FULLY KILLED & FINE GRAIN PRACTICE.
Tensile & Impact: Transverse specimens A370.
N_NORMALIZED AT 900 C AND ALLOWED TO COOL IN STILL AIR.



SAN ENG STEEL FORGING CO LTD
 311, Jen Hsin Road, Jen Wu District
 Kaohsiung, Taiwan, R.O.C.
 TEL:07-3724249 ; FAX:07-3712923
 URL: www.saneng.com.tw
 e-mail: saneng@ksts.seed.net.tw

MILL TEST CERTIFICATE

EN10204-3.1
 Customer: SEYBOLD INTERNATIONAL CORP.
 Order No.: 7013071(6)-DNOW


Certificate No.: SE3071F1
 Date: 07/13/2017
 Page: 1 OF 1

PRODUCT			MATERIAL SPECIFICATIONS										DIMENSIONAL SPECIFICATIONS						
FORGED CARBON STEEL FLANGES			ASTM A105-15/ASME SA105-2015										ASME B16.5-13 CSA Z245.12						
Item No.	CODE NO	DESCRIPTION	QUANTITY	CHEMICAL COMPOSITION (%)															
				C	Si	Mn	P	S	Cu	Cr	Ni	Mo	V	Nb	N	Ti	B	CE(*3)	
1	1018927	900/1500 THRF 2" A105N	76 PCE	0.196	0.200	1.070	0.009	0.013	0.010	0.030	0.051	0.005	0.002	0.005	0.006	0.002	3.000	0.386	
2	1018927	900/1500 THRF 2" A105N	6 PCE	0.200	0.220	1.130	0.022	0.003	0.006	0.030	0.010	0.003	0.004	0.001	0.007	0.002	7.000	0.397	
3	1018927	900/1500 THRF 2" A105N	18 PCE	0.200	0.190	1.030	0.015	0.005	0.180	0.100	0.070	0.017	0.002	0.001	0.008	0.002	4.000	0.412	
4	725525	300 WNRF XS 1" A105N	30 PCE	0.208	0.260	1.080	0.009	0.006	0.012	0.053	0.054	0.005	0.006	0.001	0.005	0.002	3.000	0.405	
5	725578	300 WNRF XS 8" A105N	10 PCE	0.210	0.210	1.110	0.021	0.006	0.007	0.010	0.010	0.004	0.005	0.001	0.005	0.002	3.000	0.400	
6	780468	600 WNRF S160 2" A105N	300 PCE	0.202	0.260	1.080	0.018	0.010	0.014	0.049	0.059	0.005	0.008	0.001	0.004	0.002	3.000	0.399	

Item No.	Heat No.	T.S.(*1) (MPA)	Y.S.(*1) (MPA)	E.L.(*1) (%)	Hardness (HB)	R.A.(*1) (%)	Impact Test Temp: Minimum: Joule			Material Supplier	HEAT TREATMENT(*2) <input checked="" type="checkbox"/> N
							1	2	3		
1	536937	516.0	343.0	35.6	152/150	69.5				NTMK ACOMINAS WEI CHIH STEEL NTMK ACOMINAS NTMK	REMARKS 880°CX4HRS CONFORMS WITH NACE MR0103/ISO17495-1:2016 AND NACE MR0175/ISO15156.2009 CLAUSE 7.2.1.4 REGION 3 AND ANNEX A. CONFORMS WITH Z245.12 CAT I GR248 SOUR SERVICE-09(FOR USE AS WELDING NECK AND BLIND FLANGES ONLY) MN TO C RATIO IS GREATER THAN 3.0" B/10000 COUNTRY OF ORIGIN: TAIWAN
2	4723476	524.0	348.0	35.6	153/151	70.4					
3	102640	514.0	341.0	37.4	153/150	69.5					
4	517058	518.0	335.0	37.8	152/150	71.3					
5	2807068903	527.0	383.0	35.8	153/151	69.5					
6	635897	529.0	374.0	34.0	153/151	69.5					

*1: T.S. = Tensile Strength, Y.S.=Yield Strength, E.L.=Elongation, R.A.=Reduction of Area.
 *2: N=Normalized, A=Annealed, Q=Quenched, T=Tempered, S.T=Solution Treated, S.R=Stress Relieved,
 A.C=Air Cooled, F.C=Furance Cooled, W.C=Water Cooled, O.C=Oil Cooled.
 *3: C.E. Value = C + (Mn /6) + (Cr + Mo +V) / 5 + (Ni + Cu) / 15

We hereby certify that the material has been tested in accordance with the above specification and also with the requirements called for by the above order.


 Manager of Quality Assurance Dept



ISO 9001:2008

TRILAD Flanges and Fittings, Inc.

172 Turbo Drive
Sherwood Park, AB, CANADA T8H 2J6
(PHONE) 780-464-7774
(FAX) 780-464-0044
www.tri-lad.com

35528

CERTIFIED MATERIAL TEST REPORT

Certificate No. **17253084**

EN 10204 3.1

Date of Report **2/16/2017**

Customer
ALLIED EDMONTON - CAD\$
172 TURBO DRIVE
SHERWOOD PARK AB T8H 2J6

Customer Order No.
286

Quantity
200

Tri-Lad Order No. **956318** Line No. **22**

Specification A105N STOCK	Heat Treatment NORMALISED
Item Description 2 X 1 150 TD RF (886330)	Temperature Initial 1634 F 890 C
Shop Order/Trace No.	Time N=1.00HRS Lot Definition
Lot No.	
Heat Code TL10014915	
C.E. .40	Melt Practice EF

	Chemical Composition									
	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	V
Heat Product	.21	.99	.022	.010	.23	.07	.03	.11	.00	.001
Heat Product	Nb .00									
Heat Product										

Mechanical Properties						Impact Values		Shear Fracture			
Yield	Tensile		Elongation	Reduction of Area	Hardness	Impact Test Temperature					
Ksi 54 Mpa 369	Ksi 77 Mpa 534		35 %	63 %	HBW 153 HBW 153						
Tensile Specimen			STD RD								
Lateral Expansion			Impact Type		Impact Orientation		Starting Material		Impact Specimen		

Notes	
Cr+Mo <= 0.32%	0.11
Cr+Cu+Mo+Ni+V <= 1.00%	0.22
Mn/C >= 3.0	4.74
CE = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15	0.40
ASTM A105N-14	CSA Z245.12-13 GR 248 CAT I SS
ASME SA105N 2013 Edition	ANSI/NACE MR0175/ISO15156:2009(E)
	NACE MR0103 LATEST ED.
	NACE MR0175/ISO15156-09

Material is in accordance with the applicable Standard to which it is ordered including:
ASME Sect II, ASME B16.5, B16.9, B16.36, B16.47, CSA, MSS, AWWA C-207
NO WELD REPAIR

Material conforms to both ASTM (A) and ASME (SA) applicable specifications.
We hereby certify that all information presented on this CMTR conforms to the above specification.

We hereby certify the results to be a true copy of the records of the company.

Troy Gorrell
Q.C. Inspector



ISO 9001:2008

TRILAD Flanges and Fittings, Inc.

172 Turbo Drive
Sherwood Park, AB, CANADA T8H 2J6
(PHONE) 780-464-7774
(FAX) 780-464-0044
www.tri-lad.com

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CERTIFIED MATERIAL TEST REPORT

Certificate No. 17266466	EN 10204 3.1	Date of Report 8/21/2017
Customer ALLIED EDMONTON - CAD\$ 172 TURBO DRIVE SHERWOOD PARK	AB T8H 2J6	Customer Order No. 598607
		Quantity 30
		Tri-Lad Order No. 989616
		Line No. 1

Specification A105N STOCK	Heat Treatment NORMALISED
Item Description 2 X .75 600 THD RF . (885182)	Temperature Init 1634 F 890 C
Shop Order/Trace No.	Time N=1.15HRS
Lot No.	Lot Definition
Heat Code TL10012904	
C.E. .42	Melt Practice EF

Heat Product	Chemical Composition										
	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	V	
	.19	1.18	.023	.021	.24	.09	.03	.13	.01	.001	
	Nb	.00									

Mechanical Properties						Impact Values	Shear Fracture
Yield	Tensile	Elongation	Reduction of Area	Hardness	Impact Test Temperature		
Ksi 54 Mpa 369	Ksi 79 Mpa 546	34 %	66 %	HBW 149 HBW 149			
Tensile Specimen STD RD							
Lateral Expansion		Impact Type	Impact Orientation	Starting Material		Impact Specimen	

Notes	
Cr+Mo <= 0.32%	0.14
Cr+Cu+Mo+Ni+V <= 1.00%	0.25
Mn/C >= 3.0	6.24
CE = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15	0.42
ASTM A105N-14	CSA Z245.12-13 GR 248 CAT I SS
ASME SA105N 2013 Edition	ANSI/NACE MR0175/ISO15156:2009(E)
	NACE MR0103 LATEST ED.
	NACE MR0175/ISO15156-09

Material is in accordance with the applicable Standard to which it is ordered including: ASME Sect II, ASME B16.5, B16.9, B16.36, B16.47, CSA, MSS, AWWA C-207.

NO WELD REPAIR

Material conforms to both ASTM (A) and ASME (SA) applicable specifications.

We hereby certify that all information presented on this CMTR conforms to the above specification.

We hereby certify the results to be a true copy of the records of the company.

Troy Gorrell
Q.C. Inspector



ISO 9001:2008

TRILAD Flanges and Fittings, Inc.

35528

172 Turbo Drive
Sherwood Park, AB, CANADA T8H 2J6
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www.tri-lad.com

CERTIFIED MATERIAL TEST REPORT

Certificate No. **16235651**

EN 10204 3.1

Date of Report **5/09/2016**

Customer
ALLIED EDMONTON - CAD\$
172 TURBO DRIVE
SHERWOOD PARK AB T8H 2J6

Customer Order No.
533666

Quantity **10**

Tri-Lad Order No. **917413** Line No. **1**

Specification A105N STOCK	Heat Treatment NORMALISED
Item Description 2 X 1 600 THD RF W/HUB (885246)	Temperature Init 1634 F 890 C
Shop Order/Trace No.	Time N=1. 15HRS Lot Definition
Lot No.	
Heat Code TL10010728	
C.E. .41	Melt Practice EF

	Chemical Composition									
Heat Product	C .18	Mn 1.18	P .019	S .024	Si .22	Cu .08	Ni .09	Cr .10	Mo .02	V .004
Heat Product	Nb .00									
Heat Product										

Mechanical Properties							Impact Values		Shear Fracture	
Yield Ksi 56 Mpa 387	Tensile Ksi 80 Mpa 551	Elongation 29 %	Reduction of Area 48 %	Hardness HBW 159 HBW 159	Impact Test Temperature					
Tensile Specimen STD RD										
Lateral Expansion		Impact Type		Impact Orientation		Starting Material		Impact Specimen		

Notes	
Cr+Mo <= 0.32%	0.12
Cr+Cu+Mo+Ni+V <= 1.00%	0.30
Mn/C >= 3.0	6.56
CE = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15	0.41
ASTM A105N-14	CSA Z245.12-13 GR 248 CAT I SS
ASME SA105N 2013 Edition	ANSI/NACE MR0175/I S015156: 2009(E) NACE MR0103 LATEST ED. NACE MR0175/I S015156-09

Material is in accordance with the applicable Standard to which it is ordered including:
ASME Sect II, ASME B16.5, B16.9, B16.36, B16.47, CSA, MSS, AWWA C-207.

NO WELD REPAIR

Material conforms to both ASTM (A) and ASME (SA) applicable specifications.

We hereby certify that all information presented on this CMTR conforms to the above specification.

We hereby certify the results to be a true copy of the records of the company.

Troy Gorrell
Q.C. Inspector



ISO 9001:2008

TRILAD Flanges and Fittings, Inc.

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 Sherwood Park, AB, CANADA T8H 2J6
 (PHONE) 780-464-7774
 (FAX) 780-464-0044
 www.tri-lad.com

CERTIFIED MATERIAL TEST REPORT

Certificate No. 15213459	EN 10204 3.1	Date of Report 5/11/2015
---------------------------------	--------------	---------------------------------

Customer ALLIED EDMONTON - CAD\$ 172 TURBO DRIVE SHERWOOD PARK AB T8H 2J6	Customer Order No. AR.169	Quantity 100
	Tri-Lad Order No. 774487	Line No. 11

Specification A105N STOCK	Heat Treatment NORMALISED
Item Description 3 X 1 600 TD RF W/HUB (920037)	Temperature Init 1634 F 890 C
Shop Order/Trace No.	Time N=1.30HRS
Lot No.	Lot Definition
Heat Code TL10010174	
C.E. .40	Melt Practice EF

	Chemical Composition									
	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	V
Heat Product	.17	1.17	.026	.014	.24	.03	.07	.10	.02	.007
Heat Product	Nb .00									
Heat Product										

Mechanical Properties								
Yield	Tensile		Elongation	Reduction of Area	Hardness	Impact Test	Impact Values	Shear Fracture
Ksi 56	Ksi 79				HBW 159	Temperature		
Mpa 388	Mpa 547	29 %	52 %		HBW 159			
Tensile Specimen		STD RD						
Lateral Expansion		Impact Type		Impact Orientation		Starting Material		Impact Specimen

Cr+Mo <= 0.32% Cr+Cu+Mo+Ni+V <= 1.00% Mn/C >= 3.0 CE = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15	Notes 0.12 0.24 6.88 0.40
ASTM A105N-14 ASME SA105N 2013 Edition	CSA Z245.12-13 GR 248 CAT I SS ANSI/NACE MRO175/ISO15156:2009(E) NACE MRO103 LATEST ED. NACE MRO175/ISO15156-09

Material is in accordance with the applicable Standard to which it is ordered including:
 ASME Sect II, ASME B16.5, B16.9, B16.36, B16.47, CSA, MSS, AWWA C-207.
 NO WELD REPAIR
 Material conforms to both ASTM (A) and ASME (SA) applicable specifications.
 We hereby certify that all information presented on this CMTR conforms to the above specification
 We hereby certify the results to be a true copy of the records of the company

Troy Gorrell
 Troy Gorrell
 Q.C. Inspector

wo # 35527 / 28



ISO 9001:2008

TRILAD Flanges and Fittings, Inc.

172 Turbo Drive
 Sherwood Park, AB, CANADA T8H 2J6
 (PHONE) 780-464-7774
 (FAX) 780-464-0044
 www.tri-lad.com

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CERTIFIED MATERIAL TEST REPORT

Certificate No. 17275456	EN 10204 3.1	Date of Report 12/13/2017
---------------------------------	--------------	----------------------------------

Customer ALLIED EDMONTON - CAD\$ 172 TURBO DRIVE SHERWOOD PARK AB T8H 2J6	Customer Order No. 121317	Quantity 10
	Tri-Lad Order No. 121867	Line No. 1

Specification A105N STOCK	Heat Treatment NORMALISED
Item Description 3 X 2 600 THD RF (887226)	Temperature Init 1706 F 930 C
Shop Order/Trace No.	Time N=1.25HRS
Lot No.	Lot Definition
Heat Code TL10015676	
C.E. .40	Melt Practice EF

Heat Product	Chemical Composition									
	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	V
Heat Product	.18	1.18	.027	.017	.23	.04	.01	.06	.00	.001
Heat Product	Nb .00									
Heat Product										

Mechanical Properties							Impact Values	Shear Fracture
Yield	Tensile		Elongation	Reduction of Area	Hardness	Impact Test Temperature		
Ksi 51 Mpa 350	Ksi 79 Mpa 543		35 %	71 %	HBW 149 HBW 153			
Tensile Specimen STD RD								
Lateral Expansion		Impact Type		Impact Orientation		Starting Material		Impact Specimen

Notes	
Cr+Mo <= 0.32%	0.06
Cr+Cu+Mo+Ni+V <= 1.00%	0.11
Mn/C >= 3.0	6.41
CE = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15	0.40
ASTM A105N-14 ASME SA105N 2013 Edition	CSA Z245.12-13 GR 248 CAT I SS ANSI/NACE MR0175/ISO15156:2009(E) NACE MR0103 LATEST ED. NACE MR0175/ISO15156-09

Material is in accordance with the applicable Standard to which it is ordered including:
 ASME Sect II, ASME B16.5, B16.9, B16.36, B16.47, CSA, MSS, AWWA C-207.
 NO WELD REPAIR
 Material conforms to both ASTM (A) and ASME (SA) applicable specifications.
 We hereby certify that all information presented on this CMTR conforms to the above specification.
 We hereby certify the results to be a true copy of the records of the company.

Troy Gorrell
 Troy Gorrell
 Q.C. Inspector

35528

SO# 323840 HEAT# 76180 3 600 RF HUB BLIND A105N * 3/4 NPT



METALFAR
PRODOTTI INDUSTRIALI S.P.A.

STAMPAGGIO A CALDO DI ACCIAI COMUNI - LEGATI E INOSSIDABILI
SALA PROVE E ANALISI MATERIALI / MATERIAL TEST DEPARTMENT

SEDE AMMINISTRATIVA E STABILIMENTO:
23861 CESANA BRIANZA (LC) - Italy
Via G. Pirelli, 28
Tel. +39 031.655441
Fax +39 031.655149
quality.mtf@farmas.com

COMPANY WITH QUALITY MANAGEMENT
SYSTEM CERTIFIED BY DNV
= ISO 9001:2008 =

CERTIFICATO DI COLLAUDO SECONDO EN 10204 - 3.1 INSPECTION CERTIFICATE

SILBO INDUSTRIES	Certif. N. 2812	Del/Dated 23.05.2011
50 CHESTNUT RIDGE ROAD SUITE 204	Fettura / Invoice N. 1756	Del/Dated 23.05.2011
07845 MONTVALE N.J. US	DDT / Del Note N. 2017	Del/Dated 23.05.2011
	No.Ord. / Our ref. N.	Del/Dated

COD. COL. COLATA POS. VS.ORDINE Q.TA' DESCRIZIONE DIM.IN ACC. A VISIVO E DIMENS.	HEAT CODE HEAT ITEM YOUR REFERENCE Q.TY DESCRIPTION DIM. ACCORDANCE TO VIS. & DIMENS.	ASME/ANSI B16.5														SATISFACTORY				
08/74492 009	61460/PV	25,00	THR.D 1500 RF 2"	A105	C%	Si%	Mn%	S%	P%	Cr%	Ni%	Mo%	Ti%	Cu%	V%	Nb%	N%	Al%	C.E.%	
					0,195	0,200	1,040	0,013	0,018	0,130	0,080	0,010	0,009	0,210	0,002	0,001	0,000	0,021	0,414	
MATERIALE / MATERIAL					ASTM A105															
PROVETTA / TEST SPECIMEN					REBILLENZA / IMPACT TEST - JOULE/cm²															SNERVAMENTO
SEZ. mm ²	LUNG. mm	FORMA	SNERVAMENTO	ROTTURA	ALLUNGAMENTO	CONTRAZIONE	DUREZZA	TIPO / TYPE 10x10mm				°C			YIELD POINT			No.Rif.		
SECT. mm ²	LENGHT mm	SHAPE	N/mm ² >=0,2%	TENSILE STRENGTH	%	REDUCTION OF AREA	HBW	KV							N/mm ² >=1,0%			OUR REF.		
126,60	50,80	1	339,0	648,0	32,0	87,0	164,0 - 166,0								0,0					
MATERIALE IN ACCORDO A / MATERIAL IN ACC. TO					TRATTAMENTO TERMICO / HEAT TREATMENT															ORIGINE / ORIGIN
ASTM/ASME A 105/SA 105 M - 09					NORMALIZED AT 920 C - COOLED IN STILL AIR															EUROPE

COD. COL. COLATA POS. VS.ORDINE Q.TA' DESCRIZIONE DIM.IN ACC. A VISIVO E DIMENS.	HEAT CODE HEAT ITEM YOUR REFERENCE Q.TY DESCRIPTION DIM. ACCORDANCE TO VIS. & DIMENS.	ASME/ANSI B16.5														SATISFACTORY				
10/33059 019	61460/PV	30,00	RED.THRD 300 RF 3"X1"	A105	C%	Si%	Mn%	S%	P%	Cr%	Ni%	Mo%	Ti%	Cu%	V%	Nb%	N%	Al%	C.E.%	
					0,190	0,250	1,130	0,025	0,010	0,090	0,050	0,010	0,021	0,140	0,002	0,002	0,000	0,035	0,411	
MATERIALE / MATERIAL					ASTM A105															
PROVETTA / TEST SPECIMEN					REBILLENZA / IMPACT TEST - JOULE/cm²															SNERVAMENTO
SEZ. mm ²	LUNG. mm	FORMA	SNERVAMENTO	ROTTURA	ALLUNGAMENTO	CONTRAZIONE	DUREZZA	TIPO / TYPE 10x10mm				°C			YIELD POINT			No.Rif.		
SECT. mm ²	LENGHT mm	SHAPE	N/mm ² >=0,2%	TENSILE STRENGTH	%	REDUCTION OF AREA	HBW	KV							N/mm ² >=1,0%			OUR REF.		
126,60	50,80	1	345,0	535,0	31,0	58,0	163,0 - 165,0								0,0					
MATERIALE IN ACCORDO A / MATERIAL IN ACC. TO					TRATTAMENTO TERMICO / HEAT TREATMENT															ORIGINE / ORIGIN
ASTM/ASME A 105/SA 105 M - 09					NORMALIZED AT 920 C - COOLED IN STILL AIR															EUROPE

COD. COL. COLATA POS. VS.ORDINE Q.TA' DESCRIZIONE DIM.IN ACC. A VISIVO E DIMENS.	HEAT CODE HEAT ITEM YOUR REFERENCE Q.TY DESCRIPTION DIM. ACCORDANCE TO VIS. & DIMENS.	ASME/ANSI B16.5														SATISFACTORY				
76180 024	61460/PV	75,00	BOSSED 600 RF 3"	A105	C%	Si%	Mn%	S%	P%	Cr%	Ni%	Mo%	Ti%	Cu%	V%	Nb%	N%	Al%	C.E.%	
					0,200	0,240	0,980	0,014	0,013	0,070	0,040	0,010	0,006	0,160	0,001	0,000	0,000	0,025	0,392	
MATERIALE / MATERIAL					ASTM A105															
PROVETTA / TEST SPECIMEN					REBILLENZA / IMPACT TEST - JOULE/cm²															SNERVAMENTO
SEZ. mm ²	LUNG. mm	FORMA	SNERVAMENTO	ROTTURA	ALLUNGAMENTO	CONTRAZIONE	DUREZZA	TIPO / TYPE 10x10mm				°C			YIELD POINT			No.Rif.		
SECT. mm ²	LENGHT mm	SHAPE	N/mm ² >=0,2%	TENSILE STRENGTH	%	REDUCTION OF AREA	HBW	KV							N/mm ² >=1,0%			OUR REF.		
126,60	50,80	1	337,0	645,0	33,0	58,0	164,0 - 165,0								0,0					
MATERIALE IN ACCORDO A / MATERIAL IN ACC. TO					TRATTAMENTO TERMICO / HEAT TREATMENT															ORIGINE / ORIGIN
ASTM/ASME A 105/SA 105 M - 09					NORMALIZED AT 920 C - COOLED IN STILL AIR															EUROPE

NOTE MATERIAL IN ACCORDANCE WITH NACE MR-0175/2003 ISO 15156 NOTES	UFFICIO CONTROLLO QUALITA' QUALITY CONTROL DEPARTEMENT	ENTE UFFICIALE DI COLLAUDO INSPECTION AUTHORITY	MARCHIO PRODUZIONE MANUFACTURER'S SYMBOL
	<i>S. Corti</i> <i>Carlo Sergio</i>		

35528

SO# 323840 HEAT# 318893 3 600 RF HUB BLIND A105N * 3/4 NPT



SAN ENG STEEL FORGING CO LTD
311, Jen Hsin Road, Jen Wu District
Kaohsiung, Taiwan, R.O.C.
TEL: 07-3724249; FAX: 07-3712823
URL: www.saneng.com.tw
e-mail: saneng@ksts.seed.net.tw

MILL TEST CERTIFICATE

EN10204-3.1.B(DIN50048/3.1.B)
Customer: SEYBOLD INTERNATIONAL CORP.
Order No.: 7007839(4)-PVF


Certificate No.: SE-7839D
Date: 04/24/2014
Page: 2 OF 4

PRODUCT		MATERIAL SPECIFICATIONS										DIMENSIONAL SPECIFICATIONS						
FORGED CARBON STEEL FLANGES		ASTM A105-13/ASME SA-105-13										ASME B16.5-13 CSA Z245.12						
Item No.	CODE NO	DESCRIPTION	QUANTITY	CHEMICAL COMPOSITION (%)														CE(*3)
				C	Si	Mn	P	S	Cu	Cr	Ni	Mo	V	Nb	N			
			Mn Max	0.350	0.100 0.350	0.600 1.050	0.035	0.040	0.400	0.300	0.400	0.120	0.080	0.020				
11		300 BLRF 2 1/2" A105N	50 PCE	0.200	0.190	1.140	0.024	0.011	0.010	0.030	0.010	0.010	0.004	0.002	0.006			0.400
12		600 BLRF 2 1/2" A105N	6 PCE	0.210	0.220	1.160	0.016	0.004	0.007	0.010	0.010	0.003	0.006	0.001	0.007			0.408
13		600 BLRF 2 1/2" A105N	6 PCE	0.200	0.210	1.170	0.019	0.007	0.006	0.010	0.010	0.002	0.004	0.001	0.003			0.399
14		300 BLRF 3" A105N	30 PCE	0.200	0.190	1.140	0.024	0.011	0.010	0.030	0.010	0.010	0.004	0.002	0.006			0.400
15		300 BLRF 3" A105N	20 PCE	0.220	0.220	1.150	0.018	0.004	0.006	0.020	0.010	0.002	0.006	0.001	0.007			0.418
16		300 HUB BLRF 3" A105N	50 PCE	0.220	0.210	1.150	0.023	0.005	0.006	0.020	0.010	0.004	0.009	0.001	0.005			0.419
17		600 BLRF 3" A105N	50 PCE	0.200	0.220	1.130	0.022	0.003	0.006	0.030	0.010	0.003	0.004	0.001	0.007			0.397
18		600 BLRTJ 3" A105N	14 PCE	0.210	0.220	1.160	0.016	0.004	0.007	0.010	0.010	0.003	0.006	0.001	0.007			0.408
19		600 BLRTJ 3" A105N	6 PCE	0.215	0.310	1.080	0.014	0.008	0.006	0.051	0.043	0.005	0.017	0.005	0.005			0.413
20		600 HUB BLRF 3" A105N	50 PCE	0.197	0.240	1.020	0.012	0.017	0.005	0.032	0.050	0.005	0.021	0.005	0.004			0.382

Item No.	Heat No.	T.S.*1 (MPA)	Y.S.*1 (MPA)	E.L.*1 (%)	Hardness (HB)	R.A.*1 (%)	Impact Test Temp:			Material Supplier	HEAT TREATMENT(*2)	
							Minimum:	Joule	3		<input checked="" type="checkbox"/> N	REMARKS
		Mn Max	485.0	250.0	22.0	187	30.0	1	2	3		
11	4803122	512.0	337.0	33.4	152/150	69.5					ACOMINAS	880°CX4HRS CONFORMS WITH NACE MR0103-12 AND NACE MR0175/ISO15156,2-09 CLAUSE 7.2.1.4 REGION 3 AND ANNEX A. CONFORMS WITH Z245.12 CAT I GR248-SOUR SERVICE-09(FOR USE AS WELDING NECK AND BLIND FLANGES ONLY) MN TO C RATIO IS GREATER THAN 3.0*
12	4677171	518.0	350.0	35.8	153/151	70.4					ACOMINAS	
13	4414985	513.9	367.7	38.0	149/152	72.1					ACOMINAS	
14	4803122	512.0	337.0	33.4	152/150	69.5					ACOMINAS	
15	4723468	531.0	360.0	36.2	154/151	71.3					ACOMINAS	
16	4553922	535.0	358.0	34.2	154/151	68.6					ACOMINAS	
17	4723476	524.0	348.0	35.8	153/151	70.4					ACOMINAS	
18	4677171	518.0	350.0	35.8	153/151	70.4					ACOMINAS	
19	10986	529.6	354.0	35.0	152/154	70.4					NTMK	
20	318893	503.0	341.0	36.8	150/148	68.6					NTMK	

*1: T.S. = Tensile Strength, Y.S.=Yield Strength, E.L.=Elongation, R.A.=Reduction of Area.
 *2: N=Normalized, A=Annealed, Q=Quenched, T=Tempered, S.T=Solution Treated, S.R=Stress Relieved, A.C=Air Cooled, F.C=Furnace Cooled, W.C=Water Cooled, O.C=Oil Cooled.
 *3: C.E. Value = C + (Mn /8) + (Cr + Mo +V) / 5 + (Ni + Cu) / 15

We hereby certify that the material has been tested in accordance with the above specification and also with the requirements called for by the above order.


 Manager of Quality Assurance Dept



ISO 9001:2008

TRILAD Flanges and Fittings, Inc.

172 Turbo Drive
 Sherwood Park, AB, CANADA T8H 2J6
 (PHONE) 780-464-7774
 (FAX) 780-464-0044
 www.tri-lad.com

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CERTIFIED MATERIAL TEST REPORT

Certificate No. 17252592	EN 10204 3.1	Date of Report 2/13/2017
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Customer ALLIED EDMONTON - CAD\$ 172 TURBO DRIVE SHERWOOD PARK AB T8H 2J6	Customer Order No. 192	Quantity 27
	Tri-Lad Order No. 955342	Line No. 2

Specification A350-LF2-CL 1 STOCK	Heat Treatment NORMALISED
Item Description 4 X 1 600 TD RF (895754)	Temperature Init 1688 F 920 C
Shop Order/Trace No.	Time N=3HRS
Lot No.	Lot Definition
Heat Code TL10010582	
C.E. .43	Melt Practice EF

Heat Product	Chemical Composition									
	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	V
	.21	1.27	.022	.015	.24	.01	.02	.03	.00	.001
	Nb .00									

Mechanical Properties									
Yield Ksi 53 Mpa 365	Tensile Ksi 83 Mpa 569	Elongation 32 %	Reduction of Area 72 %	Hardness HBW 159 HBW 167	Impact Test Temperature M50 F M46 C	Impact Values Ft-lbs 46 40 46 Joules 62 54 62			Shear Fracture
Tensile Specimen STD RD		Impact Type VNOTCH		Impact Orientation		Starting Material		Impact Specimen FULL SIZE	

Notes	
Cr+Mo <= 0.32%	0.03
Cr+Cu+Mo+Ni+V <= 1.00%	0.06
Mn/C >= 3.0	6.05
CE = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15	0.43
ASTM A350-15 LF2 CLASS 1	CSA Z245.12-13 GR 248 CAT II M46C SS
ASME SA350 2013 Ed LF2 CLASS 1	ANSI/NACE MRO175/ISO15156:2009(E)
	NACE MRO103 LATEST ED.
	NACE MRO175/ISO15156-09

Material is in accordance with the applicable Standard to which it is ordered including:
 ASME Sect II, ASME B16.5, B16.9, B16.36, B16.47, CSA, MSS, AWWA C-207.
 NO WELD REPAIR MERCURY FREE
 Material conforms to both ASTM (A) and ASME (SA) applicable specifications.
 We hereby certify that all information presented on this CMTR conforms to the above specification.
 We hereby certify the results to be a true copy of the records of the company.

Troy Gorrell
 Troy Gorrell
 Q.C. Inspector

Purchaser: ALBERTA PIPE FITTINGS LTD
 Order No.: APF2011/13
 Invoice No.: ZX111A0583A

INSPECTION CERTIFICATE
ZIBO WEL-FIT METAL PRODUCTS CO., LTD
 NO 18, LUSHAN ROAD, LINZI, ZIBO, P.R.CHINA 255418

ORIGINAL

Date: 2011-06-23
 Certificate No: ZX111A0583A
 Certificate to: EN10204-2004 3.1

Material Specification	Specification for Inspection	Visual and Dimensional	Hardness	Cr+Ni+Cr+Mo	Cr+Mo	MT:(5) GOOD
ASTM A420-06/ASME SA420	ASME B16.9-07	Inspection GOOD	Max 197HB			
WPL6 NACE MR0175/0103	CSA Z245.11-09	Impact Test Method: Longitudinal	<197HB	RT:(5)	IGC:(5)	PMI:(5):
CSA Z245.11-09 GR241 CATII	GR241 CATII M45C					

Product Description	Heat I.D.	Quantity (Pcs)	Tension Test (1)			IMPACT TEST			Chemical Composition %													Heat Treatment (3)	Raw Material		
			YS Mpa	TS Mpa	E %	Impact Energy			Specimen Size	temperature (°C)	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	V	Nb		CE(2)	Type (4)	Manufacturer (5)
						240	415	30																	
			585	1	2	3	0.30	0.40	1.35	0.035	0.040	0.30	0.12	0.40	0.40	0.08	0.02								
CON REDUCER STD WPL6 3 X 2	02062	200	346	482	39	56	50	46	10X5X55	-56°C	0.14	0.25	1.97	0.01	0.003	0.04	0.01	0.12	0.07	0.001	0.001	0.32	S	1	BST
CON REDUCER STD WPL6 4 X 2	02228	200	323	462	40	20	22	18	10X2.5X55	-73°C	0.15	0.26	1.02	0.01	0.002	0.04	0.02	0.12	0.08	0.002	0.001	0.35	S	1	BST
CON REDUCER STD WPL6 4 X 3	02228	200	323	462	40	20	22	18	10X2.5X55	-73°C	0.15	0.26	1.02	0.01	0.002	0.04	0.02	0.12	0.08	0.002	0.001	0.35	S	1	BST
CON REDUCER XS WPL6 3 X 2	02198	300	315	505	31	32	38	44	10X5X55	-56°C	0.2	0.21	0.52	0.015	0.007	0.04	0.004	0.03	0.05	0.002	0.001	0.30	S	1	XSP
CON REDUCER XS WPL6 4 X 2	02367	200	315	511	35	44	40	38	10X5X55	-56°C	0.21	0.22	0.52	0.01	0.009	0.04	0.010	0.01	0.05	0.001	0.001	0.31	S	1	BST
CON REDUCER XS WPL6 4 X 3	02367	200	315	511	35	44	40	38	10X5X55	-56°C	0.21	0.22	0.52	0.01	0.009	0.04	0.010	0.01	0.05	0.001	0.001	0.31	S	1	BST
LR 45 ELBOW STD WPL6	00084	100	325	480	35	20	18	18	10X2.5X55	-73°C	0.18	0.25	0.56	0.006	0.007	0.05	0.008	0.04	0.08	0.002	0.002	0.29	S	1	BST
LR 45 ELBOW STD WPL6	002006	50	310	495	32	18	20	24	10X2.5X56	-73°C	0.18	0.21	0.53	0.013	0.008	0.015	0.007	0.013	0.05	0.001	0.002	0.28	S	1	XSP
LR 45 ELBOW XS WPL6	01188	100	315	510	32	20	18	18	10X2.5X56	-73°C	0.19	0.22	0.52	0.011	0.007	0.014	0.008	0.014	0.03	0.001	0.001	0.28	S	1	XSP
LR 45 ELBOW XS WPL6	02198	50	315	505	31	32	38	44	10X5X55	-56°C	0.2	0.21	0.52	0.015	0.007	0.04	0.004	0.03	0.05	0.002	0.001	0.30	S	1	XSP
LR 90 ELBOW SCH160 WPL6	01443K	200	310	495	32	40	36	35	10X5X55	-56°C	0.18	0.23	0.53	0.013	0.007	0.015	0.007	0.013	0.05	0.002	0.001	0.28	S	1	XSP
LR 90 ELBOW SCH160 WPL6	02163K	20	310	490	30	72	80	82	10X10X55	-46°C	0.19	0.21	0.51	0.015	0.009	0.018	0.004	0.025	0.05	0.001	0.001	0.28	S	1	XSP
LR 90 ELBOW SCH160 WPL6	02188K	20	350	485	23	74	70	68	10X10X55	-46°C	0.2	0.22	0.53	0.012	0.015	0.036	0.011	0.026	0.06	0.001	0.002	0.29	S	1	SHT
LR 90 ELBOW STD WPL6	01130	200	320	505	32	18	22	18	10X2.5X55	-73°C	0.18	0.22	0.53	0.01	0.004	0.05	0.010	0.05	0.19	0.002	0.002	0.29	S	1	XSP
LR 90 ELBOW STD WPL6	00084	200	325	480	35	20	18	18	10X2.5X55	-73°C	0.18	0.25	0.56	0.006	0.007	0.05	0.008	0.04	0.08	0.002	0.002	0.29	S	1	BST
LR 90 ELBOW STD WPL6	002006	50	310	495	32	18	20	24	10X2.5X56	-73°C	0.18	0.21	0.53	0.013	0.008	0.015	0.007	0.013	0.05	0.001	0.002	0.28	S	1	XSP
LR 90 ELBOW STD WPL6	02575	50	315	510	31	40	38	36	10X5X55	-56°C	0.19	0.21	0.52	0.011	0.011	0.012	0.009	0.01	0.012	0.002	0.002	0.29	S	1	BST
LR 90 ELBOW XS WPL6	01188	800	315	510	32	20	18	18	10X2.5X56	-73°C	0.19	0.22	0.52	0.011	0.007	0.014	0.008	0.014	0.03	0.001	0.001	0.28	S	1	XSP
LR 90 ELBOW XS WPL6	03579	300	345	520	31	34	36	42	10X5X55	-56°C	0.18	0.21	0.57	0.023	0.008	0.015	0.009	0.013	0.028	0.001	0.002	0.28	S	1	BTP
LR 90 ELBOW XS WPL6	02198	200	315	505	31	32	38	44	10X5X55	-56°C	0.2	0.21	0.52	0.015	0.007	0.04	0.004	0.03	0.05	0.002	0.001	0.30	S	1	XSP

6860054
 6860057
 6860006
 6860049

Note: (1) YS=Yield Strength TS=Tensile Strength E=Elongation (2) CE=C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15
 Note: (3) HF: Hot formed (620-980 °C) and cooled in still air. S: Cold formed and normalized (900 °C x 0.5HR), cooled in still air. SA: Cold formed and solution annealed at 1050 °C ± 10°C, water quenched.
 (4) 1=Seamless Pipe 2=Welded Pipe 3=Steel Plate. Note: (5) IGC=Interggranular Corrosion Test to ASTM A262
 PMI=Positive Material Inspection RT=Radiographical Test MT=Magnetic Particle Test
 Note: (6) BST=BAOSTEEL_XSP=XISHAN PIPE CORP,SHT=SHANDONG HUITONG,BTP=BAOTOU PIPE CORP



We hereby certify that the products detailed herein have been manufactured and inspected in accordance with the specifications concerned and also with the purchaser's requirements and that the test results shown herein are correct. This material was manufactured, tested, and inspected without mercurial and radiation contamination.

General Note: The analysis for the elements with an amount of less than 0.02% is reported as "<0.02" represented by a "*" above.

Purchaser: ALBERTA PIPE FITTINGS LTD
 Order No.: PO/18
 Invoice No.: ZXL11A0640A

ORIGINAL

INSPECTION CERTIFICATE

ZIBO WEL-FIT METAL PRODUCTS CO., LTD
 NO 18, LUSHAN ROAD, LINZI, ZIBO, P.R.CHINA 255418

Date: 2011-09-19
 Certificate No: ZXL11A0640A
 Certificate to: EN10204-2004 3.1

Material Specification	Specification for Inspection	Visual and Dimensional	Hardness	Cu+Ni+Cr+Mo	Cr+Mo	MT:(5) GOOD
ASTM A420-06/ASME SA420	ASME B16.9-07	Inspection GOOD				
WPL6	CSA Z245.11			RT:(5)	IGC:(5)	PMI(5):
CSA Z245.11	NACE MR0175-09					

Product Description	Heat I.D.	Quantity (Pcs)	Tension Test (1)			IMPACT TEST				Chemical Composition %											Heat Treatment (3)	Raw Material			
			YS Mpa	TS Mpa	E %	Impact Energy			Specimen Size	Temperature (°C)	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	V		Nb	CE(2)	Type (4)	Manufacturer (6)
						240	415	30																	
			585																						
CAP SCH160 WPL6	2 0412	100	300	460	33	40	42	38	10X5	-56	0.18	0.2	0.5	0.019	0.02	-	-	-	-	-	-	0.26	S	3	TTD
CAP SCH160 WPL6	3 0414	100	300	460	33	78	76	82	10X10	-46	0.16	0.2	0.5	0.019	0.02	-	-	-	-	-	-	0.24	S	3	TTD
CAP SCH160 WPL6	4 0415	100	320	435	32	80	80	88	10X10	-46	0.2	0.26	0.54	0.022	0.013	0.042	0.007	0.02	0.07	0.02	-	0.31	S	3	YPL
CAP XXS WPL6	2 0414	100	300	460	33	78	76	82	10X10	-46	0.16	0.2	0.5	0.019	0.02	-	-	-	-	-	-	0.24	S	3	TTD
CAP XXS WPL6	3 0417	100	320	435	32	76	70	82	10X10	-46	0.23	0.25	0.53	0.021	0.012	-	-	-	-	-	-	0.32	S	3	YPL
CAP XXS WPL6	4 0419	100	315	495	32	80	72	84	10X10	-46	0.22	0.24	0.53	0.021	0.012	-	-	-	-	-	-	0.31	S	3	YPL
CON REDUCER STD WPL6	3 X 2 002003	200	315	505	31	18	18	20	10X2.5	-73	0.2	0.22	0.51	0.011	0.01	0.012	0.01	0.011	0.01	-	-	0.29	S	1	XSP
CON REDUCER STD WPL6	4 X 2 02228	7	323	462	40	18	20	22	10X2.5	-73	0.15	0.26	1.02	0.01	0.002	0.04	0.02	0.12	0.08	-	-	0.35	S	1	BST
CON REDUCER STD WPL6	4 X 2 02389	193	310	495	32	18	18	18	10X2.5	-73	0.19	0.21	0.53	0.016	0.009	0.015	0.007	0.013	0.05	-	-	0.29	S	1	XSP
CON REDUCER STD WPL6	4 X 3 02228	12	323	462	40	18	20	22	10X2.5	-73	0.15	0.26	1.02	0.01	0.002	0.04	0.02	0.12	0.08	-	-	0.35	S	1	BST
CON REDUCER STD WPL6	4 X 3 02389	188	310	495	32	18	18	18	10X2.5	-73	0.19	0.21	0.53	0.016	0.009	0.015	0.007	0.013	0.05	-	-	0.29	S	1	XSP
CON REDUCER XS WPL6	3 X 2 02200	200	320	510	32	40	40	38	10X5	-56	0.18	0.23	0.54	0.011	0.011	0.011	0.008	0.01	0.012	-	-	0.28	S	1	XNT
CON REDUCER XS WPL6	4 X 2 02390	200	305	500	31	38	42	40	10X5	-56	0.2	0.22	0.53	0.011	0.008	0.02	0.006	0.02	0.02	-	-	0.30	S	1	XSP
CON REDUCER XS WPL6	4 X 3 02390	200	305	500	31	38	42	40	10X5	-56	0.2	0.22	0.53	0.011	0.008	0.02	0.006	0.02	0.02	-	-	0.30	S	1	XSP
LR 45 ELBOW STD WPL6	2 01187	100	320	500	31	18	22	20	10X2.5	-73	0.18	0.2	0.51	0.013	0.008	0.04	0.003	0.025	0.04	-	-	0.28	S	1	XSP
LR 45 ELBOW STD WPL6	3 01598	100	320	510	32	22	22	20	10X2.5	-73	0.21	0.21	0.51	0.013	0.013	0.01	0.01	0.011	0.011	-	-	0.30	S	1	XSP
LR 45 ELBOW STD WPL6	4 002006	100	305	500	32	18	24	26	10X2.5	-73	0.19	0.22	0.52	0.009	0.008	0.02	0.008	0.02	0.016	-	-	0.28	S	1	XSP
LR 45 ELBOW XS WPL6	2 01190	100	315	510	31	24	20	22	10X2.5	-73	0.18	0.22	0.53	0.008	0.009	0.009	0.009	0.009	0.012	-	-	0.27	S	1	XSP
LR 45 ELBOW XS WPL6	3 01591	100	305	495	31	42	38	40	10X5	-56	0.2	0.21	0.52	0.01	0.004	0.025	0.004	0.04	0.05	-	-	0.30	S	1	XSP
LR 45 ELBOW XS WPL6	4 002004	100	315	510	31	36	42	40	10X5	-56	0.21	0.21	0.53	0.011	0.01	0.011	0.009	0.01	0.012	-	-	0.30	S	1	XSP

Note: (1) YS=Yield Strength TS=Tensile Strength E=Elongation (2) CE=C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15
 Note: (3) HF: Hot formed (620-980 °C) and cooled in still air. S: Cold formed and normalized (900 °C x 0.5HR), cooled in still air. SA: Cold formed and solution annealed at 1050 °C ± 10°C, water quenched.
 (4) 1=Seamless Pipe 2=Welded Pipe 3=Steel Plate. Note: (5) IGC=Intergranular Corrosion Test to ASTM A262 E PMI=Positive Material Inspection RT=Radiographical Test MT=Magnetic Particle Test
 Note: (6) TTD=TIANDUN STL PLATE, YPL=YingKou Medium Plate, XSP=XISHAN PIPE CORP, BST=BAOSTEEL, XNT=XINING SPECIAL STEEL



The materials detailed herein have been manufactured in accordance with the specifications concerned and also with the purchaser's requirements. The test results shown herein are correct, the materials manufactured, tested, and inspected are free from contamination.

General Note: The analysis for the elements with an amount of less than 0.02% is reported as "<0.02%" represented by a "-" above.

<p>SHENYANG UNIWEL MACHINERY CO.,LTD NO. 8 ROAD BEI 21, ECONOMIC DEVELOPMENT ZONE, SHENYANG, 110141 CHINA</p>	<p>INSPECTION CERTIFICATE (MILL TEST CERTIFICATE)</p> <p>Certificate to: EN 10204 -2004-3.1</p> <p>LRQA:QAC6015836 & API No: Q1-2053 ISO/TUV Register. No. 01 100 085921 CRN. 0A13475.5C</p>	<p>Date: 20/07/17</p> <p>Purchase Order No 4899647-00</p> <p>Certificate No.: P17038-1</p>
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<p>PURCHASER: CCTF-EDMONTON 5407 53 AVENUE EDMONTON, AB T6B 3G2</p>	<p>REQUIREMENT & Material: A234-14/SA234-07 WPB,ISO 17945/NACE MR0103-2015 & NACE MR0175/ISO 15156-2: 2015 Dimension: ANSI B16.9-2012 Starting Material: MADE FROM SEAMLESS PIPE</p>	<p>REMARKS / NOTES: CEq=C + (Mn)/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15 Cu + Ni + Cr + Mo ≤ 1.00% Cr + Mo ≤ 0.32%</p>
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Item	Quant.	Heat No.	Product No.	DESCRIPTION	CHEMICAL COMPOSITION										PHYSICAL PROPERTIES					
					C	Mn	P	S	Si	Cr	Mo	Ni	Cu	V	Ceq	Tensile Strength Mpa	Yield Point Mpa	Elongation %	Hardness	Heat Treatment (HT)
					Min	0.29	-	-	0.10	-	-	-	-	-	-	415	240	30	197	
1	40	03013	6860233	E 1/2 STD LR 90 WELD ELL WPB	0.200	0.480	0.020	0.015	0.250	0.050	0.001	0.030	0.010	0.001	0.29	475	315	32	148	1
2	500	01054	6860276	E 1 STD LR 90 WELD ELL WPB	0.210	0.450	0.018	0.010	0.200	0.030	0.001	0.020	0.010	0.001	0.29	479	342	30	140	1
3	1000	09271	6860346	E 2 STD LR 90 WELD ELL WPB	0.170	0.430	0.013	0.008	0.230	0.010	0.010	0.011	0.009	0.001	0.25	490	345	30	145	1
4	1200	60676	6860381	E 3 STD LR 90 WELD ELL WPB	0.220	0.570	0.011	0.005	0.220	0.001	0.001	0.010	0.001	0.001	0.32	472	313	35	148	1
5	1000	70061	6860420	E 4 STD LR 90 WELD ELL WPB	0.210	0.410	0.016	0.003	0.220	0.010	0.001	0.006	0.001	0.001	0.28	492	337	33.5	141	1
6	200	74010	6860462	E 6 STD LR 90 WELD ELL WPB	0.210	0.580	0.018	0.008	0.220	0.030	0.001	0.001	0.001	0.001	0.31	497	316	32	140	1
7	100	65583	6860489	E 8 STD LR 90 WELD ELL WPB	0.200	0.570	0.015	0.002	0.220	0.001	0.001	0.010	0.010	0.001	0.30	460	296	33	145	1
8	4	61402	6860837	E 20 STD LR 90 WELD ELL WPB	0.200	0.540	0.013	0.008	0.220	0.060	0.001	0.040	0.010	0.001	0.31	467	289	33	148	1
9	200	11059	6860888	E 1-1/2 XH LR 90 WELD ELL WPB	0.180	0.440	0.023	0.005	0.230	0.030	0.001	0.009	0.013	0.001	0.26	480	340	30	144	1
10	1500	60542	6860900	E 2 XH LR 90 WELD ELL WPB	0.170	0.430	0.013	0.008	0.240	0.010	0.001	0.011	0.010	0.001	0.25	490	340	30.5	146	1
11	140	61614	6860942	E 3 XH LR 90 WELD ELL WPB	0.200	0.550	0.019	0.005	0.230	0.001	0.001	0.005	0.010	0.010	0.30	485	315	30	147	1
12	60	22257	6861035	E 6 XH LR 90 WELD ELL WPB	0.200	0.550	0.014	0.008	0.210	0.060	0.001	0.030	0.020	0.001	0.31	460	295	30	144	1
13	70	44877	6861051	E 8 XH LR 90 WELD ELL WPB	0.210	0.540	0.013	0.007	0.220	0.010	0.001	0.020	0.010	0.001	0.30	485	280	31.5	145	1

NDT					
UT	MPI	LPT	Surface Appearance	Dimensional	RT
N/A	N/A	N/A	GOOD	GOOD	N/A

Heat Treatment: (HT)
(1) Hot Forming Between 630°C and 980°C, AC
(2) Cold Forming: STRESS RELIEVED AT 600°C X 120Minutes
(3) Hot Forming Between 630°C and 980°C, AC; Normalized at 920°C X 60 Minutes

LEGEND:
 TR: It is within the standard range <0.008% and include trace element.
 LA: Ladle Analysis WQ: Water Quenched PA: Product Analysis
 NDT: Non-destructive Test A: Annealing N: Normalized
 HB: Brinell Hardness HRC: Rockwell Hardness N/A: Not Applicable
 AC: Air Cooled WC: Water Cooled L: Longitudinal T: Transversal

OC: Oil Cooled
 G: Hot Dip Galvanized
 SR: Stress Relieving

We hereby certify that the material described herein has been made in accordance with the requirements called for by the above order and is the product which has been tested to the satisfaction of the inspector.

Reviewed and approved by: witnessed by:



INSPECTION CERTIFICATE

Customer : SEYBOLD INTERNATIONAL CORP.
 Product : SEAMLESS CARBON STEEL BUTT WELD FITTINGS
 Spec : ASTM A234 /SA 234 WPB-2015
 CSA Z245.11-13 Gr 241 Cat I/(standard)
 EN10204 3.1/NACE ANSI/NACE MR0175/
 ISO 15156-2:2015/MR0103-12

(MILL TEST)
 ACCORDANCE WITH EN 10204-3.1
CHUP HSIN ENTERPRISE CO., LTD.
 17, TUNG LI ROAD HSIAO KANG,
 KAOHSIUNG, TAIWAN, R.O.C.
 TEL:(07)831-9157 FAX:(07)821-7500, 831-2942

Certificate No : O0600121-0201
 Order No : 7013468/ E1-8358
 Date : 2017/10/16

Starting Material		Specification for Inspection					Visual Inspection			Dimensional Inspection								
ASTM A106 GR.B		ASME B16.9-2012					GOOD			GOOD								
Item	Description	Quantity	Heat ID	Heat No	Raw Certificate No.	NDE	Impact Test											
							Test Temp	Size of specimen	Charpy V.-Notch Impact Value J	Ave.								
1	90 E L/R XS	1	75	779A	15306779													
4	90 E L/R STD	16	32	D227	28227H													
12	90 E L/R S160	2	123	850B	15305850													
16	90 E L/R STD	20	10	5579	165579													
25	90 E L/R STD	4	161	E603	17316603													
Specifi- cation	Chemical Composition%												Tension Test			Hardness Test	Heat Treatment	REMARK
	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Nb	C.E	Y.S	T.S	E			
Min.		10	29										35000	60000	30			
Max.	22		135	50	58	40	40	40	15	80	20	50		95000			197	
1	17	24	58	10	6	2	3	7	1	<1	1	28	41632	70865	32.7	135-136	620°C TO 980°C HOT FORMED	12.70mm Rectangular Longitudinal
4	14	17	89	10	2	1	4	5	<1	<1	2	30	42293	67064	34.2	137-138		25.40mm Rectangular Longitudinal
12	19	24	60	11	6	3	2	5	1	<1	<1	30	43058	71347	31.8	132-133		12.70mm Rectangular Longitudinal
16	17	23	96	12	8	1	3	8	1	1	<1	35	52461	72038	34.0	136-137		25.40mm Rectangular Longitudinal
25	14	15	77	9	6	3	2	4	2	<1	1	28	47662	67394	33.6	137-138		19.05mm Rectangular Longitudinal

$$C.E. = C + Mn / 6 + (Cr + Mo + V) / 5 + (Ni + Cu) / 15$$

We hereby certify that the material herein described has been manufactured, sampled, tested and inspected in accordance with, and was found to meet, the requirements of above specifications and purchaser's order.

L. S. Tsai

Chief of Quality Assurance Section

Order#: 618006 PO#: 110-001379-00 Seq: 10
 Conco Part#: WF 2 160 90 PBC Part Description: Weld Fittings 2 (60.3mm O.D.) Sch. 160 LR 90 DEG ELBOW A234-WPB COMM.
 Heat#: 850B Mill: Chup Hsin Enterprise Co



**INSPECTION CERTIFICATE
(MILL TEST CERTIFICATE)
EN 10204 3.1**

CHARM MING VIETNAM CO., LTD
SAIGON - LINH TRUNG, EXPORT PROCESSING ZONE
THU DUC DISTRICT, HO CHI MINH CITY, VIET NAM.
TEL : 84-8-3897 4885
FAX : 84-8-3897 4894

PURCHASER : CCTF CORPORATION
ORDER NO. : 4899443-00
SPEC. FOR RAW MATERIAL : ASTM A106 Gr. B
SPEC. FOR INSPECTION : ASTM A234 - 15 WPB/ CSA Z245.11-09 Gr. 241
ASME SA234 - 2013 WPB
ASME B16.9-2012 / ASME B16.25-2012
BS EN 10204 3.1-2004

JOB NO. : CC1702019
CERTIFICATE NO. : Q170723019-03
DATE : JULY. 23, 2017

Product & Size(Inch)		Heat Code		Quantity	Heat No.	Raw Material Mfg.	Certificate No.										
11	90 ELBOW LR 2 XH	601	960	17316601	BAOSHAN	BGSAG1705040005200		686									
12	90 ELBOW LR 3 XH	572	350	17315572	BAOSHAN	BGSAG1704070003800		0900									
13	90 ELBOW LR 2 STD	724	735	17315724	BAOSHAN	BGSAG1703060003700		0942									
14	90 ELBOW LR 2 STD	571	345	17315571	BAOSHAN	BGSAG1703060002500		0346									
15	90 ELBOW LR 2-1/2 STD	822	715	17315822	BAOSHAN	BGSAG1705040008100		11									
Spec.	Chemical Composition %												Tension Test			Hardness Test	Magnetic Particle Exam.
	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Nb	CE	Yield Strength	Tensile Strength	Elongation		
	X100	X100	X100	X1000	X1000	X100	X100	X100	X1000	X1000	X100		P.S.I	P.S.I	%		
MIN		10	29										35000	60000	30		
MAX	22	35	135	50	58	40	40	40	15	80	20	42		95000		197	
11	14	16	77	9	6	3	2	4	2	<10	<1	28	38570	61915	34	116-122	N/A
12	13	24	127	12	2	3	3	17	1	<10	1	38	38425	64235	38	126-132	N/A
13	14	14	78	8	1	4	2	4	<1	<10	<1	28	52345	66120	40	129-134	N/A
14	12	22	125	8	1	3	2	4	1	<10	1	34	41470	63655	32	130-137	N/A
15	13	15	76	9	3	3	1	4	1	<10	2	27	45820	65540	38	125-130	N/A
	Visual Examination			Dimensional Inspection			Heat Treatment										
	Acceptable			Acceptable			N/A										

$$CE = C + Mn/6 + (Cr + Mo + V) / 5 + (Ni + Cu) / 15$$


MATERIAL (HARDNESS) CONFORMS TO THE REQUIREMENTS OF NACE MR0103-2015/ NACE MR0175-2015 and ISO 15156-2015

We hereby certify that the products described here in have been manufactured and tested in accordance with specifications and also the purchaser's requirements concerned.

The products have been made from Seamless steel pipe.

NOTE:

- ABOVE - LISTED ELBOWS HAVE BEEN HOT - FORMED AT A TEMPERATURE ABOVE 1150°F (620°C) AND BELOW 1800°F (980°C) AND SUBSEQUENTLY COOLED IN STILL AIR.
- THE QUALITY MANAGEMENT SYSTEM OF ISO 9001-2008 AND PED 2014/68/EU, ANNEX I PARAGRAPH 4.3 HAVE BEEN APPROVED BY LRQA
- ANOTHER PED 2014/68/EU, ANNEX I SEC. 4.3 TUV-NORD 0045
- THE MANGANESE ABOVE THE SPECIFIED MAXIMUM WILL BE PERMITTED UP TO A MAXIMUM OF 1.65%. (FOOTNOTE D IN TABLE 1 OF ASTM A234 -15 WPB).


 Quality Assurance Section / Manager



INSPECTION CERTIFICATE

Customer : CCTF CORPORATION
 Product : SEAMLESS LOW TEMPERATURE CABON
 STEEL BUTT WELD FITTINGS
 Spec : ASTM A420-14/ASME SA420-14 WPL6,
 CSA Z245.11-13 Gr 241 Cat II -45C SS
 NACE MRO175/ISO 15156-2 Region 3-09
 & NACE MR0103-12

(MILL TEST)
 ACCORDANCE WITH EN 10204-3.1
CHUP Hsin ENTERPRISE CO., LTD.
 17, TUNG LI ROAD HSIAO KANG,
 KAOHSIUNG, TAIWAN, R.O.C.
 TEL:(07)831-9157 FAX:(07)821-7500, 831-2942

Certificate No : O0500155-0101
 Order No : 4810562-00
 Date : 2017/02/10

Starting Material		Specification for Inspection				Visual Inspection			Dimensional Inspection										
ASTM A333 GR-6		ASME B16.9-2012				GOOD			GOOD										
Item	Description	Quantity	Heat ID	Heat No	Raw Certificate No.	NDE MT	Impact Test												
							Test Temp	Size of specimen	Charpy V.-Notch Impact Value J			Ave.							
3	90 E L/R WPL6 XS	4	A908	15309908	BAOSTEEL 1601180007000	PASS PASS	-45	10 X 7.5 X 55	20	215	254	163							
5	90 E L/R WPL6 XS	6	A421	16313421	BAOSTEEL BGSAG1609130022300		-45	10 X 10 X 55	172	190	186	182.67							
6	90 E L/R WPL6 XS	8	A968	16311968	BAOSTEEL 1605060004800		-45	10 X 10 X 55	372	408	425	401.67							
7	TEE WPL6 XS	2	7880	15307880	BAOSTEEL 1511050008400		-45	10 X 5 X 55	66	57	59	60.67							
9	TEE WPL6 STD	4	F465	15309465	BAOSTEEL 1512110002200		-45	10 X 5 X 55	59	66	61	62							
Specifi- cation	Chemical Composition%												Tension Test			Hardness Test	Heat Treatment	REMARK	
	C	Si	Mn	P	S		CU	Ni	Cr	Mo	V	Nb	C.E	Y.S	T.S				E
Min.		15	50											35000	60000	30		NORM. 910°Cx0.5HR AC	
Max.	30	40	135	35	40		40	40	30	12	80	20	50		95000		197		
3	12	24	124	9	1	4	2	5	1	<1	2	34	50060	71000	39.5	132			
5	13	16	78	10	6	3	1	9	0	<1	<1	28	42805	65300	38.0	133			
6	13	25	126	8	2	5	3	6	1	<1	1	36	48754	81700	43.1	133			
7	13	25	125	8	2	3	2	5	2	<1	<1	35	49044	77300	34.9	138			
9	13	25	128	6	<1	4	2	4	2	<1	1	36	49769	72700	34.7	138			

$$C.E. = C + Mn / 6 + (Cr + Mo + V) / 5 + (Ni + Cu) / 15$$

We hereby certify that the material herein described has been manufactured, sampled, tested and inspected in accordance with, and was found to meet, the requirements of above specifications and purchaser's order.

L. S. Tsai

Chief of Quality Assurance Section

35528

<p>SHENYANG UNIWEL MACHINERY CO.,LTD NO. 8 ROAD BEI 21, ECONOMIC DEVELOPMENT ZONE, SHENYANG, 110141 CHINA</p>	<p>INSPECTION CERTIFICATE (MILL TEST CERTIFICATE)</p> <p>Certificate to: EN 10204 -2004-3.1</p> <p>LRQA:QAC6015836 & API No: Q1-2053 ISO/TUV Register. No. 01 100 085921 CRN. 0A13475.SC</p>	<p>Date: 30/09/17 Purchase Order Nc 4900168-00 Certificate No.: P17123-1</p>
<p>PURCHASER: CCTF-EDMONTON 5407 53 AVENUE EDMONTON, AB T6B 3G2</p>	<p>REQUIREMENT & Material: A234-14/SA234-07 WPB,ISO 17945/NACE MR0103-2015 & NACE MR0175/ISO 15156-2: 2015 Dimension: ANSI B16.9-2012 Starting Material: MADE FROM SEAMLESS PIPE</p>	<p>REMARKS / NOTES: CEq=C + (Mn)/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15 Cu + Ni + Cr + Mo ≤ 1.00% Cr + Mo ≤ 0.32%</p>

Item	Quant.	Heat No.	Product No.	DESCRIPTION	CHEMICAL COMPOSITION										PHYSICAL PROPERTIES					
					C	Mn	P	S	Si	Cr	Mo	Ni	Cu	V	Ceq	Tensile Strength Mpa	Yield Point Mpa	Elongation %	Hardness	Heat Treatment (HT)
					Min	0.29	-	-	0.10	-	-	-	-	-	-	415	240	30	-	
1	30	03013	6860233	E 1/2 STD LR 90 WELD ELL WPB	0.200	0.480	0.020	0.015	0.250	0.050	0.001	0.030	0.010	0.001	0.28	475	315	32	148	1
2	1000	5945F	6860292	E 1-1/4 STD LR 90 WELD ELL WPB	0.200	0.400	0.007	0.007	0.230	0.010	0.001	0.010	0.010	0.001	0.27	480	280	30	145	1
3	100	76595	6860462	E 6 STD LR 90 WELD ELL WPB	0.220	0.570	0.011	0.003	0.240	0.008	0.001	0.006	0.010	0.001	0.32	491	327	31	144	1
4	125	74273	6860513	E 10 STD LR 90 WELD ELL WPB	0.200	0.570	0.011	0.011	0.240	0.050	0.001	0.050	0.010	0.001	0.30	481	291	30.5	148	1
5	180	81818	6860985	E 4 XH LR 90 WELD ELL WPB	0.210	0.550	0.013	0.003	0.220	0.008	0.001	0.004	0.010	0.001	0.30	494	306	30.5	144	1
6	10	50815	6861140	E 10 STD SR 90 WELD ELL WPB	0.190	0.530	0.015	0.006	0.200	0.020	0.002	0.010	0.010	0.003	0.28	484	294	33.5	144	1
7	220	10752	6861159	E 1-1/2 STD LR 45 WELD ELL WPB	0.190	0.430	0.019	0.008	0.210	0.020	0.001	0.010	0.012	0.001	0.26	460	320	31	145	1
8	25	00782	6861191	E 2-1/2 STD LR 45 WELD ELL WPB	0.180	0.420	0.018	0.005	0.210	0.010	0.001	0.020	0.010	0.002	0.25	470	325	30.5	145	1
9	15	42069	6861272	E 5 STD LR 45 WELD ELL WPB	0.190	0.540	0.013	0.006	0.220	0.190	0.001	0.140	0.020	0.001	0.29	503	328	32.5	140	1
10	15	74273	6861345	E 10 STD LR 45 WELD ELL WPB	0.200	0.570	0.011	0.011	0.240	0.050	0.001	0.050	0.010	0.001	0.30	481	291	30.5	148	1
11	25	06601	6861469	E 2 XH LR 45 WELD ELL WPB	0.180	0.410	0.018	0.004	0.220	0.010	0.001	0.010	0.010	0.001	0.25	490	330	30.5	140	1

NDT					
UT	MPI	LPT	Surface Appearance	Dimensional	RT
N/A	N/A	N/A	GOOD	GOOD	N/A

Heat Treatment: (HT)
(1) Hot Forming Between 630°C and 980°C, AC
(2) Cold Forming: STRESS RELIEVED AT 600°C X 120Minutes
(3) Hot Forming Between 630°C and 980°C, AC: Normalized at 920°C X 60 Minutes

LEGEND:
 TR: It is within the standard range <0.008% and include trace element.
 LA: Laddle Analysis WQ: Water Quenched PA: Product Analysis
 NDT: Non-destructive Test A: Annealing N: Normalized
 HB: Brinell Hardness HRC: Rockwell Hardness N/A: Not Applicable
 AC: Air Cooled WC: Water Cooled L: Longitudinal T: Transversal
 OC: Oil Cooled
 G: Hot Dip Galvanized
 SR: Stress Relieving

We hereby certify that the material described herein has been made in accordance with the requirements called for by the above order and is that which has been tested to the satisfaction of the Inspector.

Reviewed and approved by: witnessed by:

SHENYANG UNIWEL MACHINERY CO., LTD.

  <p>SHENYANG UNIWEL MACHINERY CO.,LTD NO. 8 ROAD BEI 21, ECONOMIC DEVELOPMENT ZONE, SHENYANG, 110141 CHINA</p>	INSPECTION CERTIFICATE (MILL TEST CERTIFICATE) EN 10204 3.1 LRQA:QAC6015836 & API No: Q1-2053 ISO/TUV Register. No. 01 100 085921 CRN. 0A13475.5C	Date: 24/06/17 Purchase Order No: 4899442-00 Certificate No.: P17008-5
	PURCHASER: CCTF-EDMONTON 5407 53 AVENUE EDMONTON, AB T6B 3G2	

REQUIREMENT & SPECIFICATIONS: Material: A234-14/SA234-07 WPB,ISO 17945/NACE MR0103-2015 & NACE MR0175/ISO 15156-2: 2015 Dimension: ANSI B16.9-2012 Starting Material: MADE FROM SEAMLESS PIPE	REMARKS / NOTES: $CEq=C + (Mn)/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15$ $Cu + Ni + Cr + Mo \leq 1.00\%$ $Cr + Mo \leq 0.32\%$
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Item	Quant.	Heat No.	Product No.	DESCRIPTION	CHEMICAL COMPOSITION								PHYSICAL PROPERTIES				Heat Treatment (HT)			
					C	Mn	P	S	Si	Cr	Mo	Ni	Cu	V	Ceq	Tensile Strength Mpa		Yield Point Mpa	Elongati on %	Hardne ss
					Min	0.29	-	-	0.10	-	-	-	-	-	-	415		240	30	197
66	40	03737	6861671	E 1 STD WELD TEE WPB	0.200	0.430	0.015	0.013	0.260	0.070	0.001	0.040	0.010	0.001	0.29	470	280	30	145	2
68	25	15029	6861710	E 1-1/2 STD WELD TEE WPB	0.200	0.460	0.020	0.014	0.230	0.070	0.001	0.060	0.010	0.001	0.30	485	260	30	148	2
69	250	4325F	6861736	E 2 STD WELD TEE WPB	0.190	0.420	0.020	0.010	0.240	0.080	0.001	0.040	0.010	0.001	0.28	460	280	31	140	2
70	120	10951	6861752	E 2-1/2 STD WELD TEE WPB	0.200	0.430	0.018	0.009	0.240	0.080	0.001	0.040	0.020	0.001	0.29	485	285	30	148	2
71	270	68258	6861779	E 3 STD WELD TEE WPB	0.200	0.380	0.015	0.005	0.220	0.010	0.001	0.010	0.020	0.001	0.27	491	326	32.5	140	2
72	450	73381	6861817	E 4 STD WELD TEE WPB	0.220	0.540	0.011	0.013	0.240	0.050	0.001	0.060	0.010	0.002	0.33	490	310	34	145	2
73	25	04691	6861833	E 5 STD WELD TEE WPB	0.190	0.550	0.020	0.005	0.220	0.010	0.002	0.010	0.020	0.002	0.29	485	305	30.5	148	2
74	200	80471	6861850	E 6 STD WELD TEE WPB	0.200	0.580	0.023	0.007	0.220	0.020	0.002	0.004	0.010	0.003	0.30	498	335	31	147	2
75	22	46193	6861876	E 8 STD WELD TEE WPB	0.210	0.520	0.012	0.006	0.210	0.060	0.001	0.040	0.020	0.001	0.31	480	300	31.5	144	2
79	5	31029	6862007	E 1-1/4 XH WELD TEE WPB	0.200	0.430	0.016	0.011	0.230	0.170	0.001	0.040	0.010	0.001	0.31	480	270	30	145	2
80	10	37070	6862023	E 1-1/2 XH WELD TEE WPB	0.200	0.450	0.016	0.011	0.240	0.090	0.001	0.040	0.010	0.001	0.30	480	280	30	145	2
81	800	35054	6862040	E 2 XH WELD TEE WPB	0.200	0.420	0.016	0.010	0.270	0.100	0.001	0.050	0.010	0.001	0.29	470	275	30	145	1
82	10	66775	6862066	E 2-1/2 XH WELD TEE WPB	0.190	0.460	0.015	0.009	0.210	0.016	0.001	0.050	0.020	0.001	0.27	495	285	31.5	147	2

NDT						
UT	MPI	LPT	Surface Appearance	Dimensional	RT	
N/A	GOOD	N/A	GOOD	GOOD	N/A	


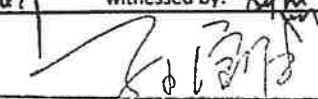
Heat Treatment: (HT)
(1) Hot Forming Between 630°C and 980°C,AC
(2) Cold Forming: STRESS RELIEVED AT 600°C X 120Minutes
(3) Hot Forming Between 630°C and 980°C,AC; Normalized at 920°C X 60 Minutes

LEGEND:

TR: It is within the standard range <0.008% and include trace element.
 LA: Laddle Analysis WQ: Water Quenched PA: Product Analysis
 NDT: Non-destructive Test A: Annealing N: Normalized
 HB: Brinell Hardness HRC: Rockwell Hardness N/A: Not Applicable
 AC: Air Cooled WC: Water Cooled L: Longitudinal T: Transversal

OC: Oil Cooled
 G: Hot Dip Galvanized
 SR: Stress Relieving

We hereby certify that the material described herein has been made in accordance with the requirements called for by the above order and is that which has been tested to the satisfaction of the inspector. SHENYANG UNIWEL MACHINERY CO.,LTD.

Reviewed and approved by:  witnessed by: 

PO# 110001379-00 Item# 1
 Heat Number: 17H10841
 Trans Am Piping Products Ltd. Rev'd By: SB
 Shipment / Seq #: 17 1782 225

2" SCH 160 BW TEE A234-WPB

Purchaser: TRANS-AM PIPING PRODUCTS LTD.

INSPECTION CERTIFICATE



Thai Benkan Co., Ltd.
 58 Soi Watsirunai, Bangkru, Prapadaeng,
 Samutprakarn, 10130 Thailand.

TO EN10204 3.1/ISO 10474 3.1B

E-No. ME-394 Purchase Order No. CL-17-464 C/O:1 Job No. _____

D M Y Certificate No.
 08/10/2017 T- 2017180194

No.	MFG. No.	Specification for Material Made from Seamless Pipe			Specification for Inspection		Visual Examination	Dimensional Inspection
		ASTM A234-17/ASME SA234-17 Gr.WPB CSAZM6.11 Gr.241 CAT: NACE MR0175/ISO 15156-2:2016 & MRS103-2016			ASME B16.9-2012, B16-25-2012		Good	Good
		Product & Size	(T:*1)	Quantity	Heat Treatment (Note 1)	Hardness Actual Data		
1	17H10841	T WPB 2 S160			N	HBW : 118 - 145		
2	16G10839	T WPB 2 X 1 1/2 S160			N	HBW : 120 - 135		
3	60F10012	T WPB 2 X 1 XS/S160			N	HBW : 120 - 150		
4	60F10016-1	T WPB 4 X 2 XS/S160			N	HBW : 120 - 140		
5	60F10016	T WPB 4 X 2 XS/S160			N	HBW : 120 - 140		

Specification	Chemical Composition %												Tension Test *2			HARDNESS MAX
	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Nb	C.E.	YS	TS	E	
Min.	X100	X100	X100	X1000	X1000	X100	X100	X100	X100	X1000	X1000	X100	MPa.		%	
Max.		10	29										240	415	30	
Base Material Heat No.	30		106	50	58	40	40	40	15	80	20		655			
1	J7L1331	20	21	85	17	4	2	2	6	10	0	0	37	293	487	58
2	J6K1836	20	21	84	16	4	2	3	5	11	0	0	38	295	487	60
3	J7K4134	19	22	87	17	5	2	2	5	1	0	0	35	315	480	58
4	J7L1331	20	21	85	17	4	2	2	6	10	0	0	37	306	509	40
5	J7K3420	20	22	82	12	3	2	2	11	10	0	0	38	343	519	39

(Note 1) A : Hot formed with final temperature between 620 °C-980 °C, Air Cooling N : Normalizing 910 °C x 40 Minutes, Air Cooling

C.E. = C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15

MAGNETIC PARTICLE EXAMINATION FOR TEE ONLY :

* 1 : "T" symbolized wall thickness in mm. * 2 : YS Yield strength TS = Tensile strength E = Elongation

GOOD

We hereby certify that the product described herein has been manufactured in accordance with the specifications concerned and also with the purchaser's requirements and that the test results shown herein are correct.

Note for WPB: For each reduction of 0.01 % below the specified carbon maximum, an increase of 0.06 % manganese above the specified maximum will be permitted, up to a maximum of 1.65 %

Form TZ-6H


 Rungrape Karapiratan
 Quality Assurance Manager
 Thai Benkan Co., Ltd.

ORIGINAL

PO# 110-001379-00 Item# 1
 Heat Number: 17A10823
 Trans Am Piping Products Ltd. Rev'd By: SB
 Shipment/Seq #: 1710

2" SCH 160 BW TEE A234-WPB

Purchaser: TRANS-AM PIPING PRODUCTS LTD.

INSPECTION CERTIFICATE



Thai Benkan Co., Ltd.
 58 Soi Watkransi, Bangkru, Prapadaeng,
 Samutprakarn, 10130 Thailand.

TO EN10204 3.1/ISO 10474 3.1B

E-No. ME-394 Purchase Order No. CI-17-484 CAO:1 Job No. _____

D M Y Certificate No. _____

06/09/2017 T. 2017180189

No.	MFG. No.	Specification for Material Made from Seamless Pipe										Specification for Inspection		Visual Examination	Dimensional Inspection					
		ASTM A234-17/ASME SA234-16 GR.WPB CSA Z245.11 Gr.241 CAT1 NACE MR0175ISO 15169-2:2016 & MR0183-2016										ASME B16.9-2012, B16-26-2012		Good	Good					
		Product & Size					(T:*1)	Quantity	Heat Treatment (Note 1)			Hardness Actual Data								
1	17G10802	T WPB 10 S40												N	HBW : 120 - 150					
2	17G10822	T WPB 4 X 3 S80												N	HBW : 130 - 145					
3	17A10623	T WPB 2 S180												N	HBW : 118 - 145	←				
4	60F10010	T WPB 3 X 2 STD/XS												N	HBW : 118 - 145					
5	17G10830	T WPB 3 X 2 S180												N	HBW : 118 - 145					
Specification		Chemical Composition %											Tension Test #2			HARDNESS MAX				
		C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Nb	C.E.	YS	TS		E			
		X/100	X/100	X/100	X/1000	X/1000	X/100	X/100	X/100	X/100	X/100	X/1000	X/1000	X/100	MPa.		%			
Min.																	240	415	30	197 HBW : GOOD
Max.			10	29																
Base Material Heat No.		30		106	50	58	40	40	40	15	80	20						665		
1	J7L2078	20	23	85	18	5	4	2	4	11	0	0	38	332	505	41	ORIGINAL			
2	42B14	18	26	82	12	1	11	4	7	3	4	3	35	330	483	38				
3	J4KC587	20	23	84	14	5	1	2	4	11	0	0	37	321	484	64	←			
4	42B14	18	26	82	12	1	11	4	7	3	4	3	35	330	487	38				
5	42B14	18	26	82	12	1	11	4	7	3	4	3	35	330	491	36				

(Note 1) A : Hot formed with final temperature between 620 °C-980 °C, Air Cooling N : Normalizing 910 °C x 40 Minutes, Air Cooling

C.E. = C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15 MAGNETIC PARTICLE EXAMINATION FOR TEE ONLY: **GOOD**
 *1 : *T* symbolized wall thickness in mm. *2 : YS Yield strength TS = Tensile strength E = Elongation

We hereby certify that the product described herein has been manufactured in accordance with the specifications concerned and also with the purchaser's requirements and that the test results shown herein are correct.

Note for WPB: For each reduction of 0.01 % below the specified carbon maximum, an increase of 0.06 % manganese above the specified maximum will be permitted, up to a maximum of 1.65 %
 Form TZ-6H

Rungnara Kanchiranon
 Quality Assurance Manager
 Thai Benkan Co., Ltd.

PO# 10-001379-00 Item# 2
 Heat Number: 17D10843
 Trans Am Piping Products Ltd.
 Shipment / Seq #: 17-5041
 Rev'd By: VI

3" SCH 160 BW TEE A234-WPB

Purchaser: TRANS-AM PIPING PRODUCTS LTD.

INSPECTION CERTIFICATE

TO EN10204 3.1/ISO 10474 3.1B



Thai Benkan Co., Ltd.
 58 Soi Watkrumai, Bangkrui, Prapadaeng,
 Samutprakarn, 10130 Thailand.

E-No. ME-325 Purchase Order No. PI-17-35007 Job No. _____

D M Y Certificate No.
02/06/2017 T- 2017180062

No.	MFG. No.	Specification for Material Made from Seamless Pipe											Specification for Inspection			Visual Examination	Dimensional Inspection
		ASTM A234-TRASMIE SA234-15 GR. WPB CSA Z46.11 Gr.241 CAT I NACE MR0175/ISO 16158-2:2015 & MR0109-2015											ASME B16.9-2012, B16-25-2012			Good	Good
		Product & Size (T:*1)											Quantity	Heat Treatment (Note 1)	Hardness Actual Data		
1	60C10021	T WPB 4 X 3 S160/XS											10	N	HBW : 118 - 145		
2	17D10844	T WPB 3 X 2 S160											20	N	HBW : 118 - 145		
3	17D10843	T WPB 3 S160											10	N	HBW : 118 - 145		
4	16N10840	T WPB 4 S160											5/10	N	HBW : 118 - 145		
5	16N10830	T WPB 4 X 3 S160											20	N	HBW : 118 - 145		
Specification		Chemical Composition %											Tension Test *2			HARDNESS MAX 197 HBW : GOOD	
		C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Nb	C.E.	YS	TS		
Min.		X100	X100	X100	X1000	X1000	X100	X100	X100	X100	X1000	X1000	X100	MPa.		%	
Max.			10	29										240	415	30	
Base Material Heat No.		30		106	50	58	40	40	40	15	80	20					
1	76891	16	24	85	13	1	12	7	13	7	3	3	36	338	487	39	
2	77506	16	26	84	13	1	7	3	8	4	3	3	34	335	479	39	
3	J6L7413	20	24	83	16	5	1	3	3	10	0	0	37	313	511	42	
4	75150	16	23	90	13	2	12	7	10	4	3	3	35	324	473	42	
5	76891	16	24	85	13	1	12	7	13	7	3	3	36	338	487	39	

ORIGINAL

(Note 1) A : Hot formed with final temperature between 620 °C-980 °C, Air Cooling N : Normalizing 910 °C x40 Minutes, Air Cooling

C.E. = C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15

* 1 : *T* symbolized wall thickness in mm. * 2 : YS Yield strength TS = Tensile strength E = Elongation

We hereby certify that the product described herein has been manufactured in accordance with the specifications concerned and also with the purchaser's requirements and that the test results shown herein are correct.

Note for WPB: For each reduction of 0.01 % below the specified carbon maximum, an increase of 0.05 % manganese above the specified maximum will be permitted, up to a maximum of 1.65 % Form TZ-6H

GOOD

Rungnara Kampanon
 Quality Assurance Manager
 Thai Benkan Co., Ltd.

PO# 110-001379-00 Item# 11
 Heat Number: 17D2752
 Trans Am Piping Products Ltd. Rev'd By: SB
 Shipments/Seq #: 17 1841 19

6" XH BW TEE A234-WPB



INSPECTION CERTIFICATE

RIGID INDUSTRIES CO., LTD.

PURCHASER : SEYBOLD INT'L CORP.
 STANDARD : ASTM A234 WPB-17
 ASME SA234 WPB-13
 CSA Z245.11-13 Gr.241 CAT I Sour Service
 MATERIALS : ASTM A106 Gr.B
 INSP. SPEC. : ASME B16.9 -12

8. MEI-CHUNG RD. NIAO-SONG,
 KAOHSIUNG 83301, TAIWAN
 TEL: 886-77310527~8
 FAX: 886-77315887

DATE: 2017-10-25
 ORDER NO: 7013108/CI-17-340
 P.I. NO: 17D03-4
 CERTIFI. NO: 170905-5

ACCORDING TO EN10204/DIN50049/3.1

ITEM NO.	PRODUCT & SIZE	QUANTITY PCS	MFG NO.	VISUAL & DIMENSIONAL INSPECTION	HARDNESS MAX 197 HB	HEAT TREATMENT (NOTE)	MAGNETIC PARTICLE EXAMINATION
5	ELL 45 LR 8" XH		17E3449	GOOD	139-145	A	
6	ELL 90 LR 3" S160		17B4567	GOOD	138-150	N	
7	CON-RED 2.1/2X2" STD		17D1008	GOOD	124-137	N	
8	CON-RED 3X2" XH		17D1771	GOOD	124-136	N	
9	CON-RED 6X4" STD		17E545V	GOOD	125-134	N	
10	TEE 3" XH		17G6271	GOOD	139-147	N	GOOD
11	TEE 6" XH		17D2752	GOOD	134-153	N	GOOD
12	TEE 12" STD		17G128H	GOOD	140-149	N	GOOD
13	RED-TEE 6X4" STD		17F430V	GOOD	127-137	N	GOOD
14	RED-TEE 8X4" XH		17B232V	GOOD	154-169	N	GOOD

ITEM NO.	MATERIAL CHARGE NO.	CHEMICAL COMPOSITION %											* PHYSICAL TEST					
		C x100	Si x100	Mn x100	P x1000	S x1000	Cu x100	Ni x100	Cr x100	Mo x100	V x100	Nb x1000	Y S KSI	T S KSI	***E %	**	C.E. X100	
		MIN.	10	29									35.0	60.0	30.0			
	STANDARD	MAX.	30	35	135	50	58	40	40	40	15	8	20		95.0			50
5	16314849	14	16	76	6	3	3	2	4	1	<1	<1	42.7	64.0	38.4	L	28	
6	16311967	13	24	126	8	1	6	3	5	1	<1	1	48.4	69.7	34.3	L	36	
7	16315108	13	15	75	10	7	3	1	7	1	<1	<1	48.2	68.3	32.9	L	27	
8	17315571	12	22	125	8	1	3	2	4	1	<1	1	47.8	69.3	34.9	L	34	
9	WHD72-0215V	11	24	127	11	4	4	3	5	1	<1	5	49.8	69.6	38.7	L	34	
10	17315571	12	22	125	8	1	3	2	4	1	<1	1	49.1	69.7	35.0	L	34	
11	WB629752	12	24	127	13	4	1	1	1	<1	<1	1	48.8	65.4	40.0	L	34	
12	27788H	14	17	90	14	3	1	5	14	<1	1	<1	42.7	65.4	33.6	L	32	
13	WHD72-1020V	11	22	127	13	2	3	3	4	1	<1	3	50.5	69.7	36.4	L	34	
14	1632752V	9	25	125	11	2	9	3	6	1	<1	1	45.0	65.9	33.0	L	32	

(NOTE):A:HOT FORMED WITH FINAL TEMPERATURE BETWEEN 620°C-980°C, AIR COOLING.
 N:NORMALIZING AT TEMPERATURE 880°C X0.5HR, AIR COOLING.
 NACE MR-01-75-09/ISO15156.2_NACE MR 0103-16:SATISFACTORY
 WE HEREBY CERTIFY THAT THE PRODUCT DESCRIBED HEREIN HAS BEEN MANUFACTURED IN ACCORDANCE WITH THE SPECIFICATIONS CONCERNED AND ALSO WITH THE PURCHASER'S REQUIREMENTS AND THAT THE TEST RESULTS SHOWN HEREIN ARE CORRECT.
 * TYPE OF SPECIMEN:STRIP(WIDTH:1 in./GAUGE LENGTH:2 in.) ** SAMPLING DIRECTION:L=LONGITUDINAL T=TRANSVERSE
 *** ACTUAL THICKNESS OF SPECIMEN(t) LESS THAN 5/16" E=48t+15 (L) E=32t+10 (T)

Ou L Lan

MANAGER OF Q.A. DEPT.

PO# 10-001379-00 Item# 1
 Heat Number: 14A10853
 Trans Am Piping Products Ltd. 3 Rev'd BY: SJ
 P.O. / S# 10301

6" XH BW TEE A234-WPB



Thai Benkan Co., Ltd.
 58 Soi Watkrumai, Bangkok, Prapadaeng,
 Samutprakarn, 10130 Thailand.

Purchaser : WFF FITTINGS AND FLANGES(CANADA) LTD.

INSPECTION CERTIFICATE

TO EN10204 3.1/ISO 10474 3.1B

D M Y Certificate No.

E-No. Purchase Order No. Job No.
 A-123 E000480

31/03/2014 T- 2014140291

No.	MFG. No.	Specification for Material Made from Seamless Pipe		Specification for Inspection		Visual Examination	Dimensional Inspection
		ASTA A234-13/ASME SA234-13 Gr.WPB CSA Z45.11-09 Gr.2W1 CATT 537/Annex A		ASME B16.9-2012, B16.25-2012		Good	Good
		Product & Size (t*f)	Quantity	Heat Treatment (Note 1)	Hardness Actual Data	Item No.	
1	14A10819	T WPB 3 S40	4	N	HB : 118 - 145	41030042	
2	14A10847	T WPB 6 S80	13/24	N	HB : 118 - 145	41060043	
3	14A10832	T WPB 3 S80	15/84	N	HB : 118 - 145	41030043	
4	✓ 14A10853	T WPB 6 S80	58/72	N	HB : 118 - 145	41060043	
5							

Specification	Chemical Composition %												Tension Test #2			HARDNESS MAX
	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Nb	C.E.	YS	TS	E	
Min.	X 100	X 100	X 100	X 1000	X 1000	X 100	X 100	X 100	X 100	X 1000	X 1000	X 100	MPa.		%	
Max.		10	20										240	415	30	
Base Material Heat No.	30		100	50	58	40	40	30	10	60	20	42		656		
1	30767	15	23	82	9	1	10	5	7	4	2	1	32	334	470	35
2	52158	18	23	82	10	1	8	3	6	2	3	1	33	340	474	41
3	J3LB177	19	22	87	14	8	3	3	5	1	0	0	35	335	512	38
4	112804	17	21	75	9	4	17	6	5	1	1	2	32	311	486	36
5																

(Note 1) A : Hot formed with final temperature between 620 °C-980°C, Air Cooling N : Normalizing 910°Cx0.5 HR, Air Cooling
 NACE MR0175/ISO 15156-2 Sour Service Region 3 Annex A & MR0103 Sour Service

The fittings was manufactured, sampled, tested, and inspected in accordance with the specification, and was found to meet the requirements.
 C.E. = $\frac{C+Mn}{6} + \frac{(Cr+Mo+V)}{5} + \frac{(Ni+Cu)}{15}$

* 1 : "T" symbolized wall thickness in mm. * 2 : YS Yield strength TS = Tensile strength E = Elongation GOOD

We hereby certify that the product described herein has been manufactured in accordance with the specifications concerned and also with the purchaser's requirements and that the test results shown herein are correct.

Note for WPB: For each reduction of 0.01% below the specified carbon maximum, an increase of 0.06% manganese above the specified maximum will be permitted, up to a maximum of 1.35%

Rungnara Kumpalarn

Quality Assurance Manager
 Thai Benkan Co., Ltd.

35527/35528

Purchaser : TRANS-AM PIPING PRODUCTS LTD.

INSPECTION CERTIFICATE

BENKAN

Thai Benkan Co., Ltd.
58 Soi Waikrunai, Bangkru, Prapadaeng,
Samutprakam, 10130 Thailand.

TO EN10204 3.1/ISO 10474 3.1B

D M Y Certificate No.
08/10/2017 T- 2017180177

E-No. Purchase Order No. Job No.
ME-339 PI-17-339 C/O : 2

No.	MFG. No.	Specification for Material Made from Seamless Pipe ASTM A234-17/ASME SA234-17 Gr. WPB CSA Z45.11 Gr.241 CAT1 NACE MR0175/ISO 15165-2:2015 & MR0103-2015											Specification for Inspection ASME B16.9-2012, B16-25-2012			Visual Examination	Dimensional Inspection		
		Product & Size (T.*1)		Quantity	Heat Treatment (Note 1)		Hardness Actual Data	Good	Good										
1	17E10835	T WPB 1 S160											N		HBW : 118 - 145				
2	17F10809	T WPB 2 X 1 S160											N		HBW : 118 - 145	←			
3	17G10833	T WPB 8 X 4 S160											N		HBW : 118 - 145				
4	60D10056-1	T WPB 3 X 2 XS/S160											N		HBW : 118 - 145				
5	60D10057-1	T WPB 4 X 2 XS/S160											N		HBW : 120 - 140				
Specification		Chemical Composition %											Tension Test #2			HARDNESS MAX			
		C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Nb	C.E.	YS	TS		E		
Min.		X100	X100	X100	X1000	X1000	X100	X100	X100	X100	X1000	X1000	X100	MPa.		%			
Max.			10	29										240	415	30	197 HBW GOOD		
Base Material Heat No.		30		108	50	58	40	40	40	15	80	20							
1	118711	12	21	107	8	2	14	6	6	2	5	3	33	314	466	36	ORIGINAL		
2	41468	17	24	83	10	1	7	4	8	4	3	3	34	337	483	34			
3	J7K3429	20	22	82	12	3	2	2	11	10	0	0	38	319	488	49			
4	69707	18	24	88	14	1	5	2	4	1	2	1	32	330	466	38			
5	J7K3429	20	22	82	12	3	2	2	11	10	0	0	38	343	519	39			

(Note 1) A : Hot formed with final temperature between 620 °C-980 °C, Air Cooling N : Normalizing 910 °C x 40 Minutes, Air Cooling

C.E. = C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15

MAGNETIC PARTICLE EXAMINATION FOR TEE ONLY : GOOD

* 1 : "T" symbolized wall thickness in mm. * 2 : YS Yield strength TS = Tensile strength E = Elongation

We hereby certify that the product described herein has been manufactured in accordance with the specifications concerned and also with the purchaser's requirements and that the test results shown herein are correct.

Note for WPB: For each reduction of 0.01 % below the specified carbon maximum, an increase of 0.06 % manganese above the specified maximum will be permitted, up to a maximum of 1.65 %

Form TZ-6H


Rungnapa Kampranon

Quality Assurance Manager
Thai Benkan Co., Ltd.

PO# 659730333-AB45 Item# 1
 Heat Number: 17F10809
 Trans Am Piping Products Ltd. - Rev'd By: SB
 Shipments / Seq #: 1782 95
 2X1 SCH 160 BW RED TEE
 A234-WPB

Purchaser : TRANS-AM PIPING PRODUCTS LTD.

INSPECTION CERTIFICATE



Thai Benkan Co., Ltd.
58 Soi Watkrnai, Bangkru, Prapadaeng,
Samutprakam, 10130 Thailand.

TO EN10204 3.1

Purchase Order No.
CI-17-195 C/O: 1

Job No.
(MILL TEST REPORTS)

D M Y Certificate No.
28/07/2017 T - 2017060522

E-No.	Specification for Material Made from Seamless Pipe	Specification for Inspection	Visual Examination	Dimensional Inspection															
ME-295	ASTM A420-16/ ASME SA420-16 WPL6 CSA Z46.15-13 & 241 CAT II SS ANSINACE MR01758015166-2.16MR0103.15	ASME B16.9-2012, B16.25-2012	Good	Good															
MFG. No.	Product & Size (T:*1)		Quantity	Hardness Actual Data															
17F11821	T WPL6 4 X 2 S160			HBW : 149-165															
	Material Heat No.																		
	J7L4324			ORIGINAL															
Specifi- cation	Chemical Composition %													*2 Tension Test			HARDNESS MAX 197 HB : GOOD		
	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	Al	V	Nb	C.E.	YS	TS	E	Impact Test (J)		
	X	X	X	X	X	X	X	X	X	X	X	X	X	MPa.			%	10 X 7.5 X 2V AT -45 °C	
Min.		15	50											240	415	30	251	AVE. 257	
Max.	30	40	135	35	40	40	40	30	12		80	20			585		264		
	11	25	126	16	1	2	3	12	1		0	0	35	313	458	49	256		

NORMALIZING @ 910 C X 40 MINUTES. COOLED IN STILL AIR

C.E. = $C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15$

MAGNETIC PARTICLE EXAMINATION FOR TEE ONLY :

GOOD

We hereby certify that the product described herein has been manufactured in accordance with the specifications concerned and also with the purchaser's requirements and that the test results shown herein are correct.

* 1 : *T* symbolized wall thickness in mm. * 2 : YS Yield strength TS = Tensile strength E = Elongation
Form TZ-6J/1

Rungrana Kamphanon
Quality Assurance Manager

Thai Benkan Co., Ltd.

PO# 110-001379-00 Item# 1
 Heat Number: 17F11821
 Trans Am Piping Products Ltd. Rev'd By: SB
 Shipment / Seq #: 17 - 1618 39
 4X2 SCH 160 BW RED TEE
 A / SA420 - WPL6

PO# 110-001379-00 Item# 3
 Heat Number: 17G11822
 Trans Am Piping Products Ltd. Rev'd By: SB
 Shipment/Seq #: S 17 1782
 4X2 SCH 160 BW RED TEE
 A/SA420-WPL6

Purchaser : TRANS-AM PIPING PRODUCTS LTD.

INSPECTION CERTIFICATE



Thai Benkan Co., Ltd.
 58 Soi Watkrumai, Bangkok, Prapadaeng,
 Samutprakarn, 10130 Thailand.

TO EN10204 3.1

D M Y Certificate No.

Purchase Order No. CI-17-321 C/O: 3
 Job No. (MILL TEST REPORTS)

09/10/2017 T - 2017080772

E-No.	Specification for Material Made from Seamless Pipe		Specification for Inspection		Visual Examination	Dimensional Inspection													
ME-331	ASTM A420-16/ASME SA420-17 WPL6 <small>CSA Z245.11-13 Gr 241 CAT II SS ANS/NACE MR0175/ISO15156-2/15MR0103/5</small>		ASME B16.9-2012,B16.25-2012		Good	Good													
MFG. No.	Product & Size (T:*1)				Quantity	Hardness Actual Data													
17G11822	T WPL6 4 X 2 S160					HBW : 120 - 135													
	Material Heat No.																		
	J7L4324					ORIGINAL													
Specifi- cation	Chemical Composition %													*2 Tension Test			HARDNESS MAX 197 HB : GOOD		
	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	Al	V	Nb	C.E.	YS	TS	E	Impact Test (J)		
X	X	X	X	X	X	X	X	X	X	X	X	X	X	MPa.			%	10 X 7.5 X 2V AT -45 °C	
Min.		15	50											240	415	30	251	AVE. 257	
Max.	30	40	135	35	40	40	40	30	12		80	20			585		264		
	11	25	126	16	1	2	3	12	1		0	0	35	313	458	49	256		

NORMALIZING 810 C X 40 MINUTES. COOLED IN STILL AIR

C.E. = C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15 MAGNETIC PARTICLE EXAMINATION FOR TEE ONLY:

We hereby certify that the product described herein has been manufactured in accordance with the specifications concerned and also with the purchaser's requirements and that the test results shown herein are correct.

GOOD

Rungnara Kampranon
 Quality Assurance Manager
 Thai Benkan Co., Ltd.

* 1 : "T" symbolized wall thickness in mm. * 2 : YS Yield strength TS = Tensile strength E = Elongation
 Form TZ-6J/1

4XS STD BW RED TEE A234-WPB

PC# 110-150318567 Item# 377
 Head Number: 17A4138
 Trans AM Piping S 17
 Shipments/Seq #: 1408 37
 Rev'd By: SB



INSPECTION CERTIFICATE

RIGID INDUSTRIES CO., LTD.

PURCHASER : SEYBOLD INTL CORP.
 STANDARD : ASTM A234 WPB-16
 ASME SA234 WPB-04
 CSA Z245.11-13 Gr.241 CAT I Sour Service
 MATERIALS : ASTM A106 Gr.B
 INSP. SPEC. : ASME B16.9 -12

8, MEI-CHUNG RD, NIAO-SONG,
 KAOHSIUNG 83301, TAIWAN
 TEL: 886-77310527-8
 FAX: 886-77315987

DATE: 2017-05-08

ORDER NO: 7013108/CI-17-340

P.I. NO: 17D03-1

CERTIFL NO: 170503-1

ACCORDING TO EN10204/DIN50049/3.1

ITEM NO.	PRODUCT & SIZE	QUANTITY PCS	MFG NO.	VISUAL & DIMENSIONAL INSPECTION	HARDNESS MAX 197 HB	HEAT TREATMENT (NOTE)	MAGNETIC PARTICLE EXAMINATION
26	ECC-RED 12X8" XH		8H3718	GOOD	142-144	N	
27	TEE 2.1/2" XH		1A1612	GOOD	120-125	N	GOOD
28	TEE 3" STD		17A349V	GOOD	131-175	N	GOOD
29	TEE 3" XH		17A3589	GOOD	113-117	N	GOOD
30	TEE 4" S160		16H3768	GOOD	119-172	N	GOOD
31	TEE 4" S160		5L3350	GOOD	135-148	N	GOOD
32	TEE 8" STD		17B1982	GOOD	129-139	N	GOOD
33	TEE 10" STD		17C392V	GOOD	145-150	N	GOOD
34	RED-TEE 3X1.1/2" XH		16A2565	GOOD	122-161	N	GOOD
35	RED-TEE 4X3" STD		17A4138	GOOD	142-144	N	GOOD

ITEM NO.	MATERIAL CHARGE NO.	CHEMICAL COMPOSITION %											PHYSICAL TEST					
		C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Nb	Y.S.	T.S.	E	**	C.E.	
		x100	x100	x100	x1000	x1000	x100	x100	x100	x100	x100	x1000	KSI	KSI	%		X100	
	STANDARD	MIN.	10	29									35.0	60.0	30.0			
		MAX.	30	35	135	50	58	40	40	40	15	8	20		95.0		.50	
26	J6K6718		9	24	127	10	3	3	2	12	<1	<1	<1	43.1	64.3	53.5	L	33
27	M18012		13	22	92	10	4	1	1	2	<1	<1	1	59.9	71.1	36.0	L	29
28	1524239V		14	23	85	9	6	5	2	6	2	<1	1	47.8	68.3	33.9	L	30
29	16314889		13	16	75	5	3	3	2	8	2	<1	<1	44.1	65.3	34.2	L	28
30	16311968		13	25	126	8	2	5	3	6	1	<1	1	45.8	68.1	33.7	L	36
31	J9LB750		11	26	128	10	3	2	2	11	1	<1	<1	51.6	65.9	43.0	L	35
32	WB625282		11	21	126	11	5	1	1	1	<1	<1	3	49.4	66.6	33.9	L	32
33	1534532V		10	30	128	13	1	5	1	3	1	<1	1	45.7	66.9	34.0	L	33
34	15309465		13	25	128	6	<1	4	2	4	2	<1	1	46.5	67.0	33.1	L	36
35	605338		17	23	99	8	2	7	3	3	1	<1	<1	46.8	68.1	34.0	L	35

(NOTE): A: HOT FORMED WITH FINAL TEMPERATURE BETWEEN 620°C - 980°C AIR COOLING.

N: NORMALIZING AT TEMPERATURE 880°C X0.5HR, AIR COOLING.

NACE MR-01-75-09/ISO15156.2, NACE MR 0103-16: SATISFACTORY

WE HEREBY CERTIFY THAT THE PRODUCT DESCRIBED HEREIN HAS BEEN MANUFACTURED IN ACCORDANCE WITH THE SPECIFICATIONS CONCERNED AND ALSO WITH THE PURCHASER'S REQUIREMENTS AND THAT THE TEST RESULTS SHOWN HEREIN ARE CORRECT.

* TYPE OF SPECIMEN: STRIP (WIDTH: 1 in./GAUGE LENGTH: 2 in.) ** SAMPLING DIRECTION: L=LONGITUDINAL T=TRANSVERSE

*** ACTUAL THICKNESS OF SPECIMEN(t) LESS THAN 5/16" E=40t±15 (L) E=32t±10 (T)

Ou E Lan

MANAGER OF Q.A. DEPT.

Purchaser : CCTF CORPORATION

INSPECTION CERTIFICATE

TO EN10204 3.1/ISO 10474 3.1B

E-No. ME-299 Purchase Order No. 4899508-00 Job No.

D M Y Certificate No. 04/04/2017 T- 2017200062

No.	MFG. No.	Specification for Material Made from Seamless Pipe		Specification for Inspection		Visual Examination	Dimensional Inspection
		ASTM A234-16/ASME SA234-16 Gr.WPB CSA Z45 11-13 Gr.241 CAT 1 SS NACE MR0175/ISO 15156-2 R3-15 & MR0103-15		ASME B16.9-2012, B16-25-2012		Good	Good
		Product & Size (T:*)	Quantity	Heat Treatment (Note 1)	Hardness Actual Data	Item No.	
1	17B00206	180 EL WPB 1 1/2 S40	35	A	HB : 125 - 140	7512309	
2	17A20015	RC WPB 8 X 4 S40	30	N	HB : 135 - 150	7513882	
3	17B20046	RC WPB 8 X 3 S40	5	N	HB : 125 - 135	7513836	
4	60B20002	RC WPB 3 X 2 STD/XS	40	N	HB : 125 - 145	7510428	
5							

Specification	Chemical Composition %												Tension Test #2			HARDNESS MAX
	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Nb	C.E.	YS	TS	E	
Min.	X/100	X/100	X/100	X/1000	X/1000	X/100	X/100	X/100	X/100	X/1000	X/1000	X/100	MPa.		%	
Max.		10	29										240	415	30	
Base Material Heat No.	30		106	50	58	40	40	40	15	80	20			655		
1	2-14011	19	26	84	17	7	<1	1	2	<1	2	<1	34	374	505	47
2	J6L3033	18	16	82	16	4	1	3	4	1	0	0	33	315	478	42
3	J6L3033	18	16	82	16	4	1	3	4	1	0	0	33	315	478	42
4	41469	18	24	84	9	1	1	4	7	3	3	3	32	322	467	34
5																

(Note 1) A : Hot formed with final temperature between 620 °C-980 °C, Air Cooling N : Normalizing 910 °C x 40 Minutes, Air Cooling

C.E. = $C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15$

* 1 : "T" symbolized wall thickness in mm. * 2 : YS Yield strength TS = Tensile strength E = Elongation

We hereby certify that the product described herein has been manufactured in accordance with the specifications concerned and also with the purchaser's requirements and that the test results shown herein are correct.

Note for WPB: For each reduction of 0.01 % below the specified carbon maximum, an increase of 0.06 % manganese above the specified maximum will be permitted, up to a maximum of 1.65 %
Form TZ-6H

Quality Assurance Manager
Thai Benkan Co., Ltd.

Order#: 618006 PO#: 110-001379-00 Seq: 32
 Comco Part#: WF 4X2 STD/XS CO PBC Part Description: Weld Fittings 4 (114.3mm O.D.)X2 (60.3mm O.D.) STD/XS CONCENTRIC REDUCER A234-WPB COMM.
 Heat#: TL10015571 Mill: Tri-Lad



ISO 9001:2008

TRILAD Flanges and Fittings, Inc.

172 Turbo Drive
 Sherwood Park, AB, CANADA T8H 2J6
 (PHONE) 780-464-7774
 (FAX) 780-464-0044
 www.tri-lad.com

CERTIFIED MATERIAL TEST REPORT

Certificate No. 17264409	EN 10204 3.1	Date of Report 7/24/2017
--------------------------	--------------	--------------------------

Customer AB	Customer Order No. 199	Quantity 25
	Tri-Lad Order No. 983545	Line No. 72

Specification A234-16/SA234-15 WPB CSA Z245.11 241 CAT I	Heat Treatment STRESS RELIEVED
Item Description 4 STD X 2 XS CONC (885870)	Temperature
Shop Order/Trace No.	Time
Lot No.	Lot Definition
Heat Code TL10015571	
C.E. .25	Melt Practice

	Chemical Composition										
	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	V	
Heat Product	10	80	.012	.003	17	.02	.02	.05	.01	.00	
Heat Product											
Heat Product											

Mechanical Properties							
Yield	Tensile	Elongation	Reduction of Area	Hardness	Impact Test Temperature	Impact Values	Shear Fracture
Ks i 43 Mpa 296	Ks i 65 Mpa 447	32 %		HBW 127 HBW 128			
Tensile Specimen	STD RD						
Lateral Expansion	Impact Type	Impact Orientation	Starting Material	Impact Specimen			
			PI PE				

Notes

NACE MR0103 LATEST ED.
 NACE MR0175/1 S015156-09

Material is in accordance with the applicable Standard to which it is ordered including:
 ASME Sect II, ASME B16.5, B16.9, B16.36, B16.47, CSA, MSS, AWWA C-207.
 NO WELD REPAIR MERCURY FREE
 Material conforms to both ASTM (A) and ASME (SA) applicable specifications.
 We hereby certify that all information presented on this CMTR conforms to the above specification.
 We hereby certify the results to be a true copy of the records of the company.

Troy Gorrell
 Troy Gorrell
 Q.C. Inspector

Purchaser: ALBERTA PIPE FITTINGS LTD
 Order No.: APF/2010/12 R01
 Invoice No.: ZICN-Z11-001

MILL TEST CERTIFICATE

Date: Apr 10th, 2011
 Certificate No: 1104253

YINGKOU ZICN PIPE MANUFACTURING CO.,LTD
 NO.72 1ST STREET OF MINXING RIVER,XISHI DISTRICT,YINGKOU, LIAONING,P.R.CHINA 115004

CERTIFICATE COMPLYING TO EN10204-2004 3.1

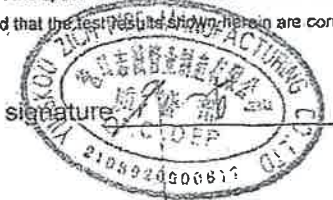
Material Specification	Specification for Inspection	Visual and Dimensional Inspection	Hardness Max HB	Cu+Ni+Cr+Mo	Cr+Mo	RT(5)	UT(5)	MT(5)	PT(5)
ASTM/ASME SA/A 234 WPB NACE MR-0175-05	ANSI B 16.9-2007	GOOD	<197HB	≤1.00%	≤0.32%			OK	

ITEM	DESCRIPTION	QTY (PCS)	HEAT NO.	CHEMICAL COMPOSITION % MAX											MECHANICAL PROPERTY(1)Min			Raw Material			
				C	Mn	P	S	Si	Cr	Mo	V	Ni	Cu	CE(2)	Y.S.	T.S.	EL	Heat treatment (3)	Type (4)	Manufacturer (5)	
				x10 ⁻²	x10 ⁻²	x10 ⁻²	x10 ⁻³	x10 ⁻²	x10 ⁻²	x10 ⁻²	x10 ⁻²	x10 ⁻²	x10 ⁻²	x10 ⁻²	Mpa	Mpa	%				
					29		10								240	415	30				
				30	106	50	58		40	15	8	40	40	50		585					
20	BW CONC REDUCER	3" X 2" STD	500	833	19	53	10	3	21	7	2	0.1	3	11	30.8	320	460	34.5	S	1	JSCD
21	BW CONC REDUCER	3" X 2" XS	500	553	19	62	15	6	18	5	1	1	4	10	32	395	525	41	S	1	HTHL
22	BW CONC REDUCER	4" X 2" STD	200	134	18.7	53	11	3	24	6	2	0.2	3	12	30.2	325	470	33.5	S	1	JSCD
23	BW CONC REDUCER	4" X 2" XS	200	105	19	52	12	3	24	6	2	0.2	3	12	30.3	325	470	33.5	S	1	JSCD
24	BW CONC REDUCER	4" X 3" STD	200	134	18.7	53	11	3	24	6	2	0.2	3	12	30.2	325	470	33.5	S	1	JSCD
25	BW CONC REDUCER	4" X 3" XS	200	105	19	52	12	3	24	6	2	0.2	3	12	30.3	325	470	33.5	S	1	JSCD
26	BW CONC REDUCER	6" X 4" STD	100	964	19	49	10	12	20	3	3	3	3	9	29.8	335	465	33	S	1	JSCD
27	BW CONC REDUCER	6" X 4" XS	100	196	17	45	11	11	20	2	3	3	3	9	26.9	330	480	35.4	S	1	JSCD

Note: (1) YS=Yield Strength TS=Tensile Strength EL=Elongation (2)CE=C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15
 (3) HF: Hot formed (620-980°C) and cooled in still air. S: cold formed and normalized(900°C x0.5HR, cooled in still air. SA: Cold forming and solution annealed at 1050°C ± 10°C, water quenched.
 (4) 1=seamless pipe 2=welded pipe 3=steel plate
 (5) RT=Radiographical Test UT= Ultrasonic Test MT=Magnetic Particle Test PT=Penetration Test
 (6) Manufacturer
 ISO 9001 Certified company (Cert.No. 00109Q26422R0S/2200)

We hereby certify that the products detailed herein have been manufactured and inspected in accordance with the specifications concerned and also with the purchaser's requirements and that the test results shown herein are correct.

Stamp and signature



PO# 110-001379-00 Item# 4
 Heat Number: 17D25552
 Trans Am Piping Products Ltd. Rev'd By: SB
 Shipment/Seq #: S 17 1636 12
 6X4 XH BW CONC REDUCER
 A234-WPB



INSPECTION CERTIFICATE

RIGID INDUSTRIES CO., LTD.

PURCHASER : SEYBOLD INT'L CORP.
 STANDARD : ASTM A234 WPB-17
 ASME SA234 WPB-04
 CSA Z245.11-13 Gr.241 CAT I Sour Service
 MATERIALS : ASTM A106 Gr.B
 INSP. SPEC. : ASME B16.9 -12

8. MEI-CHUNG RD. NIAO-SONG,
 KAOHSIUNG 83301, TAIWAN
 TEL: 886-77310527~8
 FAX: 886-77315887

DATE: 2017-08-09

ORDER NO: 7013108/CI-17-340

P.I. NO: 17D03-3

CERTIFI. NO: 170701-4

ACCORDING TO EN10204/DIN50049/3.1

ITEM NO.	PRODUCT & SIZE	QUANTITY PCS	MFG NO.	VISUAL & DIMENSIONAL INSPECTION	HARDNESS MAX. 197 HB	HEAT TREATMENT (NOTE)	MAGNETIC PARTICLE EXAMINATION
1	ELL 90 LR 4" XH		17E3371	GOOD	137-145	A	
2	CON-RED 6X4" XH		17D2552	GOOD	127-137	N	
3	TEE 2" XH		17B4934	GOOD	134-146	N	GOOD
4	TEE 4" STD		17E252V	GOOD	141-147	N	GOOD
5	RED-TEE 2X1" XH		17B2837	GOOD	129-185	N	GOOD
6	RED-TEE 4X2.1/2" STD		17D522V	GOOD	129-140	N	GOOD
7	RED-TEE 6X4" XH		17D4701	GOOD	128-143	N	GOOD

ITEM NO.	MATERIAL CHARGE NO.	CHEMICAL COMPOSITION %											* PHYSICAL TEST					
		C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Nb	Y S	T S	*** E	**	C.E.	
		x100	x100	x100	x1000	x1000	x100	x100	x100	x100	x100	x100	x1000	KSI	KSI	%		X100
	STANDARD	MIN.	10	29										35.0	60.0	30.0		50
		MAX.	30	35	135	50	58	40	40	40	15	8	20		95.0			
1	17315571		12	22	125	8	1	3	2	4	1	<1	1	48.4	69.6	33.9	L	34
2	WB629752		12	24	127	13	4	1	1	1	<1	<1	1	48.4	65.4	42.0	L	34
3	16314734		13	12	71	3	6	2	2	4	1	<1	<1	44.1	64.0	34.2	L	26
4	WHD72-1022V		10	23	128	10	3	3	2	4	1	<1	2	48.8	69.7	35.9	L	33
5	328937		13	16	79	8	3	5	2	3	1	<1	<1	45.5	67.7	32.9	L	27
6	WHD72-1022V		10	23	128	10	3	3	2	4	1	<1	2	49.2	67.7	37.5	L	33
7	15307501		14	23	122	6	<1	6	3	4	2	<1	<1	47.2	68.3	36.2	L	36

(NOTE): A: HOT FORMED WITH FINAL TEMPERATURE BETWEEN 620°C-980°C, AIR COOLING.

N: NORMALIZING AT TEMPERATURE 880°C X0.5HR, AIR COOLING.

NACE MR-01-75-09/ISO15156.2, NACE MR 0103-16: SATISFACTORY

WE HEREBY CERTIFY THAT THE PRODUCT DESCRIBED HEREIN HAS BEEN MANUFACTURED IN ACCORDANCE WITH THE SPECIFICATIONS CONCERNED AND ALSO WITH THE PURCHASER'S REQUIREMENTS AND THAT THE TEST RESULTS SHOWN HEREIN ARE CORRECT.

* TYPE OF SPECIMEN: STRIP (WIDTH: 1 in./GAUGE LENGTH: 2 in.) ** SAMPLING DIRECTION: L=LONGITUDINAL T=TRANSVERSE

*** ACTUAL THICKNESS OF SPECIMEN(t) LESS THAN 5/16" E=48t+15 (L) E=32t+10 (T)

Ou L Lan

MANAGER OF Q.A. DEPT.

CERTIFIED MILL TEST REPORT



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LOG NO. F0000000098451 Page 3 of 8

BONNEY FORGE CORPORATION
P.O. BOX 330 • 14496 CROGHAN PIKE • MOUNT UNION, PA 17086-0330
(814) 542-2545 • (800) 345-7546 • FAX (814) 542-4806
www.bonneyforge.com

CUSTOMER: CCTF CORPORATION

DATE 08/11/2017

CUSTOMER
ORDER NO.: 4900159-00

BONNEY ORDER NO. B000226333

SHIP TO: CCTF CORPORATION (EDMONTON)
5407 - 53RD AVE.
EDMONTON AB T6B 3G2
Canada

ITEM	QUANTITY	LOT NO.	GRADE OR SPECIFICATION NO	CHEMICAL ANALYSIS, PHYSICAL PROPERTIES, REMARKS
7550015	8	25	58501	2 1/2-11/4 X 1/4 3M A105N THRD T SA/A105N AL 0.024 C 0.190 Co 0.002 Cr 0.090 Cu 0.080 Mn 1.090 Mo 0.010 N 0.003 Nb 0.012 Ni 0.030 P 0.009 S 0.021 Si 0.190 V 0.004 CE(Long Formula) = 0.40 T/S(Psi) 72,500 Y/S(Psi) 49,375 EL(%) 32.75 RA(%) 66.30 Brinell 132 BHN 132 BHN
7550016	9	25	59997	2 1/2-11/4 X 3/8 3M A105N THRD T SA/A105N Al 0.029 C 0.200 Co 0.001 Cr 0.040 Cu 0.030 Mn 1.050 Mo 0.005 Nb 0.011 Ni 0.020 P 0.005 S 0.017 Si 0.280 V 0.001 CE(Long Formula) = 0.39 T/S(Psi) 73,500 Y/S(Psi) 49,000 EL(%) 34.00 RA(%) 69.00 Brinell 143 BHN 143 BHN
7550001	10	500	50089	8-3 X 1/2 3000 A105N THRD T SA/A105N Al 0.022 C 0.200 Co 0.003 Cr 0.030 Cu 0.060 Mn 1.010 Mo 0.006 Nb 0.015 Ni 0.030 P 0.009 S 0.017 Si 0.230 V 0.003 CE(Long Formula) = 0.38 T/S(Psi) 77,500 Y/S(Psi) 54,000 EL(%) 31.00 RA(%) 66.00 Brinell 154 BHN 154 BHN
7551576	12	100	50076	12-6 X 3/4 3000 A105N THRD T SA/A105N Al 0.027 C 0.200 Co 0.004 Cr 0.050 Cu 0.100 Mn 0.970 Mo 0.016 Nb 0.013 Ni 0.060 P 0.011 S 0.019 Si 0.220 V 0.003 CE(Long Formula) = 0.39 T/S(Psi) 76,500 Y/S(Psi) 53,000 EL(%) 31.00 RA(%) 64.00 Brinell 159 BHN 146 BHN

We certify that the data on this sheet is a true copy taken from our records of material furnished us by the production mill, or as obtained by additional laboratory checks.

by Kylee Ruiz
Kylee Ruiz
QUALITY PROCESS MANAGER

CMTR: REV2

CERTIFIED MILL TEST REPORT



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LOG NO. F00000000098451 Page 8 of 8

BONNEY FORGE CORPORATION
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(814) 542-2545 • (800) 345-7546 • FAX (814) 542-4906
www.bonneyforge.com

CUSTOMER: CCTF CORPORATION

DATE 08/11/2017

CUSTOMER

BONNEY ORDER NO. B000226333

ORDER NO.: 4900159-00

SHIP TO: CCTF CORPORATION (EDMONTON)
5407 - 53RD AVE.
EDMONTON AB T6B 3G2
Canada

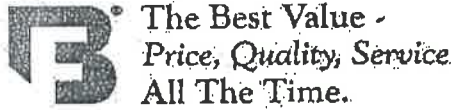
ITEM QUANTITY LOT NO. GRADE OR SPECIFICATION NO. CHEMICAL ANALYSIS, PHYSICAL PROPERTIES, REMARKS.

1. THE FITTINGS SUPPLIED ARE IN ACCORDANCE WITH PURCHASE ORDER SPECIFICATIONS.
2. THE MATERIAL SUPPLIED IDENTIFIED AS A105N WAS NORMALIZED IN ACCORDANCE WITH ASTM A105 HEAT TREATING REQUIREMENTS.
3. THE MATERIAL SUPPLIED AS A105N MEETS THE REQUIREMENTS OF BOTH NACE MRO103-2010 AND NACE MRO175/ISO 15156-2.
4. CERTIFYING ASTM A105-14 / ASME SA 105-15 EDITION.
5. THE PRODUCT SUPPLIED WAS INSPECTED IN ACCORDANCE WITH EN 10204:2004 EDITION TYPE 3.1 INSPECTION DOCUMENT. (EUROPEAN STANDARD)
6. THE UNIT OF MEASURE FOR TENSILE AND YIELD (0.2%) STRENGTH ARE REPORTED IN PSI.
7. ELONGATION TEST RESULTS ARE OBTAINED USING STANDARD ROUND SPECIMEN, 2 INCH OR 50 MM GAGE LENGTH.

We certify that the data on this sheet is a true copy taken from our records of material furnished us by the production mill, or as obtained by additional laboratory checks.

by Kylee Ruiz
Kylee Ruiz
QUALITY PROCESS MANAGER

CMTR: REV2



BONNEY FORGE CORPORATION
 P.O. BOX 330 • 14496 CROGHAN PIKE • MOUNT UNION, PA 17066-0330
 (814) 542-2545 • (800) 345-7546 • FAX (814) 542-4906
 www.bonneyforge.com

CUSTOMER: CCTF CORPORATION

DATE 10/30/2017

CUSTOMER ORDER NO.: 4900362-00

BONNEY ORDER NO. B000229803

SHIP TO: CCTF CORPORATION (EDMONTON)
 5407 - 53RD AVE.
 EDMONTON AB T6B 3G2
 Canada

ITEM	QUANTITY	LOT NO.	GRADE OR SPECIFICATION NO. CHEMICAL ANALYSIS, PHYSICAL PROPERTIES, REMARKS:
7550001	500	50089	8-3 X 1/2 3000 A105N THRD T SA/A105N Al 0.022 C 0.200 Co 0.003 Cr 0.030 Cu 0.060 Mn 1.010 Mo 0.006 Nb 0.015 Ni 0.030 P 0.009 S 0.017 Si 0.230 V 0.003 CE(Long Formula) = 0.38 T/S(Psi) 77,500 Y/S(Psi) 54,000 EL(%) 31.00 RA(%) 66.00 Brinell 154 BHN 154 BHN
7551533	25	59888	1 1/2-1 1/4 X 3/4 3M A105N THRD T SA/A105N Al 0.026 C 0.200 Co 0.005 Cr 0.060 Cu 0.110 Mn 1.010 Mo 0.007 Nb 0.011 Ni 0.040 P 0.008 S 0.020 Si 0.190 V 0.003 CE(Long Formula) = 0.39 T/S(Psi) 78,500 Y/S(Psi) 54,000 EL(%) 29.00 RA(%) 64.00 Brinell 156 BHN 159 BHN
7551568	500	50203	5-3 X 3/4 3000 A105N THRD T SA/A105N Al 0.024 C 0.200 Co 0.002 Cr 0.030 Cu 0.050 Mn 1.040 Mo 0.005 Nb 0.012 Ni 0.020 P 0.006 S 0.022 Si 0.230 V 0.003 CE(Long Formula) = 0.39 T/S(Psi) 71,500 Y/S(Psi) 48,100 EL(%) 35.00 RA(%) 69.00 Brinell 137 BHN 135 BHN
7551576	150	50076	12-6 X 3/4 3000 A105N THRD T SA/A105N Al 0.027 C 0.200 Co 0.004 Cr 0.050 Cu 0.100 Mn 0.970 Mo 0.016 Nb 0.013 Ni 0.060 P 0.011 S 0.019 Si 0.220 V 0.003 CE(Long Formula) = 0.39 T/S(Psi) 76,500 Y/S(Psi) 53,000 EL(%) 31.00 RA(%) 64.00 Brinell 159 BHN 146 BHN

We certify that the data on this sheet is a true copy taken from our records of material furnished us by the production mill, or as obtained by additional laboratory checks.

by Billie Jo Clemens
 Billie Jo Clemens
 QUALITY PROCESS MANAGER

CMTR: REV2

CERTIFIED MILL TEST REPORT



LOG NO: F0000000100928 Page 8 of 8
BONNEY FORGE CORPORATION
P.O. BOX 330 • 14498 CROGHAN PIKE • MOUNT UNION, PA 17066-0330
(814) 542-2545 • (800) 345-7548 • FAX (814) 542-4806
www.bonneyforge.com

CUSTOMER: CCTF CORPORATION

DATE 10/30/2017

CUSTOMER
ORDER NO.: 4900362-00

BONNEY ORDER NO. B000229803

SHIP TO: CCTF CORPORATION (EDMONTON)
3407 - 53RD AVE.
EDMONTON AB T6B 3G2
Canada

ITEM	QUANTITY	LOT NO.	GRADE OR SPECIFICATION NO. CHEMICAL ANALYSIS, PHYSICAL PROPERTIES, REMARKS
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1. THE MATERIAL SUPPLIED IDENTIFIED AS A105N WAS NORMALIZED IN ACCORDANCE WITH ASTM A105 HEAT TREATING REQUIREMENTS.
2. THE MATERIAL SUPPLIED AS A105N MEETS THE REQUIREMENTS OF BOTH NACE MRO103-2010 AND NACE MRO175/ISO 15156-2.
3. CERTIFYING ASTM A105-14 / ASME SA105-15 EDITION.
4. THE PRODUCT SUPPLIED WAS INSPECTED IN ACCORDANCE WITH EN 10204:2004 EDITION TYPE 3.1 INSPECTION DOCUMENT. (EUROPEAN STANDARD)
5. THE UNIT OF MEASURE FOR TENSILE AND YIELD (0.2%) STRENGTH ARE REPORTED IN PSI.
6. ELONGATION TEST RESULTS ARE OBTAINED USING STANDARD ROUND SPECIMEN, 2 INCH OR 50 MM GAGE LENGTH.
7. ITEM - 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 23, 24, 27, 28 - THE FITTINGS SUPPLIED ARE IN ACCORDANCE WITH PURCHASE ORDER SPECIFICATIONS.

We certify that the data on this sheet is a true copy taken from our records of material furnished us by the production mill, or as obtained by additional laboratory checks.

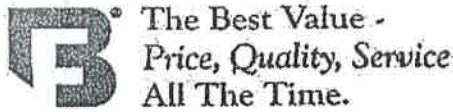
by Kylee Ruiz
Kylee Ruiz
QUALITY PROCESS MANAGER

CMTR: REV2

CERTIFIED MILL TEST REPORT

(2)

LOG NO. F0000000096575 Page 2 of 5



BONNEY FORGE CORPORATION
 P.O. BOX 330 • 14496 CROGHAN PIKE • MOUNT UNION, PA 17066-0330
 (814) 542-2545 • (800) 345-7546 • FAX (814) 542-4906
 www.bonneyforge.com

CUSTOMER: CCTF CORPORATION

DATE 06/19/2017

CUSTOMER

BONNEY ORDER NO. B000223637

ORDER NO.: 4900009-00

SHIP TO: CCTF CORPORATION (EDMONTON)
 5407 - 53RD AVE.
 EDMONTON AB T6B 3G2
 Canada

ITEM	QUANTITY	LOT NO.	GRADE OR SPECIFICATION NO.	CHEMICAL ANALYSIS, PHYSICAL PROPERTIES, REMARKS.
7550076	100	1135	36-3 X 1/4 3000 A105N THRD T	SA/A105N Al 0.023 C 0.210 Cb 0.000 Co 0.004 Cr 0.040 Cu 0.070 Mn 1.030 Mo 0.006 Nb 0.012 Ni 0.030 P 0.006 S 0.015 Si 0.230 V 0.003 CE(Long Formula) = 0.40 T/S(PSI) 82,475 Y/S(PSI) 60,756 EL(%) 35.85 RA(%) 57.30 Brinell 147 BHN 144 BHN
7551568	300	50175	5-3 X 3/4 3000 A105N THRD T	SA/A105N Al 0.022 C 0.200 Co 0.002 Cr 0.040 Cu 0.060 Mn 1.030 Mo 0.004 Nb 0.014 Ni 0.020 P 0.006 S 0.020 Si 0.250 V 0.003 CE(Long Formula) = 0.39 T/S(PSI) 71,065 Y/S(PSI) 49,370 EL(%) 37.75 RA(%) 67.02 Brinell 139 BHN 137 BHN
7551657	250	50098	31/2-3 X 1 3000 A105N THRD T	SA/A105N Al 0.030 C 0.200 Co 0.003 Cr 0.040 Cu 0.080 Mn 0.970 Mo 0.010 Nb 0.012 Ni 0.030 P 0.011 S 0.022 Si 0.240 V 0.004 CE(Long Formula) = 0.38 T/S(PSI) 75,025 Y/S(PSI) 51,626 EL(%) 35.95 RA(%) 65.41 Brinell 141 BHN 139 BHN
7551681	75	59935	36-12X1 3M A105N THRD T	SA/A105N Al 0.028 C 0.200 Co 0.004 Cr 0.060 Cu 0.100 Mn 0.980 Mo 0.011 Nb 0.012 Ni 0.040 P 0.006 S 0.017 Si 0.220 V 0.003 CE(Long Formula) = 0.39 T/S(PSI) 72,373 Y/S(PSI) 48,076 EL(%) 35.20 RA(%) 63.66 Brinell 132 BHN 132 BHN

We certify that the data on this sheet is a true copy taken from our records of material furnished us by the production mill, or as obtained by additional laboratory checks.

by Billie Jo Clemens
 Billie Jo Clemens
 QUALITY PROCESS MANAGER

CMTR: REV2

CERTIFIED MILL TEST REPORT



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LOG NO. F0000000096575 Page 5 of 5.

BONNEY FORGE CORPORATION
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(814) 542-2545 • (800) 345-7516 • FAX (814) 542-4906
www.bonneyforge.com

CUSTOMER: CCTF CORPORATION

DATE 06/19/2017

CUSTOMER

BONNEY ORDER NO. B000223637

ORDER NO.: 4900009-00

SHIP TO: CCTF CORPORATION (EDMONTON)
5407 - 53RD AVE.
EDMONTON AB T6B 3G2
Canada

ITEM	QUANTITY	LOT NO.	GRADE OR SPECIFICATION NO. CHEMICAL ANALYSIS, PHYSICAL PROPERTIES, REMARKS.
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1. THE FITTINGS SUPPLIED ARE IN ACCORDANCE WITH PURCHASE ORDER SPECIFICATIONS.
2. THE MATERIAL SUPPLIED IDENTIFIED AS A105N WAS NORMALIZED IN ACCORDANCE WITH ASTM A105 HEAT TREATING REQUIREMENTS.
3. THE MATERIAL SUPPLIED AS A105N MEETS THE REQUIREMENTS OF BOTH NACE MRO103-2010 AND NACE MRO175/ISO 15156-2.
4. CERTIFYING ASTM A105-14 / ASME SA105-15 EDITION.
5. THE PRODUCT SUPPLIED WAS INSPECTED IN ACCORDANCE WITH EN 10204:2004 EDITION TYPE 3.1 INSPECTION DOCUMENT. (EUROPEAN STANDARD)
6. THE UNIT OF MEASURE FOR TENSILE AND YIELD (0.2%) STRENGTH ARE REPORTED IN PSI.
7. ELONGATION TEST RESULTS ARE OBTAINED USING STANDARD ROUND SPECIMEN, 2 INCH OR 50 MM GAGE LENGTH.

We certify that the data on this sheet is a true copy taken from our records of material furnished us by the production mill, or as obtained by additional laboratory checks.

by Billie Jo Clemens
Billie Jo Clemens
QUALITY PROCESS MANAGER

CMTR: REV2

CERTIFIED MILL TEST REPORT



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LOG NO. F0000000097392 Page 2 of 7

BONNEY FORGE CORPORATION
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(814) 542-2545 • (800) 345-7546 • FAX (814) 542-4906
www.bonneyforge.com

CUSTOMER: CCTF CORPORATION

DATE 07/12/2017

CUSTOMER

BONNEY ORDER NO. B000224956

ORDER NO.: 4900083-00

SHIP TO: CCTF CORPORATION (EDMONTON)
5407 - 53RD AVE.
EDMONTON AB T6B 3G2
Canada

ITEM	QUANTITY	LOT NO.	GRADE OR SPECIFICATION NO.	CHEMICAL ANALYSIS, PHYSICAL PROPERTIES, REMARKS:			
4	200	50175	5 -3 X 3/4 3000 LF2 THRD T	SA/A350 LF2 CL1			
7692060			Al 0.022 C 0.200 Co 0.002 Cr 0.040 Cu 0.060 Mn 1.030 Mo 0.004 Nb 0.014 Ni 0.020 P 0.006 S 0.020 Si 0.250 V 0.003 CE(Long Formula) = 0.39 T/S(PSI) 71,065 Y/S(PSI) 49,370 EL(%) 37.75 RA(%) 67.02 Brinell 139 BHN 137 BHN Charpy -50 F 52/64/62 (Ft-Lbs) Average 59.30				
5	62	59867	2 1/2-1 1/4 X 1 3M LF2 FLEX T	SA/A350 LF2 CL1			
7690009			Al 0.024 C 0.210 Co 0.004 Cr 0.030 Cu 0.060 Mn 1.030 Mo 0.005 Nb 0.014 Ni 0.020 P 0.005 S 0.020 Si 0.190 V 0.003 CE(Long Formula) = 0.39 T/S(PSI) 71,000 Y/S(PSI) 47,200 EL(%) 34.00 RA(%) 68.00 Brinell 143 BHN 137 BHN Charpy -50 F 27/25/36 (Ft-Lbs) Average 29.30				
		59700	2 1/2-1 1/4 X 1 3M LF2 FLEX T	SA/A350 LF2 CL1			
7690009			Al 0.028 C 0.200 Co 0.030 Cr 0.060 Cu 0.060 Mn 1.030 Mo 0.005 N 0.003 Nb 0.015 Ni 0.020 P 0.005 S 0.020 Si 0.210 V 0.003 CE(Long Formula) = 0.39 T/S(PSI) 72,303 Y/S(PSI) 49,309 EL(%) 37.25 RA(%) 65.60 Brinell 132 BHN 132 BHN Charpy -50 F 35/34/39 (Ft-Lbs) Average 36.00				

We certify that the data on this sheet is a true copy taken from our records of material furnished us by the production mill, or as obtained by additional laboratory checks.

by Kylee Ruiz
Kylee Ruiz
QUALITY PROCESS MANAGER

CERTIFIED MILL TEST REPORT



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LOG NO. F0000000097392 Page 7 of 7

BONNEY FORGE CORPORATION
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(814) 542-2545 • (800) 345-7546 • FAX (814) 542-4906
www.bonneyforge.com

CUSTOMER: CCTF CORPORATION

DATE 07/12/2017

CUSTOMER

BONNEY ORDER NO. B000224956

ORDER NO.: 4900083-00

SHIP TO: CCTF CORPORATION (EDMONTON)
5407 - 53RD AVE.
EDMONTON AB T6B 3G2
Canada

ITEM	QUANTITY	LOT NO.	GRADE OR SPECIFICATION NO. CHEMICAL ANALYSIS, PHYSICAL PROPERTIES, REMARKS:
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1. THE FITTINGS SUPPLIED ARE IN ACCORDANCE WITH PURCHASE ORDER SPECIFICATIONS.
2. CERTIFYING TO ASTM A350 LF2 07 REVISION.
3. THE MATERIAL OF THE FITTINGS SUPPLIED IS ASTM A350-LF2 BUT MEETS THE REQUIREMENTS OF ASME SA350-LF2.
4. THE CHARPY V-NOTCH IMPACT TEST WAS PERFORMED AT -50 DEGREES FAHRENHEIT IN ACCORDANCE WITH A350-LF2.
5. THE MATERIAL SUPPLIED AS A350 LF2 CL1 MEETS THE REQUIREMENTS OF BOTH NACE MRO103-2007 AND NACE MRO175/ISO 15156-2.
6. THE MATERIAL SUPPLIED WAS NORMALIZED IN ACCORDANCE WITH ASTM A350 HEAT TREATING REQUIREMENTS.
7. THE PRODUCT SUPPLIED WAS INSPECTED IN ACCORDANCE WITH EN 10204:2004 EDITION TYPE 3.1 INSPECTION DOCUMENT. (EUROPEAN STANDARD)
8. THE UNIT OF MEASURE FOR TENSILE AND YIELD (0.2%) STRENGTH ARE REPORTED IN PSI.
9. ELONGATION TEST RESULTS ARE OBTAINED USING STANDARD ROUND SPECIMEN, 2 INCH OR 50 MM GAGE LENGTH.

We certify that the data on this sheet is a true copy taken from our records of material furnished us by the production mill, or as obtained by additional laboratory checks.

by Kylee Ruiz
Kylee Ruiz
QUALITY PROCESS MANAGER



925 23 Street S.W.
Medicine Hat, AB T1A 8R1
Phone (403) 526-3142
Fax (403) 526-1061

Purchase Order

P.O. Number:
Page Number:

PO-88418
1 of 1

Vendor Address
1807538 ALBERTA INC.(FOAM) 225 Somerset Way S.E. Medicine Hat, AB T1B 0b6

Ship To Address
BROMLEY MECHANICAL SERVICES 925 23 Street S.W. Medicine Hat, AB T1A 8R1

VENDOR ID	BUYER	TERMS	F.O.B.		
23311	ASANDERS	Net 30			
CONTACT		SHIPPING METHOD	ORDER DATE	DATE REQUIRED	
JUSTIN MOSSING			1/11/2018	1/11/2018	
QTY	PART ID	UM	DESCRIPTION	UNIT COST	EXTENDED COST

2.00SKID-INSULATIO EA 350.00 \$700.00

APPLY 2" INSULATON TO SKID

CONTRACTOR TO CONFORM TO THE
REQUIREMENTS OF THE BROMLEY MECHANICAL
SERVICES SAFETY MANUAL LATEST EDITION

Used by WO-35548-7/1 Op# 20

TERMS AND CONDITIONS OF THIS ORDER

1. PURCHASE ORDER NUMBER MUST APPEAR ON ALL PACKAGES, INVOICES AND CORRESPONDENCE.
2. DELIVER NO GOODS WITHOUT A PURCHASE ORDER.
3. ACKNOWLEDGE RECEIPT OF THIS ORDER SPECIFYING PRICES AND A DEFINITE SHIPPING DATE.
4. MAKE NO SUBSTITUTIONS OR CHANGES WITHOUT AUTHORITY FROM US.
5. WE RESERVE THE RIGHT TO CANCEL THIS ORDER IF SHIPMENT IS NOT MADE AS PROMISED.
6. THIS ORDER MUST NOT BE BILLED AT HIGHER PRICES THAN QUOTED.

Authorized By: _____

G.S.T. # R119459568

ORDER TOTAL:

\$700.00

CERTIFIED MILL TEST REPORT



LOG NO. F00000000101264 Page 3 of 9

BONNEY FORGE CORPORATION
 P.O. BOX 330 • 14496 CROGHAN PIKE • MOUNT UNION, PA 17066-0330
 (814) 542-2545 • (800) 345-7546 • FAX (814) 542-4906
 www.bonneyforge.com

CUSTOMER: CCTF CORPORATION

DATE 11/08/2017

CUSTOMER ORDER NO.: 4900434-00

BONNEY ORDER NO. B000230786

SHIP TO: CCTF CORPORATION (EDMONTON)
 5407 - 53RD AVE.
 EDMONTON AB T6B 3G2
 Canada

ITEM	QUANTITY	LOT NO.	GRADE OR SPECIFICATION NO.	CHEMICAL ANALYSIS, PHYSICAL PROPERTIES, REMARKS:
9	502	50121	5-4X1 3M A105N THRD T	SA/A105N
7551665			Al 0.023 C 0.210 Co 0.003 Cr 0.040 Cu 0.050 Mn 1.010 Mo 0.004 Nb 0.014 Ni 0.020 P 0.008 S 0.016 Si 0.240 V 0.003 CE(Long Formula) = 0.39 T/S(PSI) 77.810 Y/S(PSI) 51,527 EL(%) 33.75 RA(%) 59.60 Brinell 139 BHN 141 BHN	
10	13	50138	36-12X1 3M A105N THRD T	SA/A105N
7551681			Al 0.026 C 0.200 Co 0.002 Cr 0.030 Cu 0.030 Mn 1.000 Mo 0.008 Nb 0.014 Ni 0.010 P 0.007 S 0.022 Si 0.250 V 0.003 CE(Long Formula) = 0.38 T/S(PSI) 77.481 Y/S(PSI) 51,700 EL(%) 34.85 RA(%) 62.07 Brinell 139 BHN 141 BHN	
10	162	50138	36-12X1 3M A105N THRD T	SA/A105N
7551681			Al 0.026 C 0.200 Co 0.002 Cr 0.030 Cu 0.030 Mn 1.000 Mo 0.008 Nb 0.014 Ni 0.010 P 0.007 S 0.022 Si 0.250 V 0.003 CE(Long Formula) = 0.38 T/S(PSI) 77.481 Y/S(PSI) 51,700 EL(%) 34.85 RA(%) 62.07 Brinell 139 BHN 141 BHN	
11	1,500	50196	36-3X1 3M A105N FLEX T	SA/A105N
7550311			Al 0.032 C 0.200 Co 0.002 Cr 0.040 Cu 0.030 Mn 1.050 Mo 0.003 Nb 0.014 Ni 0.020 P 0.005 S 0.019 Si 0.270 V 0.003 CE(Long Formula) = 0.39 T/S(PSI) 71,610 Y/S(PSI) 47,449 EL(%) 36.85 RA(%) 57.04 Brinell 135 BHN 135 BHN	

We certify that the data on this sheet is a true copy taken from our records of material furnished us by the production mill, or as obtained by additional laboratory checks.

by Kylee Ruiz
 Kylee Ruiz
 QUALITY PROCESS MANAGER

CERTIFIED MILL TEST REPORT



The Best Value -
Price, Quality, Service
All The Time.

LOG NO. F00000000101264 Page 9 of 9

BONNEY FORGE CORPORATION
P.O. BOX 330 • 14496 CROGHAN PIKE • MOUNT UNION, PA 17066-0330
(814) 542-2545 • (800) 345-7546 • FAX (814) 542-4906
www.bonneyforge.com

CUSTOMER: CCTF CORPORATION

DATE 11/08/2017

CUSTOMER

BONNEY ORDER NO. B000230786

ORDER NO.: 4900434-00

SHIP TO: CCTF CORPORATION (EDMONTON)
5407 - 53RD AVE.
EDMONTON AB T6B 3G2
Canada

ITEM	QUANTITY	LOT NO.	GRADE OR SPECIFICATION NO. CHEMICAL ANALYSIS, PHYSICAL PROPERTIES, REMARKS:
------	----------	---------	--

1. THE FITTINGS SUPPLIED ARE IN ACCORDANCE WITH PURCHASE ORDER SPECIFICATIONS.
2. THE MATERIAL SUPPLIED IDENTIFIED AS A105N WAS NORMALIZED IN ACCORDANCE WITH ASTM A105 HEAT TREATING REQUIREMENTS.
3. THE MATERIAL SUPPLIED AS A105N MEETS THE REQUIREMENTS OF BOTH NACE MRO103-2010 AND NACE MRO175/ISO 15156-2.
4. CERTIFYING ASTM A105-14 / ASME SA105-15 EDITION.
5. THE PRODUCT SUPPLIED WAS INSPECTED IN ACCORDANCE WITH EN 10204:2004 EDITION TYPE 3.1 INSPECTION DOCUMENT. (EUROPEAN STANDARD)
6. THE UNIT OF MEASURE FOR TENSILE AND YIELD (0.2%) STRENGTH ARE REPORTED IN PSI.
7. ELONGATION TEST RESULTS ARE OBTAINED USING STANDARD ROUND SPECIMEN. 2 INCH OR 50 MM GAGE LENGTH.

We certify that the data on this sheet is a true copy taken from our records of material furnished us by the production mill, or as obtained by additional laboratory checks.

by Kylee Ruiz

Kylee Ruiz
QUALITY PROCESS MANAGER

CERTIFIED MILL TEST REPORT



**The Best Value -
Price, Quality, Service
All The Time.**

LOG NO. F00000000097987 Page 2 of 5

BONNEY FORGE CORPORATION
P.O. BOX 330 • 14496 CROGHAN PIKE • MOUNT UNION, PA 17066-0330
(814) 542-2545 • (800) 345-7546 • FAX (814) 542-4906
www.bonneyforge.com

CUSTOMER: CCTF CORPORATION

DATE 07/26/2017

**CUSTOMER
ORDER NO.:** 4900133-00

BONNEY ORDER NO. B000225600

SHIP TO: CCTF CORPORATION (EDMONTON)
5407 - 53RD AVE.
EDMONTON AB T6B 3G2
Canada

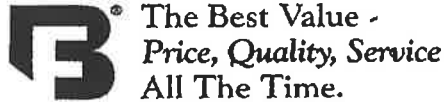
ITEM	QUANTITY	LOT NO.	GRADE OR SPECIFICATION NO.	CHEMICAL ANALYSIS, PHYSICAL PROPERTIES, REMARKS:
3 7692050	200	59213	8-3 X 1/2 3M LF2 THRD T	SA/A350 LF2 CL1 Al 0.024 C 0.210 Co 0.005 Cr 0.040 Cu 0.070 Mn 1.050 Mo 0.006 N 0.003 Nb 0.015 Ni 0.030 P 0.004 S 0.016 Si 0.220 V 0.004 CE(Long Formula) = 0.40 T/S(PSI) 74,069 Y/S(PSI) 50,651 EL(%) 34.65 RA(%) 64.94 Brinell 132 BHN 135 BHN Charpy -50 F 28/63/37 (Ft-Lbs) Average 42.70
4 7690201	750	50085	5-4 X 1 3000 LF2 THRD T	SA/A350 LF2 CL1 Al 0.028 C 0.190 Co 0.003 Cr 0.050 Cu 0.070 Mn 0.970 Mo 0.011 Nb 0.014 Ni 0.040 P 0.010 S 0.018 Si 0.240 V 0.003 CE(Long Formula) = 0.37 T/S(PSI) 72,500 Y/S(PSI) 49,800 EL(%) 33.00 RA(%) 69.00 Brinell 143 BHN 147 BHN Charpy -50 F 57/81/72 (Ft-Lbs) Average 70.00
5 7693037	100	59935	10-6 X 1 3000 LF2 THRD T	SA/A350 LF2 CL1 Al 0.028 C 0.200 Co 0.004 Cr 0.060 Cu 0.100 Mn 0.980 Mo 0.011 Nb 0.012 Ni 0.040 P 0.006 S 0.017 Si 0.220 V 0.003 CE(Long Formula) = 0.39 T/S(PSI) 72,373 Y/S(PSI) 48,076 EL(%) 35.20 RA(%) 63.66 Brinell 132 BHN 132 BHN Charpy -50 F 40/39/47 (Ft-Lbs) Average 42.00

We certify that the data on this sheet is a true copy taken from our records of material furnished us by the production mill, or as obtained by additional laboratory checks.

by Billie Jo Clemens

Billie Jo Clemens
QUALITY PROCESS MANAGER

CERTIFIED MILL TEST REPORT



LOG NO. F0000000097987 Page 6 of 6

BONNEY FORGE CORPORATION
P.O. BOX 330 • 14486 CROGHAN PIKE • MOUNT UNION, PA 17066-0330
(814) 542-2545 • (800) 345-7546 • FAX (814) 542-4906
www.bonneyforge.com

CUSTOMER: CCTF CORPORATION

DATE 07/26/2017

CUSTOMER
ORDER NO.: 4900133-00

BONNEY ORDER NO. B000225600

SHIP TO: CCTF CORPORATION (EDMONTON)
5407 - 53RD AVE.
EDMONTON AB T6B 3G2
Canada

ITEM	QUANTITY	LOT NO.	GRADE OR SPECIFICATION NO CHEMICAL ANALYSIS, PHYSICAL PROPERTIES, REMARKS.
------	----------	---------	---

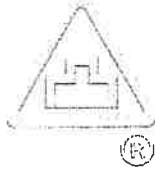
1. THE FITTINGS SUPPLIED ARE IN ACCORDANCE WITH PURCHASE ORDER SPECIFICATIONS.
2. CERTIFYING TO ASTM A350 LF2 07 REVISION.
3. THE MATERIAL OF THE FITTINGS SUPPLIED IS ASTM A350-LF2 BUT MEETS THE REQUIREMENTS OF ASME SA350-LF2.
4. THE CHARPY V-NOTCH IMPACT TEST WAS PERFORMED AT -50 DEGREES FAHRENHEIT IN ACCORDANCE WITH A350-LF2.
5. THE MATERIAL SUPPLIED AS A350 LF2 CL1 MEETS THE REQUIREMENTS OF BOTH NACE MRO103-2007 AND NACE MRO175/ISO 15156-2.
6. THE MATERIAL SUPPLIED WAS NORMALIZED IN ACCORDANCE WITH ASTM A350 HEAT TREATING REQUIREMENTS.
7. THE PRODUCT SUPPLIED WAS INSPECTED IN ACCORDANCE WITH EN 10204:2004 EDITION TYPE 3.1 INSPECTION DOCUMENT. (EUROPEAN STANDARD)
8. THE UNIT OF MEASURE FOR TENSILE AND YIELD (0.2%) STRENGTH ARE REPORTED IN PSI.
9. ELONGATION TEST RESULTS ARE OBTAINED USING STANDARD ROUND SPECIMEN, 2 INCH OR 50 MM GAGE LENGTH.

We certify that the data on this sheet is a true copy taken from our records of material furnished us by the production mill, or as obtained by additional laboratory checks.

by Kylee Ruiz
Kylee Ruiz
QUALITY PROCESS MANAGER

CMTR: REV2

Order#: 618006 PO#: 110-001379-00 Seq: 20
 Comco Part#: O 2 XS W 6X3.5 5 Part Description: O'lets 2 (60.3mm O.D.) XS WELDOLET 6X3.5 A/SA105N
 Heat#: CA0186 Mill: Both-Well



BOTH-WELL STEEL FITTINGS CO., LTD.

NO.303, REN-SIN ROAD, REN-WU DISTRICT, KAOHSIUNG CITY, TAIWAN, R.O.C.(81460)
 TEL.: (886)7-3711536, 3710497, 3720260 FAX : (886)7-371-3864, 3713882
 WEB SITE : <http://www.bothwell.com.tw> E-Mail : box@bothwell.com.tw

An ISO 9001 : 2008 Registered Manufacturer

MILL TEST & INSPECTION CERTIFICATE

ACCORDING TO EN 10204 3.1

CUSTOMER : SEYBOLD INTERNATIONAL CORP.
 CERT NO. : 161534
 ORDER NO. : 7011378

INVOICE NO. : 5200007678
 L/C NO. :

PAGE : 63
 DATE : 06/04/2016
 ORIGIN : TAIWAN

ITEM	RAW HEAT NO. HEAT NO.	QTY	DESC/GRADE OR SPECIFICATION NO. CHEMICAL COMPOSITION(%) MECHANICAL PROPERTIES.
84	0103396 CA0186	75 PCS	OUTLET STRAIGHT WAY ZP A105 6"-3-1/2"X2" XS BW O 2 XS W 6X3.5 5 W.O.L C:0.19 Si:0.18 Mn:0.85 P:0.009 S:0.009 Cu:0.09 Cr:0.05 Ni:0.05 Mo:0.01 V:0.002 Nb:0.001 Ti:0.001 CE:0.35 TS(KSI):74.7 YS 0.2%(KSI):50.2 EL(%):33.4 R.A.(%):66.4 HARDNESS 1(HBW):140 HARDNESS 2(HBW):141

REMARK :

THE MATERIAL SUPPLIED IDENTIFIED AS ASTM A105N -14, ASME SA105N-2015ED
 THE FITTING SUPPLIED IDENTIFIED AS MSS SP-97 - 2012
 THE PRODUCT SUPPLIED WAS INSPECTED IN ACCORDANCE WITH SPECIFICATION(SURFACE & DIM). : GOOD
 STANDARD : CHEMICAL COMPOSITION(%) & MECHANICAL PROPERTIES.

	C	Si	Mn	P	S	Cu	Cr	Ni	Mo	V	Ch(Nb)
MIN	-	0.10	0.60	-	-	-	-	-	-	-	-
MAX	0.35	0.35	1.05	0.035	0.040	0.40	0.30	0.40	0.12	0.08	-
	N	Al	Ti	Zr	CE	TS(KSI)	YS	YS 0.2%(KSI)	EL(%)	R of A(%)	HARDNESS(HBW)
MIN	-	-	-	-	-	70	-	36	22	30	-
MAX	-	-	-	-	0.43	-	-	-	-	-	187

HEAT TREATMENT : NORMALIZED: 900°C (1652°F) A.C.

STEEL MAKING PROCESS : ELECTRIC FURNACE

CONFORMS TO NACE MR0175-15/ISO 15156-15/MR0103-12

FULLY KILLED AND FINE GRAIN PRACTICE

CONFORM TO COATINGS OF ZINC PHOSPHATE, Min. 8 μm.

WE CERTIFY THE ABOVE MENTIONED FITTINGS HAVE BEEN MANUFACTURED,
 SAMPLED, TESTED, AND INSPECTED IN ACCORDANCE WITH THE
 SPECIFICATIONS SHOWN

C.C. Huang
 Q.C. MANAGER

C.L. Ko
 INSPECTOR

	I.M.L. - INDUSTRIA MECCANICA LIGURE S.P.A. Via Giancarlo Farina, 25 - 16030 Casarza Ligure - GE - ITALY Tel. +39 0185 467661 - Fax +39 0185 466510 - E-mail quality@imlitaly.com MATERIAL TEST DEPARTMENT	A01	COMPANY WITH QUALITY SYSTEM ISO 9001: 2008 CERTIFIED BY RINA CERT. N° 23/91/S
---	--	-----	--

INSPECTION CERTIFICATE EN 10204:2004 / 3.1		A02	Nr^{A03} 2017-C_IML-29661	Data / Dated 26.09.2017	Z02
---	--	-----	--	--------------------------------	-----

DNOW CANADA ULC 1800, 635-8th Avenue S.W. Calgary, Alberta, Canada T2P 3M3	CA	Ordine / PO 25805284 Item 510 DDT / Delivery note 2017-2E301-0000890 Packing List 2017-2E301-0000890 Fattura / Invoice 2017-2E401-0000817 Ns. rif. / Our ref. 2017-2E201-0001223-0051	A06	A07	A08
---	----	--	-----	-----	-----

Dest. UMB CA AB EDMONTON DC - DNOW CANADA ULC 2603 -76 AVENUE T6P 1P6 EDMONTON - ALBERTA	CA	A06
---	----	-----

Cod. colata ^{B07} Heat Code	Nr. colata ^{B07} Heat Nr	Quantità ^{B08} Quantity	Descrizione ^{B01 - (B09 - B11)} Description
5T4	1771947	600,00	FITTING RED.TEE THRD NPT 3M 1"x1/2" A105N

Mat. in acc. a / Mat. in acc. to^{B02} ASTM A105/A105M-14
 ASME SA105/SA105M, ASME II PART A Ed.2015
 ANSI/NACE MR 0175 - ISO 15156 Ed.2015
 ANSI/NACE MR 0103 - ISO 17945 Ed. 2015
 P.E.D. 2014/68/EU ANNEX 1 PAR. 4.3

Ann. mat. / Mat. remarks^{B02} MATERIAL FULLY KILLED & FINE GRAIN PRACTICED

Elementi / Elements ^(C71 - C92)	C	Si	Mn	S	P	Cr	Ni	Mo	Ti	Cu	V	Nb	N
LADLE ANALYSIS	0,180	0,210	1,100	0,009	0,012	0,140	0,050	0,010	0,016	0,170	0,002	0,001	0,000
	AI								CE LF	CE SF	F1	F2	PREN
LADLE ANALYSIS	0,020								0,408	0,363	0,372	0,150	-
CE LF=C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15		CE SF=C+(Mn/8)		F1=Cu+Ni+Cr+Mo+V		F2=Cr+Mo							

Provetta Test specimen	Forma ^{C10} Shape	°C ^{C03}	Snervamento>0,2% ^{C11} Yield Strength>0,2%	Snervamento>1,0% ^{C11} Yield Strength>1,0%	Rottura ^{C12} Tensile	Allungamento ^{C13} Elongation	Contrazione ^{C15} Reduction of area
Sez/Sect mm2	L. mm	1=O - 2=□	MPa	MPa	MPa	%	%
122,65	50,00	1	20	336,0	--	513,0	32,9
							54,0

DUREZZA / HARDNESS ^{C22}		RESILIENZA / IMPACT TEST					
HBW	Tipo/Type ^{C40}	Provetta / Test Specimen	°C ^{C03}	1-Joule ^{C42}	2-Joule ^{C42}	3-Joule ^{C42}	Media/Average ^{C43}
157,0 - 160,0	KV	10x10mm	-10	71	75	70	72,0

Tratt. Term. / Heat treatment ^{C70}	Normalized at 880°-920°C / Air Cool	ELECTRIC FURNACE
--	-------------------------------------	------------------

Dim in acc. a / Dim. acc. to^{B14} ASME B16.11 Ed.2016 - ASME B1.20.1 Ed.2013 - MSS SP25 Ed.2013

Marcatura in acc. ^{B06} Marking in acc. to	MSS SP25 Ed. 2013	Vis. & Dim.	SATISFACTORY	Origine Origin of Steel	ITALY
--	-------------------	-------------	--------------	----------------------------	-------

Note / Notes 100% MANUFACTURED IN ITALY
 SUPPLIED MATERIAL MEETS SPECIFICATIONS AND P.O. REQUIREMENTS

Wo # 35527/28

UFFICIO CONTROLLO QUALITA' ^{A05} QUALITY CONTROL DEPARTMENT Boris Fizzotti - Q.C. Manager 	ENTE UFFICIALE DI COLLAUDO ^{Z03} INSPECTION AUTHORITY	MARCHIO PRODUZIONE ^{A04} MANUFACTURER'S SYMBOL 
---	---	---

CLIENTE / Customer / Client

DNOW CANADA ULC
P.O. BOX 4395 STATION C
CALGARY, ALBERTA
CANADA T2T 5N2

CERTIFICADO DE INSPECCION
Inspection Certificate - Certificat de Réception

UNE EN 10204:06 / 3.1
ISO 10474:15 / 3.1



FECHA: 27/09/2017 N.º No. 190122 HOJA: Page. 1

Management Systems certified by LRQA

Certified acc. PED 97/23/EC+AD2000-W0
PED 14/68/UE
by TÜV Rheinland
N.º 01 202 EQ 02 7-43

MARCA DEL FABRICANTE
Mark of factory
Marque du fabricant



ULMA FORJA. S.COOP.
Eº Zubalaga, 3 - Apdo. 14
20560 OÑATI (Gipuzkoa) SPAIN
Tel: 34 - 943 780552
Fax: 34 - 943 781800
E-mail: ulma@ulmapiping.com

Packing List: 134445

DEPARTAMENTO QUALITY ASSURANCE
Section
Département

PRODUCTO FITTING SU PEDIDO N.º
Article - Produit Your Order No. 25708982
NORMAS APLICABLES ASME B16.11-2011
Requirements - Normes Applicables Votre Cde. N.º

MATERIAL CORRESPONDIENTE ASME SA105M-17, ASTM A105M-14
Material Correspondent - Qualité
MODO DE FUSION (*) NACE MR0175/ISO15156-02/03-15 & MR0103/ISO17495-15
Steel Making - Elaboration du l'acier
E = Elec. Y = Oxígeno básico

PARTIDA Item Posto	CANTIDAD Quantity Quantité	DESCRIPCION Description Description	OBSERVACIONES Remarks Observations (*)	COLADA N.º Heat No N.º Couloir	RESISTENCIA T Strength Resist Rupt N/mm2	LIMIT ELAST Y Strength N/mm2	ALARGAM Elongation Lo 50mm/4l %	ESTRICCION Red. Area Striction %	RESILIENCIA Impact test Résistance Joules	CHARPY V 10x10mm MEDIA Average Moyenne	DUREZA Hardness Dureté HEW
90 4083	2.000	H COUPLING 1/2 3000LB NPT A105N	NE	YR	509	311	29,10	52,60			151 154
460 750725	258	TEE 1X1/2 3000LB NPT A105N	NE	B02A5	507	309	29,70	50,10			154 152

COLADA N.º Heat No N.º Couloir	COMPOSICION QUIMICA - STEEL MAKER'S LADLE ANALYSIS - ANALYSE CHIMIQUE													
	C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	Nb %	V %	Cu %	Al %	Ti %	CEq %
B02A5	0,180	0,180	0,950	0,010	0,006	0,060	0,100	0,018	0,006	0,001	0,180	0,035	0,002	0,37
YR	0,200	0,218	0,987	0,017	0,009	0,040	0,077	0,014	0,000	0,001	0,135	0,024	0,001	0,39

- Les dimensions y la condición superficial se hallaron satisfactorias.
- Dimension and surface condition were found acceptable.
- Les dimensions et états de surface sont satisfaisants.

- Los materiales citados cumplen las normas aplicables.
- Manufacturing requirements are satisfied.
- Les normes applicables sont respectées.

EL INSPECTOR
Works Inspector - L'Inspecteur



ULMA FORJA S. COOP.
Dpto. de Garantía de calidad
Quality Assurance Dept.

(*) OBSERVACIONES: N NORMALIZED AT 900 C AND ALLOWED TO COOL IN STILL AIR.
Remarks
Observations

wo # 35527 / 28



I.M.L. - INDUSTRIA MECCANICA LIGURE S.P.A.
 Via Giancarlo Farina, 25 - 16030 Casarza Ligure - GE - ITALY
 Tel. +39 0185 467661 - Fax +39 0185 466510 - E-mail quality@imlitaly.com
 MATERIAL TEST DEPARTMENT

A01

COMPANY WITH QUALITY
 SYSTEM ISO 9001: 2008 CERTIFIED
 BY RINA
 CERT. N° 23/91/S

INSPECTION CERTIFICATE EN 10204:2004 / 3.1

A02

Nr^{A03} 2017-C_IML-29699Data / Dated 10.10.2017 ^{Z02}

DNOW CANADA ULC

1800, 635-8th Avenue S.W.
 Calgary, Alberta, Canada T2P 3M3

CA

Ordine / PO

25805284

Item

220

DDT / Delivery note

2017-2E301-0000915

Packing List

2017-2E301-0000915

Fattura / Invoice

2017-2E401-0000849

Ns. rif. / Our ref.

2017-2E201-0001223-0022

Dest. UMB CA AB EDMONTON DC - DNOW CANADA ULC

2603 -76 AVENUE
 T6P 1P6 EDMONTON - ALBERTA

CA

Cod. colata ^{B07}

Heat Code
 44M

Nr. colata ^{B07}

Heat Nr
 16/77828

Quantità ^{B08}

Quantity
 3.000,00

Descrizione

Description
 FITTING COUPLING THRD NPT 3M 1/4" A105N

B01 - (B09 - B11)

Mat. In acc. a / Mat. in acc. to ^{B02} ASTM A105/A105M-14

ASME SA105/SA105M, ASME II PART A Ed.2015
 ANSI/NACE MR 0175 - ISO 15156 Ed.2015
 ANSI/NACE MR 0103 - ISO 17945 Ed. 2015
 P.E.D. 2014/68/EU ANNEX 1 PAR. 4.3

Ann. mat. / Mat. remarks ^{B02}

MATERIAL FULLY KILLED & FINE GRAIN PRACTICED

Elementi / Elements ^(C71 - C92)

	C	Si	Mn	S	P	Cr	Ni	Mo	Ti	Cu	V	Nb	N
LADLE ANALYSIS	0,190	0,210	1,110	0,010	0,015	0,150	0,060	0,010	0,017	0,170	0,003	0,003	0,000
	Al							CE LF	CE SF	F1	F2	PREN	
LADLE ANALYSIS	0,025							0,423	0,375	0,393	0,160	-	

CE LF=C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15

CE SF=C+(Mn/6)

F1=Cu+Ni+Cr+Mo+V

F2=Cr+Mo

Provetta

Test specimen

Sez/Sect mm2
 122,65

Forma ^{C10}

Shape

1=O - 2=□
 50,00

°C ^{C03}

20

Snervamento > 0,2% ^{C11}

Yield Strength > 0,2%

MPa
 339,0

Snervamento > 1,0% ^{C11}

Yield Strength > 1,0%

MPa
 --

Rottura ^{C12}

Tensile

MPa
 536,0

Allungamento ^{C13}

Elongation

%
 31,6

Contrazione ^{C15}

Reduction of area

%
 58,0

DUREZZA / HARDNESS ^{C22}

HBW

156,0 - 160,0

Tipo/Type ^{C40}

KV

Provetta / Test Specimen

10x10mm

RESILIENZA / IMPACT TEST

°C ^{C03}

-10

1-Joule ^{C42}

74

2-Joule ^{C42}

69

3-Joule ^{C42}

71

Media/Average ^{C43}

71,3

Tratt. Term. / Heat treatment ^{C70}

Normalized at 880°-920°C / Air Cool

ELECTRIC FURNACE

Dim in acc. a / Dlm. acc. to ^{B14}

ASME B16.11 Ed.2016 - ASME B1.20.1 Ed.2013 - MSS SP25 Ed.2013

Marcatura in acc. ^{B06}
 Marking in acc. to

MSS SP25 Ed. 2013

Vis. & Dim.

SATISFACTORY

Origine
 Origin of Steel

ITALY

Note / Notes

100% MANUFACTURED IN ITALY
 SUPPLIED MATERIAL MEETS SPECIFICATIONS AND P.O. REQUIREMENTS

UFFICIO CONTROLLO QUALITA' ^{A05}
 QUALITY CONTROL DEPARTMENT

Boris Fizzotti - C.O. Manager

Boris Fizzotti

ENTE UFFICIALE DI COLLAUDO ^{Z03}
 INSPECTION AUTHORITY

MARCHIO PRODUZIONE ^{A04}
 MANUFACTURER'S SYMBOL

IML

or



wo 35527/28

35527/35528



**Phoenix * Capitol * Camco
CapProducts**

Certified Mill Test Report

Heat Code: 84VF

Heat Number: 5F5313

Item: 15130503: 1/2 X 1-1/2" SCH 160 SMLS NIPL

Material: ASTM A106-2014 / ASME SA106-2015 Edition

Chemistry Properties

C	Mn	P	S	Si	Cu	Cr
0.2000	0.4000	0.0060	0.0060	0.2300	0.2200	0.0800
Ni	Mo	V	Co	Al	Cb	N
0.1300	0.0120	0.0050				
Pb	Sn	Ta	Ti	C Eq. Long		
				0.3094		

Additional Chemical Properties

Mechanical Properties

Tensile(PSI)	Yield(PSI)	Elong. % in 2 in. or 4D	Reduction	HBW	HBW 2
62511	35244	48%		149	

Charpy Minimum Impact - ft/lbs

Test 1	Test 2	Test 3	Avg.	Test Temp.

Bend Test Passed Eddy Current Passed

We hereby certify that these parts were manufactured, sampled, tested, and inspected in accordance with the product specifications stated and were found to meet the requirements. We further certify that this material was inspected using independent inspectors conforming to the requirements of EN 10204 3.1. These products meet the requirements of the latest editions of NACE MR0175, NACE MR0103, and ISO 15156. No weld repair has been performed on these products. This material was not exposed to mercury or any other metal alloy that is liquid at ambient temperatures during processing or while in our possession.

Meets ASME SA 106 Grade B Requirements.

35527 / 35528



**Phoenix * Capitol * Camco
CapProducts**

Certified Mill Test Report

Heat Code: 84GV
Heat Number: 1566K
Item: 15130501: 1/2 X CLOSE SCH 160 SMLS NIPL
Material: ASTM A106-2011 / ASME SA106-2010 Edition

Chemistry Properties

C	Mn	P	S	Si	Cu	Cr
0.1700	0.7900	0.0130	0.0030	0.2800	0.1700	0.0510
Ni	Mo	V	Co	Al	Cb	N
0.0610	0.0260	0.0020		0.0280	0.0025	
Pb	Sn	Ta	Ti	C Eq. Long		
	0.0080		0.0026	0.3329		

Additional Chemical Properties

Mechanical Properties

Tensile(PSI)	Yield(PSI)	Elong. % in 2 in. or 4D	Reduction	HBW	HBW 2
67400	49730	39.6%		160	

Charpy Minimum Impact - ft/lbs

Test 1	Test 2	Test 3	Avg.	Test Temp.

Bend Test Passed

Hydro Test Passed at 2500 psi

We hereby certify that these parts were manufactured, sampled, tested, and inspected in accordance with the product specifications stated and were found to meet the requirements. We further certify that this material was inspected using independent inspectors conforming to the requirements of EN 10204 3.1. These products meet the requirements of the latest editions of NACE MR0175, NACE MR0103, and ISO 15156. No weld repair has been performed on these products. This material was not exposed to mercury or any other metal alloy that is liquid at ambient temperatures during processing or while in our possession.

Meets ASME SA 106 Grade B Requirements.



Phoenix * Capitol * Camco CapProducts

Certified Mill Test Report

Heat Code: 86SP

Heat Number: 605627

Item: 15131005: 1 X 2-1/2" SCH 160 SMLS NIPL

Material: ASTM A106-2014 / ASME SA106-2015 Edition

Chemistry Properties

C	Mn	P	S	Si	Cu	Cr
0.1400	0.7500	0.0080	0.0010	0.2000	0.0800	0.1100
Ni	Mo	V	Co	Al	Cb	N
0.0900	0.0200	0.0010			0.0140	
Pb	Sn	Ta	Ti	C Eq. Long		
			0.0020	0.3025		

Additional Chemical Properties

Mechanical Properties

Tensile(PSI)	Yield(PSI)	Elong. % in 2 in. or 4D	Reduction	HBW	HBW 2
69908	49313	50%		141	

Charpy Minimum Impact - ft/lbs

Test 1	Test 2	Test 3	Avg.	Test Temp.

Bend Test Passed

Hydro Test Passed at 3000 psi

We hereby certify that these parts were manufactured, sampled, tested, and inspected in accordance with the product specifications stated and were found to meet the requirements. We further certify that this material was inspected using independent inspectors conforming to the requirements of EN 10204 3.1. These products meet the requirements of the latest editions of NACE MR0175, NACE MR0103, and ISO 15156. No weld repair has been performed on these products. This material was not exposed to mercury or any other metal alloy that is liquid at ambient temperatures during processing or while in our possession.

Meets ASME SA 106 Grade B Requirements.

wo # 35527/28



**Phoenix * Capitol * Camco
CapProducts**

35527/35528

Certified Mill Test Report

Heat Code: 86BX

Heat Number: 514415

Item: 15120705: 3/4 X 2-1/2" XXH SMLS STL NIPL

Material: ASTM A106-2014 / ASME SA106-2015 Edition

Chemistry Properties

C	Mn	P	S	Si	Cu	Cr
0.1880	0.4760	0.0130	0.0170	0.3000	0.0190	0.0800
Ni	Mo	V	Co	Al	Cb	N
0.0680	0.0100	0.0240				
Pb	Sn	Ta	Ti	C Eq. Long		
				0.2959		

Additional Chemical Properties

Mechanical Properties

Tensile(PSI)	Yield(PSI)	Elong. % in 2 in. or 4D	Reduction	HBW	HBW 2
67587	38870	35%		124	

Charpy Minimum Impact - ft/lbs

Test 1	Test 2	Test 3	Avg.	Test Temp.

Bend Test Passed Eddy Current Passed

We hereby certify that these parts were manufactured, sampled, tested, and inspected in accordance with the product specifications stated and were found to meet the requirements. We further certify that this material was inspected using independent inspectors conforming to the requirements of EN 10204 3.1. These products meet the requirements of the latest editions of NACE MR0175, NACE MR0103, and ISO 15156. No weld repair has been performed on these products. This material was not exposed to mercury or any other metal alloy that is liquid at ambient temperatures during processing or while in our possession.

Meets ASME SA 106 Grade B Requirements.

WESTBROOK

MATERIAL TEST REPORT

1111 Lockwood Dr.
Houston, Tx 77020

Voice 713 675 6438
Fax 713 675 9742

To: 003668 DNOW CANADA ULC

Printed: 1/09/2018

Description:

1 X 1/4 S160 A234WPBN SP95 BLK CONC SWG
TBE

***** Specifications - Heat Code W22498 ZE: *****
A105/A105M-14, SA105, A234-14 WPB, SA234 WPB, ASME B16.5,
B16.9, B16.11, B16.36, B1.20.1, MSS SP-25, SP-44, SP-79,
SP-83, SP-95, API-605, A.W.W.A.
STARTING MATERIAL: BAR/BILLET/FORGING
A234-14 WPBN, SA234 WPBN

Chemical Composition:

C:	Mn:	P:	S:	Si:	Cr:	Ni:	Mo:
0.250	0.660	0.010	0.009	0.230	0.150	0.040	0.030
Cu:	V:	C.E.:					
0.090	0.006	.405					

Mechanical Properties:

Tensile(PSI):	Yield(PSI):	Elong(%):	RA(%):	Hardness:
73969	50038	48.00	79.50	HRB 74

Comments:

Normalized @ 1679 deg. F for 30 min. then still air cooled.
Cold drawn.
Meets Nace MR-01-75/2015, MR-01-03/2012, and ISO 15156/2015.

We certify only the chemistry and physical results shown for the referenced Heat Code as furnished by the Producing Mill. The Description is the responsibility of the requesting party. This document was electronically transmitted and is in accordance with EN10204 3.1 /DIN50049 3.1B.

WO 35527/28

WESTBROOK

MATERIAL TEST REPORT

PO Box 53591
Edmonton, AB T6X0P0

Voice 780-490-4976
Fax 780 490 0471

Sold To: **DNOW CANADA ULC**
Order No.: **149921** Order Date: **1/08/2018**

Purchase Order: **659749224-AB45**

Printed: **1/08/2018**

Line: **Description:**
1 1 X 1/4 S160 A234WPBN SP95 BLK CONC SWG
TBE

***** Specifications - Heat Code **W22415 ZE: *******
A105/A105M-14, SA105, A234-14 WPB, SA234 WPB, ASME B16.5,
B16.9, B16.11, B16.36, B1.20.1, MSS SP-25, SP-44, SP-79,
SP-83, SP-95, API-605, A.W.W.A.
STARTING MATERIAL: BAR/BILLET/FORGING
A234-14 WPBN, SA234 WPBN

Chemical Composition:

C: 0.230	Mn: 0.840	P: 0.013	S: 0.007	Si: 0.190	Cr: 0.110	Ni: 0.040	Mo: 0.020
Cu: 0.100	V: 0.009	C.E.: .407					

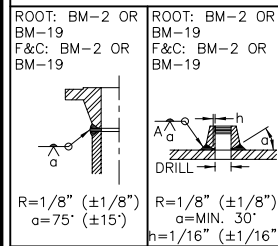
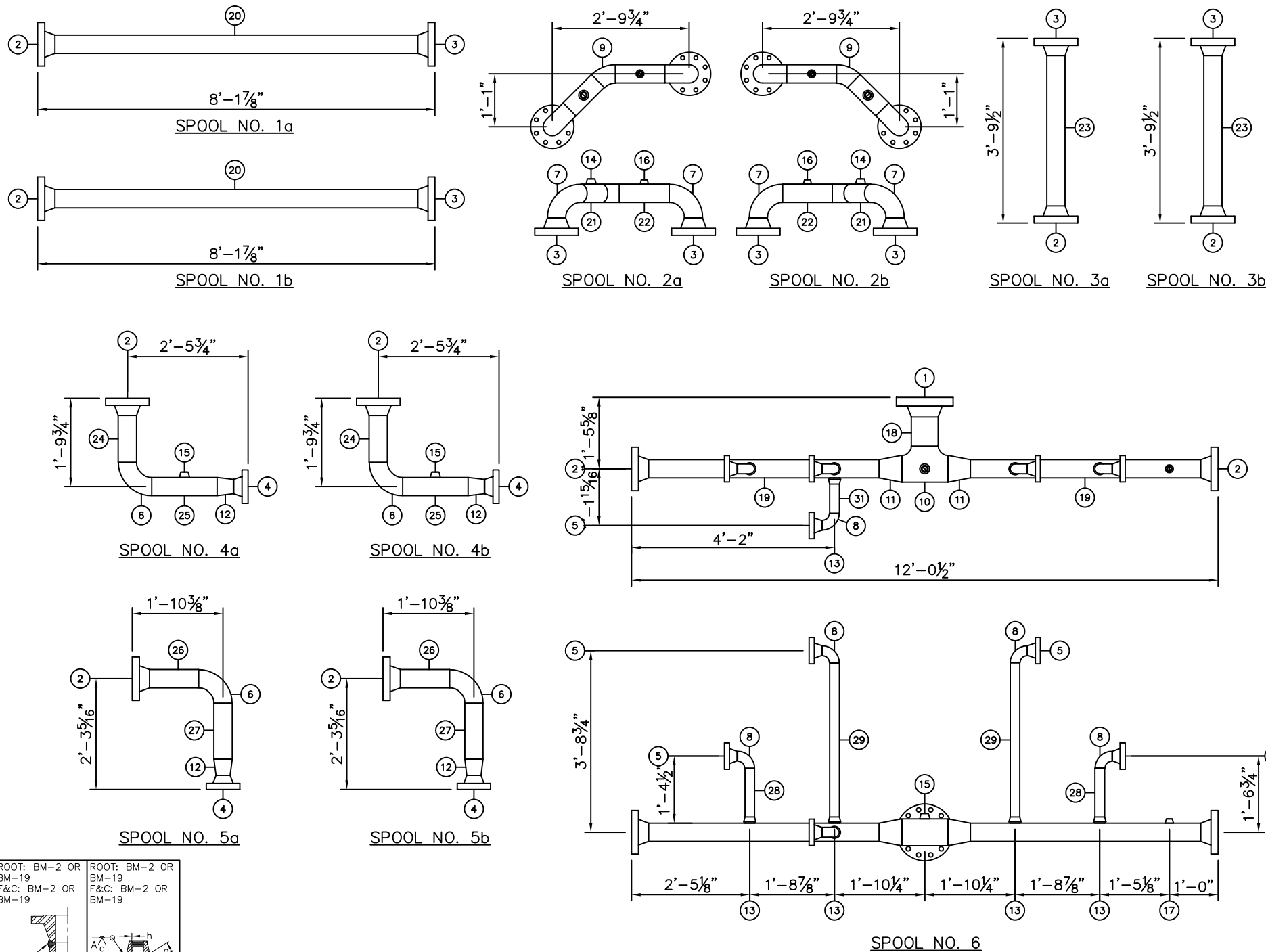
Mechanical Properties:

Tensile(PSI): 73969	Yield(PSI): 45687	Elong(%): 30.50	RA(%): 56.00	Hardness: HRB 73
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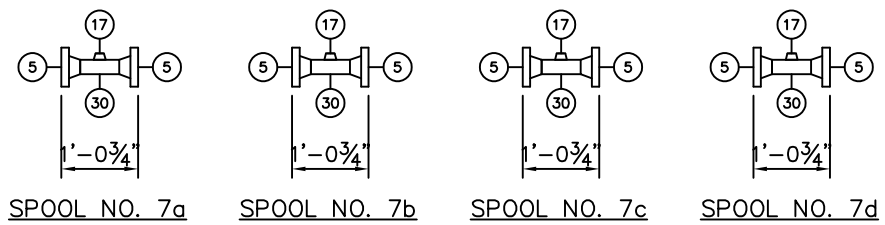
Comments:

Normalized 1679F, 30 minutes, still air cooled.
Cold drawn.
Meets Nace MR-01-75/2015, MR-01-03/2012, and ISO 15156/2015.

We hereby certify that the contents of this Material Test Report are correct and accurate to the best of our knowledge and belief, that all test results are in compliance with the material specifications and that all material meets the dimensional requirements of the order. The products described have not come into contact with mercury or any of its components. Westbrook's USA Quality System is registered to ISO 9001, Certificate No. 32813. This document is in accordance with EN10204:2004 3.1 / DIN50049 3.1B and was electronically transmitted. This inspection certificate is issued under the authority of Westbrook Mfg's Quality Control Manager.



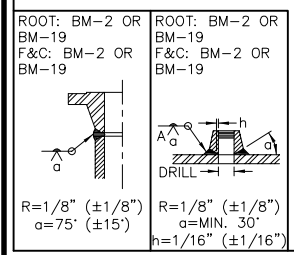
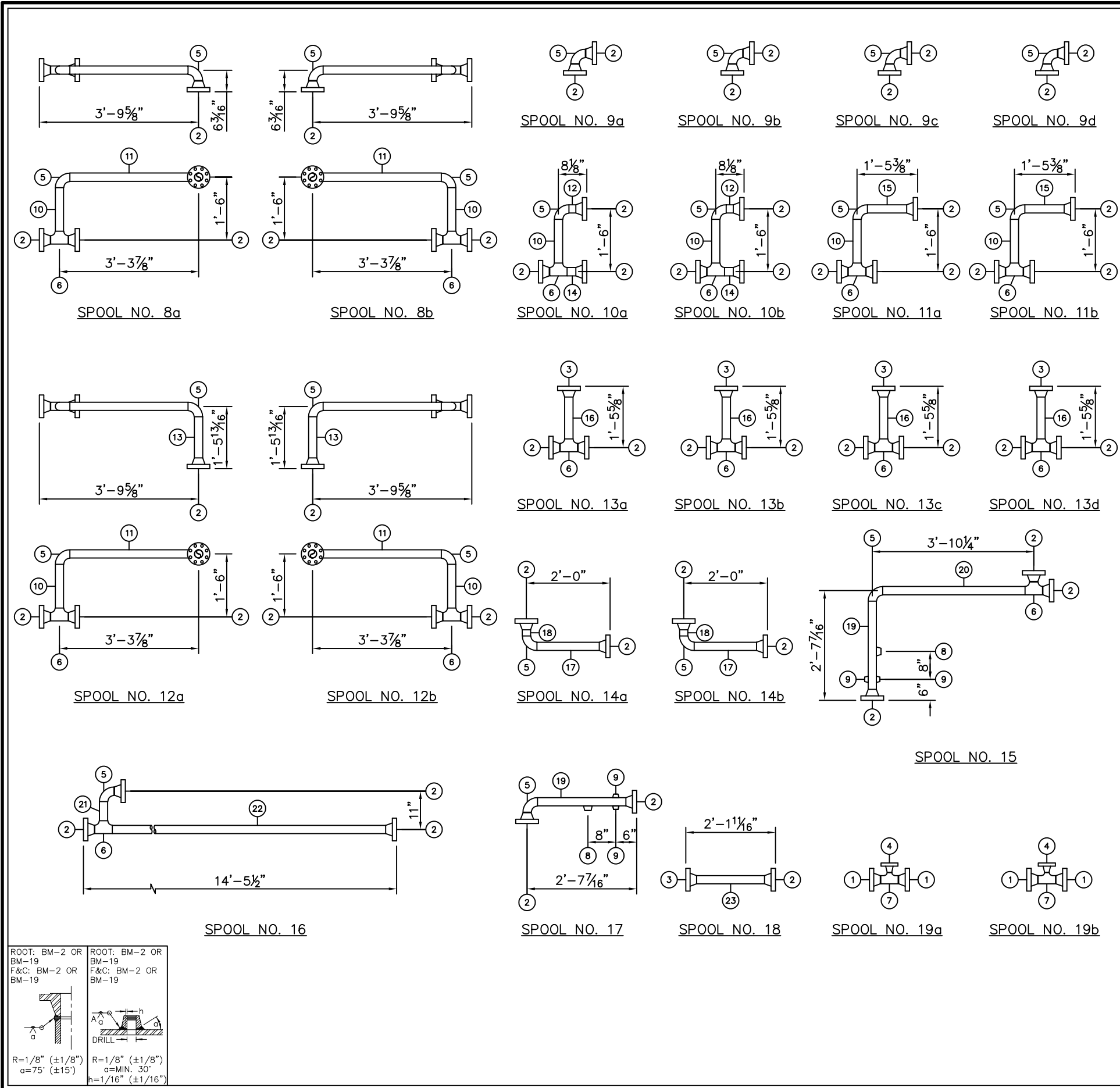
ASME B31.3 2014 ED. (NORMAL SERVICE)	
BMS AQP (S) 1009	REGISTERED WELD PROCEDURE 505.2
FOR PIPING TOLERANCES, SEE WELDER HANDBOOK	
FLUID TYPE: WATER, OIL, GAS	
M.A.W.P.: 1440 PSIG (9929 kPag) AT +130°F (+54°C)	
M.D.M.T.: -20°F (-29°C) AT 1440 PSIG (9929 kPag)	
P.W.H.T.: 1150°F FOR 60 MIN.	
RADIOGRAPHY: 100%	
CORROSION ALLOWANCE: 1/8"	
HYDROSTATIC TEST: 2160 PSIG (14893 kPag)	



BILL OF MATERIAL					
ITEM	QTY.	DESCRIPTION			
1	1	RFWN, 6" 600 ANSI SCH. 80, SA350LF2 CL1			
2	10	RFWN, 4" 600 ANSI SCH. 80, SA105N			
3	8	RFWN, 4" 600 ANSI SCH. 80, SA350LF2 CL1			
4	4	RFWN, 3" 600 ANSI SCH. 80, SA105N			
5	13	RFWN, 2" 600 ANSI SCH. 80, SA105N			
6	4	WELD 90, 4" SCH. 80 LR, SA234WPB			
7	4	WELD 90, 4" SCH. 80 LR, SA420WPL6			
8	5	WELD 90, 2" SCH. 80 LR, SA234WPB			
9	2	WELD 45, 4" SCH. 80 LR, SA420WPL6			
10	1	WELD TEE, 6" SCH. 80, SA234WPB			
11	2	WELD CONC, 6" X 4" SCH. 80, SA234WPB			
12	4	WELD CONC, 4" X 3" SCH. 80, SA234WPB			
13	5	WOL, 2" SCH. 80, SA105N			
14	2	TOL, 1" 3M SA350LF2 CL1			
15	3	TOL, 1" 3M SA105N			
16	2	TOL, 3/4" 3M SA350LF2 CL1			
17	5	TOL, 3/4" 3M SA105N			
18	1	PIPE, 6 SCH. 80 (0.432"), SA333GR6 X 7 1/8" LONG			
19	2	PIPE, 4 SCH. 80 (0.337"), SA106B X 56 3/4" LONG			
20	2	PIPE, 4 SCH. 80 (0.337"), SA333GR6 X 89 3/8" LONG			
21	2	PIPE, 4 SCH. 80 (0.337"), SA333GR6 X 9 7/8" LONG			
22	2	PIPE, 4 SCH. 80 (0.337"), SA333GR6 X 12 1/4" LONG			
23	2	PIPE, 4 SCH. 80 (0.337"), SA333GR6 X 37" LONG			
24	2	PIPE, 4 SCH. 80 (0.337"), SA106B X 11 1/2" LONG			
25	2	PIPE, 4 SCH. 80 (0.337"), SA106B X 16 1/8" LONG			
26	2	PIPE, 4 SCH. 80 (0.337"), SA106B X 12 1/8" LONG			
27	2	PIPE, 4 SCH. 80 (0.337"), SA106B X 13 13/16" LONG			
28	2	PIPE, 2 SCH. 80 (0.218"), SA106B X 12" LONG			
29	2	PIPE, 2 SCH. 80 (0.218"), SA106B X 38" LONG			
30	4	PIPE, 2 SCH. 80 (0.218"), SA106B X 6 1/2" LONG			
31	1	PIPE, 2 SCH. 80 (0.218"), SA106B X 7 3/16" LONG			

REV. No.	MM	DD	YY	DESCRIPTION	BY	CHK'D	APP'D
2	07	26	18	AS BUILT	JMR	CK	.
1	12	21	17	SPOOL 6 REVISED	CK	CK	.
0	12	06	17	ISSUED FOR CONSTRUCTION	CK	CK	.

BROMLEY MECHANICAL SERVICES	
925 - 23rd Street S.W., Medicine Hat, Alberta, Canada, T1A 8R1 (403) 526-3142	
CLIENT	ARC RESOURCES LTD.
PROJECT	TYPICAL DUAL/TEST SEPARATOR PACKAGE
TITLE	PIPING SPOOLS 1-7
Wo No.:	35528
DRAWN BY:	C. KARPIUK
REV. No.:	2
DATE: MM/DD/YY	07/26/18
DATE: MM/DD/YY	12/06/17
SCALE:	3/8"=1'
CAD No.	35528-SPOOLS-1



BILL OF MATERIAL

ITEM	QTY.	DESCRIPTION
1	4	RFWN, 2" 600 ANSI SCH. 160, SA105N
2	53	RFWN, 2" 600 ANSI SCH. 80, SA105N
3	5	RFWN, 2" 600 ANSI SCH. 80, SA350LF2 CL1
4	2	RFWN, 1" 600 ANSI SCH. 160, SA105N
5	21	WELD 90, 2" SCH. 80 LR, SA234WPB
6	14	WELD TEE, 2" SCH. 80, SA234WPB
7	2	WELD RED TEE, 2" X 1" SCH. 160, SA234WPB
8	2	TOL, 1" 3M SA105N
9	4	TOL, 1/2" 3M SA105N
10	8	PIPE, 2" SCH. 80 (0.218"), SA106B X 12 1/2" LONG
11	4	PIPE, 2" SCH. 80 (0.218"), SA106B X 33 7/8" LONG
12	2	PIPE, 2" SCH. 80 (0.218"), SA106B X 2" LONG
13	2	PIPE, 2" SCH. 80 (0.218"), SA106B X 11 3/4" LONG
14	2	PIPE, 2" SCH. 80 (0.218"), SA106B X 2 1/2" LONG
15	2	PIPE, 2" SCH. 80 (0.218"), SA106B X 11 1/4" LONG
16	4	PIPE, 2" SCH. 80 (0.218"), SA333GR6 X 12" LONG
17	2	PIPE, 2" SCH. 80 (0.218"), SA106B X 17 7/8" LONG
18	2	PIPE, 2" SCH. 80 (0.218"), SA106B X 1 3/4" LONG
19	2	PIPE, 2" SCH. 80 (0.218"), SA106B X 25 5/16" LONG
20	1	PIPE, 2" SCH. 80 (0.218"), SA106B X 40 3/4" LONG
21	1	PIPE, 2" SCH. 80 (0.218"), SA106B X 5 1/2" LONG
22	1	PIPE, 2" SCH. 80 (0.218"), SA106B X 162 1/8" LONG
23	1	PIPE, 2" SCH. 80 (0.218"), SA333GR6 X 19 7/16" LONG

REV. No.	MM	DD	YY	DATE	DESCRIPTION	BY	CHK'D	APP'D
2	07	26	18		AS BUILT	JMR	CK	
1	12	21	17		REVISED BILL OF MATERIALS, CHANGED ITEMS 4 & 7 TO 1"	CK	CK	
0	12	06	17		ISSUED FOR CONSTRUCTION	CK	CK	

ASME B31.3 2014 ED. (NORMAL SERVICE)
 BMS AQP (S) 1009 REGISTERED WELD PROCEDURE 505.2
 FOR PIPING TOLERANCES, SEE WELDER HANDBOOK
 FLUID TYPE: WATER, OIL, GAS
 M.A.W.P.: 1440 PSIG (9929 kPag) AT +130°F (+54°C)
 M.D.M.T.: -20°F (-29°C) AT 1440 PSIG (9929 kPag)
 P.W.H.T.: 1150°F FOR 60 MIN.
 RADIOGRAPHY: 100%
 CORROSION ALLOWANCE: 1/8"
 HYDROSTATIC TEST: 2160 PSIG (14893 kPag)

BROMLEY MECHANICAL SERVICES
 925 - 23rd Street S.W., Medicine Hat, Alberta, Canada, T1A 8R1 (403) 526-3142

CLIENT: ARC RESOURCES LTD.

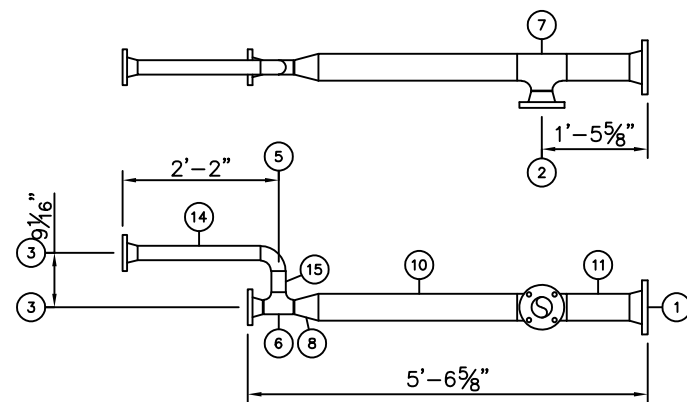
PROJECT: TYPICAL DUAL/TEST SEPARATOR PACKAGE

TITLE: PIPING SPOOLS 8-19

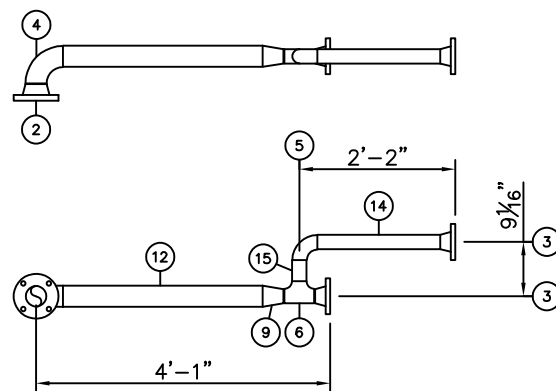
Wo No.: 35528
 DRAWN BY: C. KARPIUK
 DATE: MM/DD/YY 12/06/17

REV. No.: 2
 DATE: MM/DD/YY 07/26/18

SCALE: 3/8"=1'
 CAD No.35528-SPOOLS-2

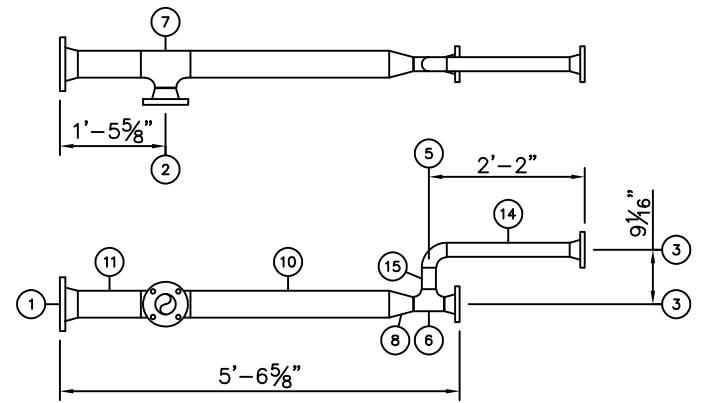


SPOOL NO. 20a

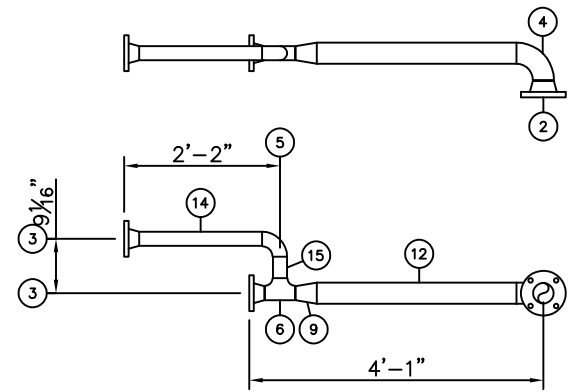


SPOOL NO. 20b

* NOTE: 20a and 20b ARE REQUIRED FOR W0.35528-1 ONLY

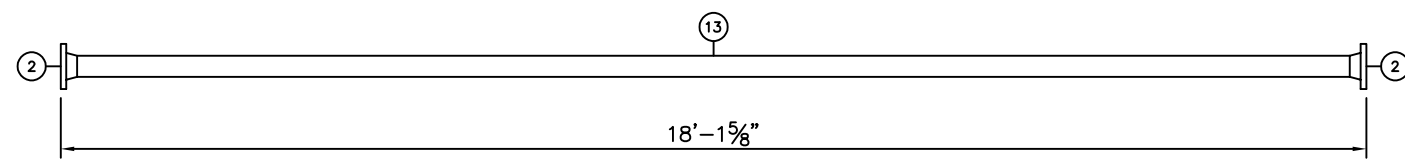


SPOOL NO. 20c

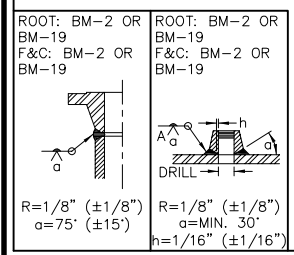


SPOOL NO. 20d

* NOTE: 20c and 20d ARE REQUIRED FOR W0.35528-2 ONLY



SPOOL NO. 21



BILL OF MATERIAL

ITEM	QTY.	DESCRIPTION
1	1	RFWN, 4" 150 ANSI SCH. 40, SA350LF2 CL1
2	4	RFWN, 3" 150 ANSI SCH. 40, SA105N
3	4	RFWN, 2" 150 ANSI SCH. 80, SA105N
4	1	WELD 90, 3" SCH. 80 LR, SA234WPB
5	2	WELD 90, 2" SCH. 80 LR, SA234WPB
6	2	WELD TEE, 2" SCH. 80, SA234WPB
7	1	WELD RED TEE, 4" X 3" SCH. 40, SA234WPB
8	1	WELD CONC, 4" X 2" SCH. 40/80, SA234WPB
9	1	WELD CONC, 3" X 2" SCH. 40/80, SA234WPB
10	1	PIPE, 4" SCH. 40 (0.237"), SA106B X 33 1/8" LONG
11	1	PIPE, 4" SCH. 40 (0.237"), SA333GR6 X 10 1/2" LONG
12	1	PIPE, 3" SCH. 40 (0.216"), SA106B X 33 1/4" LONG
13	1	PIPE, 3" SCH. 40 (0.216"), SA106B X 212 1/8" LONG
14	2	PIPE, 2" SCH. 80 (0.218"), SA106B X 20 1/2" LONG
15	2	PIPE, 2" SCH. 80 (0.218"), SA106B X 3 9/16" LONG
16		
17		
18		
19		
20		

REV. No.	MM	DD	YY	DATE	DESCRIPTION	BY	CHK'D	APP'D
3	07	26	18		AS BUILT	JMR	CK	.
2	04	23	18		AS BUILT ADDED SPOOLS 20a and 20b and NOTE	JMR	CK	.
1	12	21	17		SPOOLS 20c & 20d REVISED (MIRRORED ORIENTATION)	CK	CK	.
0	12	06	17		ISSUED FOR CONSTRUCTION	CK	CK	.

ASME B31.3 2014 ED. (NORMAL SERVICE)
 BMS AQP (S) 1009 REGISTERED WELD PROCEDURE 505.2
 FOR PIPING TOLERANCES, SEE WELDER HANDBOOK
 FLUID TYPE: WATER, OIL, GAS
 M.A.W.P.: 285 PSIG (1965 kPag) AT +130°F (+54°C)
 M.D.M.T.: -20°F (-29°C) AT 285 PSIG (1965 kPag)
 P.W.H.T.: 1150°F FOR 60 MIN.
 RADIOGRAPHY: 100%
 CORROSION ALLOWANCE: 1/8"
 HYDROSTATIC TEST: 428 PSIG (2951 kPag)

BROMLEY MECHANICAL SERVICES
 925 - 23rd Street S.W., Medicine Hat, Alberta, Canada, T1A 8R1 (403) 526-3142

CLIENT: ARC RESOURCES LTD.

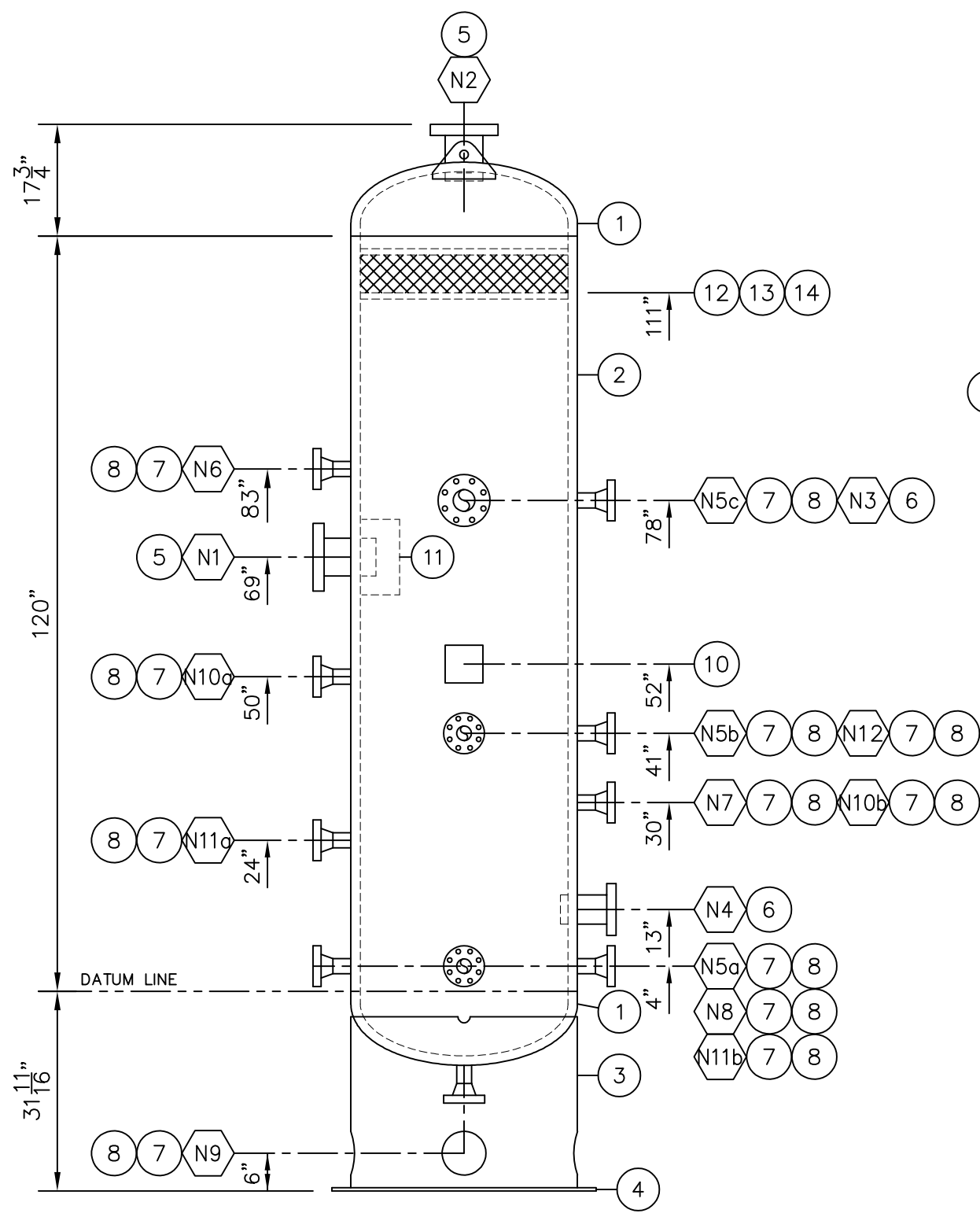
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TITLE: PIPING SPOOLS 20-21

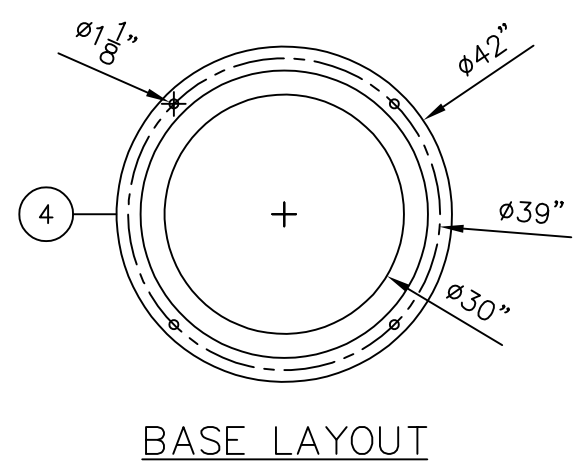
Wo No.: 35528
 DRAWN BY: C. KARPIUK
 DATE: MM/DD/YY 12/06/17

REV. No.: 3
 DATE: MM/DD/YY 07/26/18

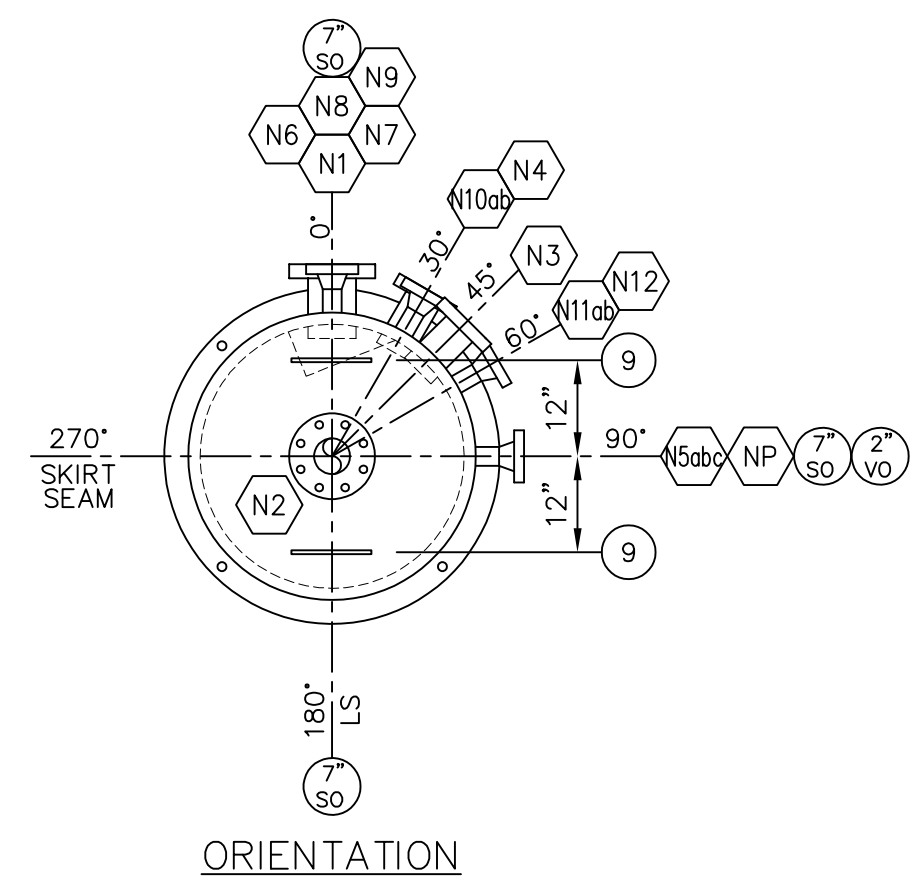
SCALE: 3/8"=1'
 CAD No.35528-SPOOLS-3



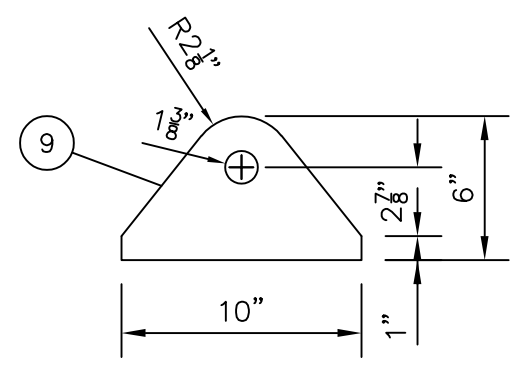
ELEVATION



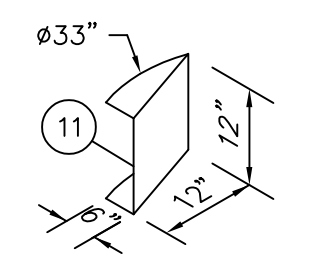
BASE LAYOUT



ORIENTATION



LIFT LUG
N.T.S.



INLET DIVERTER
N.T.S.

WELD DETAIL 1	WELD DETAIL 2	WELD DETAIL 3	WELD DETAIL 4	WELD DETAIL 5	WELD DETAIL 6	WELD DETAIL 7	WELD DETAIL 8	WELD DETAIL 9	WELD DETAIL 10	WELD DETAIL 11	WELD DETAIL 12	WELD DETAIL 13	WELD DETAIL 14	
ROOT: BA-1 F&C: BA-1	ROOT: BA-1 F&C: BA-1	ROOT: BA-1 F&C: BA-1	ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19	ROOT: BM-19 F&C: BA-2 OR BMS-710M HT BM-19	ROOT: BM-2 F&C: BM-2 OR BMS-710M HT BM-19	ROOT: BM-19 F&C: BA-2 OR BM-19	ROOT: BM-2 F&C: BM-2 OR BMS-710M HT BM-19	ROOT: BM-2 F&C: BM-2 OR BMS-710M HT BM-19	ROOT: BM-2 F&C: BM-2 OR BMS-710M HT BM-19	ROOT: BM-2 F&C: BM-2 OR BMS-710M HT BM-19	ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19	ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19	ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19	
WITHOUT BACKING	WITHOUT BACKING	3:1 TRANSITION												
R=1/2" (±1/8") a=60° (±15°)	R=1/2" (±1/8") a=60° (±15°)	R=1/2" (±1/8") a=60° (±15°)	R=1/2" (±1/8") a=75° (±15°)	R=1/2" (±1/8") a=40° (±15°)	R=1/2" (±1/8") a=40° (±15°)	R=1/2" (±1/8") a=40° (±15°)	R=1/2" (±1/8") a=40° (±15°)	R=1/2" (±1/8") a=40° (±15°)	R=1/2" (±1/8") a=40° (±15°)	R=1/2" (±1/8") a=40° (±15°)	R=1/2" (±1/8") a=40° (±15°)	R=1/2" (±1/8") a=40° (±15°)	R=1/2" (±1/8") a=40° (±15°)	
NOZ NO.	REQ'D	SIZE	RATING	TYPE OF SERVICE	OD OF NOZ NECK	PROJECTION OUTSIDE	PROJECTION INSIDE	REIF PAD OD x THK	WELD DETAIL	FILLET WELD SIZE A	FILLET WELD SIZE B	FILLET WELD SIZE C	BILL OF MAT'L ITEM No.	REMARKS
N1	1	4"	600	INLET	6.00"	6	1 1/2	-	5	3/8	5/8	-	5	-
N2	1	4"	600	OUTLET	6.00"	6	1	-	5	3/8	5/8	-	5	INSPECTION
N3	1	3"	600	LSHH	4.62"	6	1 1/2	-	5	5/8	3/4	-	6	-
N4	1	3"	600	TI	4.62"	6	1 1/2	-	5	5/8	3/4	-	6	INSPECTION
N5abc	3	2"	600	BRIDLE CONN.	2.375"	6	-	-	4,6	3/8	-	-	7,8	-
N6	1	2"	600	PSV	2.375"	6	-	-	4,6	3/8	-	-	7,8	-
N7	1	2"	600	DUMP	2.375"	6	-	-	4,6	3/8	-	-	7,8	-
N8	1	2"	600	DUMP	2.375"	6	-	-	4,6	3/8	-	-	7,8	-
N9	1	2"	600	DRAIN	2.375"	6	-	-	4,6	3/8	-	-	7,8	-
N10ab	2	2"	600	LG	2.375"	6	-	-	4,6	3/8	-	-	7,8	-
N11ab	2	2"	600	LG	2.375"	6	-	-	4,6	3/8	-	-	7,8	-
N12	1	2"	600	PIT	2.375"	6	-	-	4,6	3/8	-	-	7,8	-

BILL OF MATERIAL

ITEM	QTY.	DESCRIPTION
1	2	S.E. HEAD, 36"OD X 1.500" NOM. (1.4375" MIN.), SA516-70N, HOT FORMED
2	1	SHELL, 36"OD X 1.500" X 10'-0" LONG, SA516-70N
3	1	ROLLED PLATE, 36"OD X 0.375" X 27 3/16" LONG, SA516-70N
4	1	BASE PLATE - PLATE, 1/2", SA36/44W (SEE DETAIL)
5	2	RFLWN, 4" 600 ANSI X 10" OAL, SA350LF2 CL1
6	2	RFLWN, 3" 600 ANSI X 9" OAL, SA350LF2 CL1
7	12	RFLWN, 2" 600 ANSI SCH. 160, SA105N
8	12	PIPE, 2" SCH. 160 (0.344"), SA106B X 2 7/8" LONG
9	2	LIFT LUG - PLATE, 1", SA516-70N (SEE DETAIL)
10	1	TAG PLATE HOLDER, SA36 & VESSEL ID PLATE, ALUM
11	1	INLET DIVERTER - PLATE, 3/8", SA36/44W (SEE DETAIL)
12	1	DEM 9LB 316LSS, 33"OD X 6"TK, 3 PC, NO GRD
13	40'	FLAT, 1/4" X 1", A36/44W
14	10'	FLAT EXP. METAL, 3/4" X 9LB, CS
15		
16		
17		
18		
19		
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21		
22		
23		
24		
25		

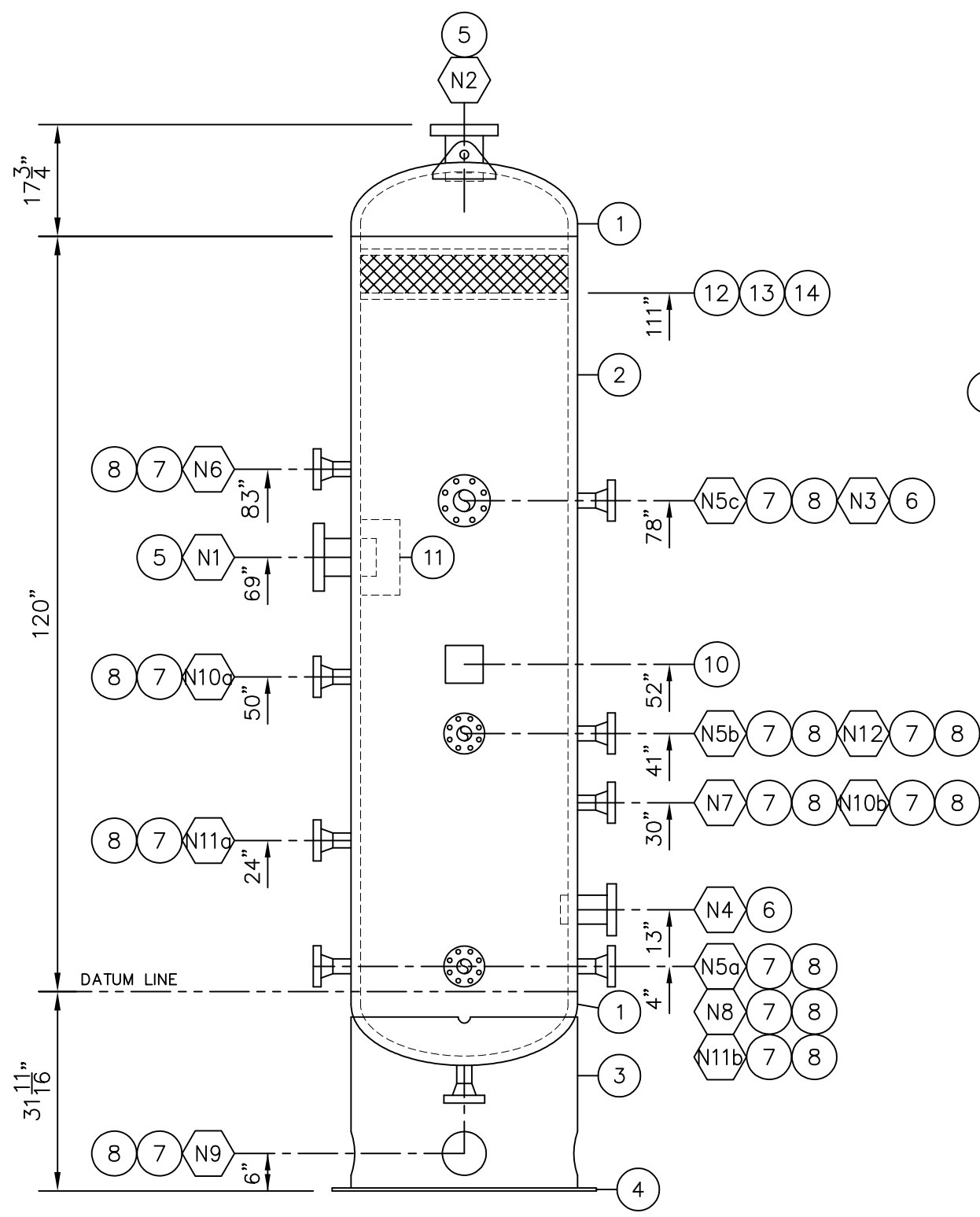
NOTES:
ALL STUD LENGTHS GIVEN ARE THREAD TO THREAD

1	07	26	18	AS BUILT	JMR	CK	-	
0	12	06	17	ISSUED FOR CONSTRUCTION	CK	CK	-	
REV. No.	MM	DD	YY	DESCRIPTION	CALC. No.	BY	CHK'D	SIGN'D

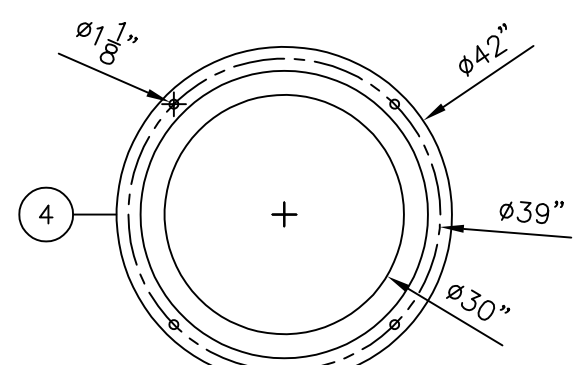
ASME 2015 ED. SEC. VIII DIV. 1

BMS AQP (S) 1009 REGISTERED WELD PROCEDURE 505.2
 FOR VESSEL TOLERANCES, SEE WELDER HANDBOOK
 VESSEL TYPE: VERTICAL
 M.A.W.P.: 1440 PSIG (9929 kPa) AT +130F (+54°C)
 M.D.M.T.: -20F (-29°C) AT 1440 PSIG (9929 kPa)
 IMPACT TESTING: EXEMPT PER UCS66(a)(b) & UG20f (1-5)
 P.W.H.T.: 1150F FOR 90 MIN.
 RADIOGRAPHY: RT-1 CIRC.: FULL LONG: FULL
 JOINT EFFICIENCY: HEADS: 1.00 SHELL: 1.00
 CORROSION ALLOWANCE: 1/8"
 HYDROSTATIC TEST: 1872 PSIG (12907 kPa)
 VOLUME: 64.5ft³ (1.84m³)
 WEIGHT (DRY): 6,600 lb (3000 kg)

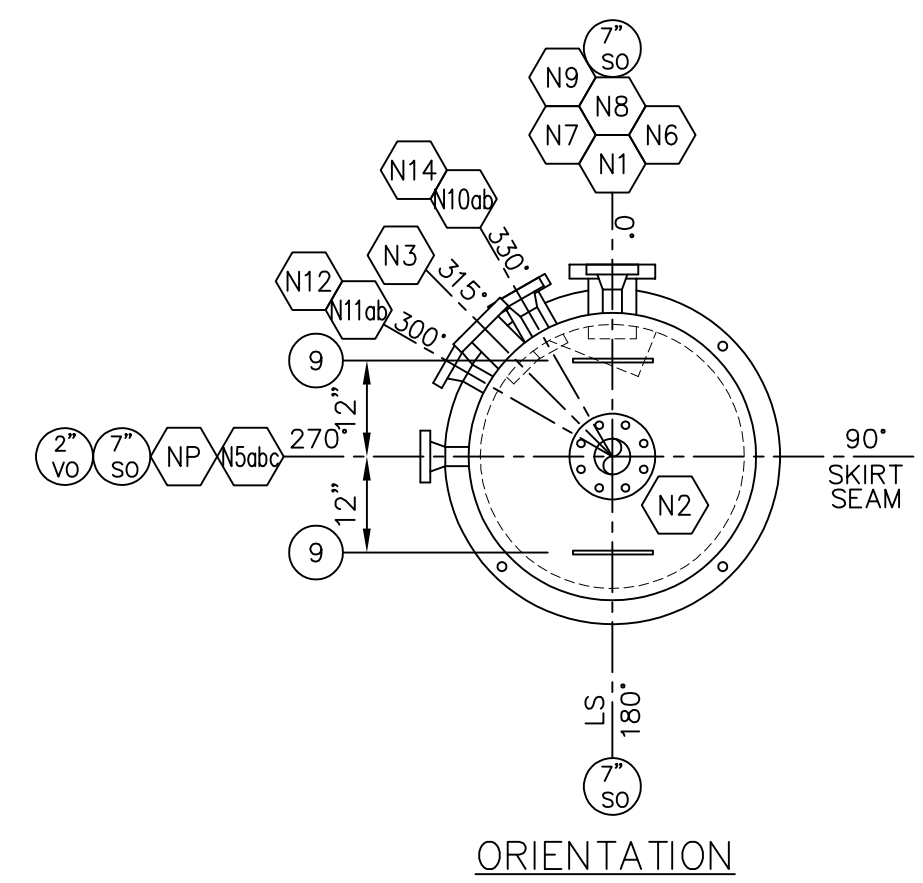
CLIENT:	ARC RESOURCES LTD.	BROMLEY MECHANICAL SERVICES A DIVISION OF ARGO SALES INC 925 23 Street SW, Medicine Hat, Alberta, Canada T1A 8R1 Ph: (403) 528-3142 Fax: (403) 526-1061 Toll Free (800) 215-9806
PROJECT:	TYPICAL DUAL/TEST SEPARATOR PACKAGE	
TITLE:	36"OD X 10'-0" X 1440 PSI TEST SEP.	
CRN:	V4393.231	Wo No.: 35528
DRAWN BY:	C. KARPIUK	REV. No.: 1
DATE: MM/DD/YY	12/06/17	SCALE: 1/2"=1'-0"
SER. No.:	35528-01/02	DATE: MM/DD/YY
CAD No.:	35528-TEST	07/26/18



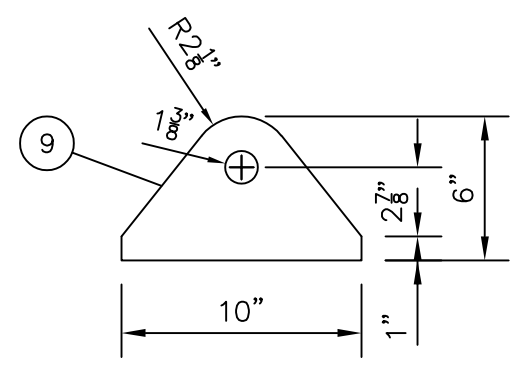
ELEVATION



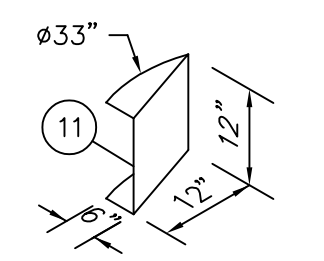
BASE LAYOUT



ORIENTATION



LIFT LUG
N.T.S.



INLET DIVERTER
N.T.S.

BILL OF MATERIAL

ITEM	QTY.	DESCRIPTION
1	2	S.E. HEAD, 36"OD X 1.500" NOM. (1.4375" MIN.), SA516-70N, HOT FORMED
2	1	SHELL, 36"OD X 1.500" X 10'-0" LONG, SA516-70N
3	1	ROLLED PLATE, 36"OD X 0.375" X 27 3/16" LONG, SA516-70N
4	1	BASE PLATE - PLATE, 1/2", SA36/44W (SEE DETAIL)
5	2	RFLWN, 4" 600 ANSI X 10" OAL, SA350LF2 CL1
6	2	RFLWN, 3" 600 ANSI X 9" OAL, SA350LF2 CL1
7	12	RFLWN, 2" 600 ANSI SCH. 160, SA105N
8	12	PIPE, 2" SCH. 160 (0.344"), SA106B X 2 7/8" LONG
9	2	LIFT LUG - PLATE, 1", SA516-70N (SEE DETAIL)
10	1	TAG PLATE HOLDER, SA36 & VESSEL ID PLATE, ALUM
11	1	INLET DIVERTER - PLATE, 3/8", SA36/44W (SEE DETAIL)
12	1	DEM 9LB 316LSS, 33"OD X 6"TK, 3 PC, NO GRD
13	40'	FLAT, 1/4" X 1", A36/44W
14	10'	FLAT EXP. METAL, 3/4" X 9LB, CS
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		

NOTES:
ALL STUD LENGTHS GIVEN ARE THREAD TO THREAD

REV. No.	MM	DD	YY	DATE	DESCRIPTION	CALC. No.	BY	CHK'D	SIGN'D
1	07	26	18		AS BUILT		JMR	CK	.
0	12	06	17		ISSUED FOR CONSTRUCTION		CK	CK	.

ASME 2015 ED. SEC. VIII DIV. 1

BMS AQP (S) 1009 REGISTERED WELD PROCEDURE 505.2
 FOR VESSEL TOLERANCES, SEE WELDER HANDBOOK
 VESSEL TYPE: VERTICAL
 M.A.W.P.: 1440 PSIG (9929 kPa) AT +130F (+54C)
 M.D.M.T.: -20F (-29C) AT 1440 PSIG (9929 kPa)
 IMPACT TESTING: EXEMPT PER UCS66(a)(b) & UG20f (1-5)
 P.W.H.T.: 1150F FOR 90 MIN.
 RADIOGRAPHY: RT-1 CIRC.: FULL LONG: FULL
 JOINT EFFICIENCY: HEADS: 1.00 SHELL: 1.00
 CORROSION ALLOWANCE: 1/8"
 HYDROSTATIC TEST: 1872 PSIG (12907 kPa)
 VOLUME: 64.5ft³ (1.84m³)
 WEIGHT (DRY): 6,600 lb (3000 kg)

WELD DETAIL 1	WELD DETAIL 2	WELD DETAIL 3	WELD DETAIL 4	WELD DETAIL 5	WELD DETAIL 6	WELD DETAIL 7	WELD DETAIL 8	WELD DETAIL 9	WELD DETAIL 10	WELD DETAIL 11	WELD DETAIL 12	WELD DETAIL 13	WELD DETAIL 14
ROOT: BA-1 F&C: BA-1	ROOT: BA-1 F&C: BA-1	ROOT: BA-1 F&C: BA-1	ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19	ROOT: BM-19 F&C: BA-2 OR BM-19	ROOT: BM-2 F&C: BM-2 OR BMS-710M HT BM-19	ROOT: BM-19 F&C: BA-2 OR BM-19	ROOT: BM-2 OR BMS-710M HT BM-19	ROOT: BM-2 F&C: BM-2 OR BMS-710M HT BM-19	ROOT: BM-2 F&C: BM-2 OR BMS-710M HT BM-19	ROOT: BM-2 F&C: BM-2 OR BMS-710M HT BM-19	ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19	ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19	ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19
WITHOUT BACKING	WITHOUT BACKING	3/4" TRANSITION											
R=1/2" (±1/16") a=60° (±15°)	R=1/2" (±1/16") a=60° (±15°)	R=1/2" (±1/16") a=60° (±15°)	R=1/2" (±1/16") a=75° (±15°)	R=1/2" (±1/16") a=40° (±15°)	R=1/2" (±1/16") a=40° (±15°)	R=1/2" (±1/16") a=40° (±15°)	R=1/2" (±1/16") a=40° (±15°)	R=1/2" (±1/16") a=40° (±15°)	R=1/2" (±1/16") a=40° (±15°)	R=1/2" (±1/16") a=40° (±15°)	R=1/2" (±1/16") a=40° (±15°)	R=1/2" (±1/16") a=40° (±15°)	R=1/2" (±1/16") a=40° (±15°)
NOZ NO.	REQ'D	SIZE	RATING	TYPE OF SERVICE	OD OF NOZ NECK	PROJECTION OUTSIDE	REIF PAD INSIDE	OD x THK	WELD DETAIL	FILLET WELD SIZE A B C	BILL OF MAT'L ITEM No.	REMARKS	
N1	1	4"	600	INLET	6.00"	6	1 1/2	.	5	3/8 5/8 .	5	.	
N2	1	4"	600	OUTLET	6.00"	6	1	.	5	3/8 5/8 .	5	INSPECTION	
N3	1	3"	600	LSHH	4.62"	6	1 1/2	.	5	5/8 3/4 .	6	.	
N4	1	3"	600	TI	4.62"	6	1 1/2	.	5	5/8 3/4 .	6	INSPECTION	
N5abc	3	2"	600	BRIDLE CONN.	2.375"	6	.	.	4,6	3/8 . .	7,8	.	
N6	1	2"	600	PSV	2.375"	6	.	.	4,6	3/8 . .	7,8	.	
N7	1	2"	600	DUMP	2.375"	6	.	.	4,6	3/8 . .	7,8	.	
N8	1	2"	600	DUMP	2.375"	6	.	.	4,6	3/8 . .	7,8	.	
N9	1	2"	600	DRAIN	2.375"	6	.	.	4,6	3/8 . .	7,8	.	
N10ab	2	2"	600	LG	2.375"	6	.	.	4,6	3/8 . .	7,8	.	
N11ab	2	2"	600	LG	2.375"	6	.	.	4,6	3/8 . .	7,8	.	
N12	1	2"	600	PIT	2.375"	6	.	.	4,6	3/8 . .	7,8	.	

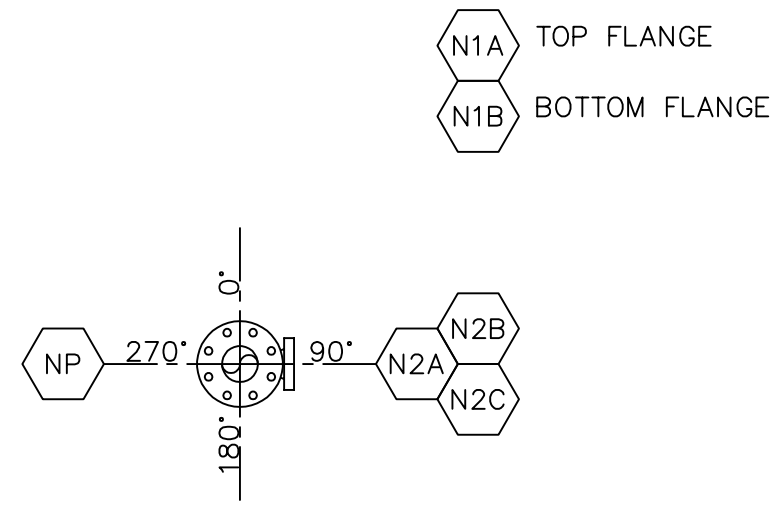
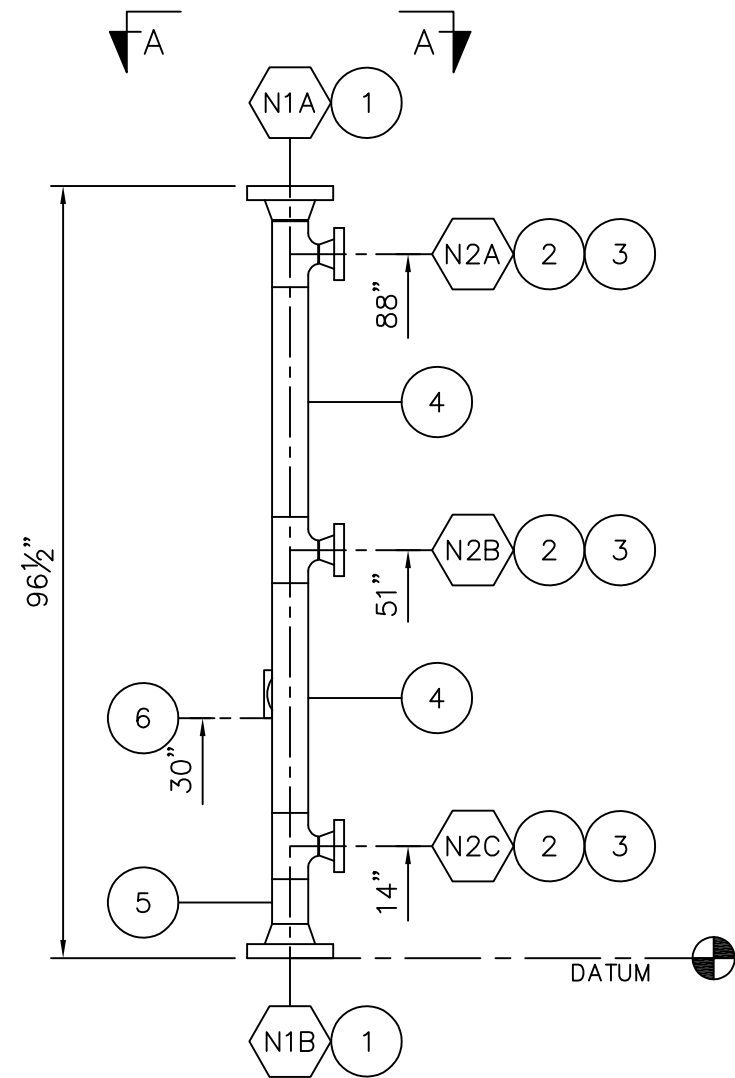
CLIENT: **ARC RESOURCES LTD.**

BROMLEY MECHANICAL SERVICES
 A DIVISION OF ARGO SALES INC
 925 23 Street SW, Medicine Hat, Alberta, Canada T1A 8R1
 Ph: (403) 526-3142 Fax: (403) 526-1061
 Toll Free (800) 215-9806

PROJECT: **TYPICAL DUAL/TEST SEPARATOR PACKAGE**

TITLE: **36"OD X 10'-0" X 1440 PSI GROUP SEP.**

CRN: V4393.231	Wo No.: 35528	SER. No.: 35528-03/04
DRAWN BY: C. KARPIUK	REV. No.: 1	DATE: MM/DD/YY 07/26/18
DATE: MM/DD/YY 12/06/17	SCALE: 1/2"=1'-0"	CAD No.: 35528-GROUP



SECTION VIEW 'A-A'

FRONT VIEW

NOTE: TWO (2) BRIDLES REQUIRED PER PACKAGE

INSIDE & OUTSIDE OF NOZZLE BE ROUNDED PER UG-76(C)

WELD DETAIL 1	WELD DETAIL 2	WELD DETAIL 3	WELD DETAIL 4	WELD DETAIL 5	WELD DETAIL 6	WELD DETAIL 7	WELD DETAIL 8	WELD DETAIL 9	WELD DETAIL 10	WELD DETAIL 11	WELD DETAIL 12	WELD DETAIL 13	WELD DETAIL 14
ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19	ROOT: BA-1 OR BM-19 F&C: BA-1 OR BM-19	ROOT: BA-1 OR BM-19 F&C: BA-1 OR BM-19	ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19	ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19	ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19	ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19	ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19	ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19	ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19	ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19	ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19	ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19	ROOT: BA-2 OR BM-19 F&C: BA-2 OR BM-19
WITHOUT BACKING R=1/8" (±1/8") α=60° (±15°) h=1/16" (±1/16")	WITHOUT BACKING R=1/8" (±1/8") α=60° (±15°) h=1/16" (±1/16")	3" TRANSITION R=1/8" (±1/8") α=60° (±15°) h=1/16" (±1/16")	R=1/8" (±1/8") α=75° (±15°)	R=1/8" (±1/8") α=40° (±15°) h=1/16" (±1/16")	R=1/8" (±1/8") α=40° (±15°) h=1/16" (±1/16")	R=1/8" (±1/8") α=40° (±15°) h=1/16" (±1/16")	R=1/8" (±1/8") α=40° (±15°) h=1/16" (±1/16")	R=1/8" (±1/8") α=40° (±15°) h=1/16" (±1/16")	R=1/8" (±1/8") α=40° (±15°) h=1/16" (±1/16")	R=1/8" (±1/8") α=40° (±15°) h=1/16" (±1/16")	R=1/8" (±1/8") α=MIN. 30° h=1/16" (±1/16")	TYPICAL NON-PRESSURE ATTACHMENT WELD	TYPICAL NON-PRESSURE WELD (LUSS, DAVIT ARMS)

NOZ NO.	NO. REQ'D	SIZE	RATING	TYPE OF SERVICE	OD OF NOZ NECK	PROJECTION OUTSIDE	REIF PAD OD x THK	WELD DETAIL	FILLET WELD SIZE	BILL OF MAT'L ITEM No.	REMARKS
N1A	1	4"	600 ANSI	HEADS	4.500"	A/R	.	4	.	1	INSPECTION
N1B	1	4"	600 ANSI	HEADS	4.500"	A/R	.	4	.	1	INSPECTION
N2A	1	2"	600 ANSI	VESSEL CONN.	2.375"	A/R	.	4	.	2,3	.
N2B	1	2"	600 ANSI	VESSEL CONN.	2.375"	A/R	.	4	.	2,3	.
N2C	1	2"	600 ANSI	VESSEL CONN.	2.375"	A/R	.	4	.	2,3	.

BILL OF MATERIAL

ITEM	QTY.	DESCRIPTION
1	2	RFWN, 4" 600 ANSI SCH. 160, SA105N
2	3	RFWN, 2" 600 ANSI SCH. 160, SA105N
3	3	WELD RED TEE, 4" X 2" SCH. 160, SA234WPB
4	2	PIPE, 4" SCH.160 (0.531"), SA106B, 28-3/4" LONG
5	1	PIPE, 4" SCH.160 (0.531"), SA106B, 5-5/8" LONG
6	1	TAG PLATE HOLDER, SA36 & VESSEL ID PLATE, ALUM
7	.	.
8	.	.
9	.	.
10	.	.

NOTE:
TWO (2) BRIDLES REQUIRED PER PACKAGE

1	07	26	18	AS BUILT	JMR	CK		
0	12	06	17	ISSUED FOR CONSTRUCTION	CK	CK		
REV. No.	MM	DD	YY	DESCRIPTION	CALC NO.	BY	CHK'D	SIGN'D

ASME 2015 ED. SEC. VIII DIV. I

BMS AQP (S) 1009 REGISTERED WELD PROCEDURE 505.2
FOR VESSEL TOLERANCES, SEE WELDER HANDBOOK

VESSEL TYPE: BRIDLE

M.A.W.P.: 1440 PSIG (9929 kPa) AT +130°F (+54°C)

M.D.M.T.: -20°F (-29°C) AT 1440 PSIG (9929 kPa)

IMPACT TESTING EXEMPT PER, UG20f (1-5)

P.W.H.T.: 1150°F FOR 60 MIN.

RADIOGRAPHY: RT-1 CIRC.: FULL LONG: SMLS

JOINT EFFICIENCY: HEADS: 1.00 SHELL: 1.00

CORROSION ALLOWANCE: 1/8"

HYDROSTATIC TEST: 1872 PSIG (12907 kPa)

VOLUME: 0.53ft³ (0.02 m³)

WEIGHT (DRY): 285 lb. (130 kg)

CLIENT: ARC RESOURCES LTD.

925 23 Street SW, Medicine Hat, Alberta, Canada T1A 8R1
Ph: (403) 526-3142 Fax: (403) 526-1061
Toll Free (800) 215-9806

PROJECT: TYPICAL DUAL/TEST SEPARATOR PACKAGE

TITLE: 4"NPS X 88"S/S X 1440 PSI BRIDLE

C.R.N.: OH18137.2	Wo No.: 35528	SERIAL No.: 35528-F05/F06/F07/F08
DRAWN BY: C KARPIUK	REV. No.: 1	DATE: MM/DD/YY 07/26/18
DATE: MM/DD/YY 12/06/17	SCALE: 1/2"=1'-0"	CAD No.: 35528-BRIDLE


INSTRUMENTS

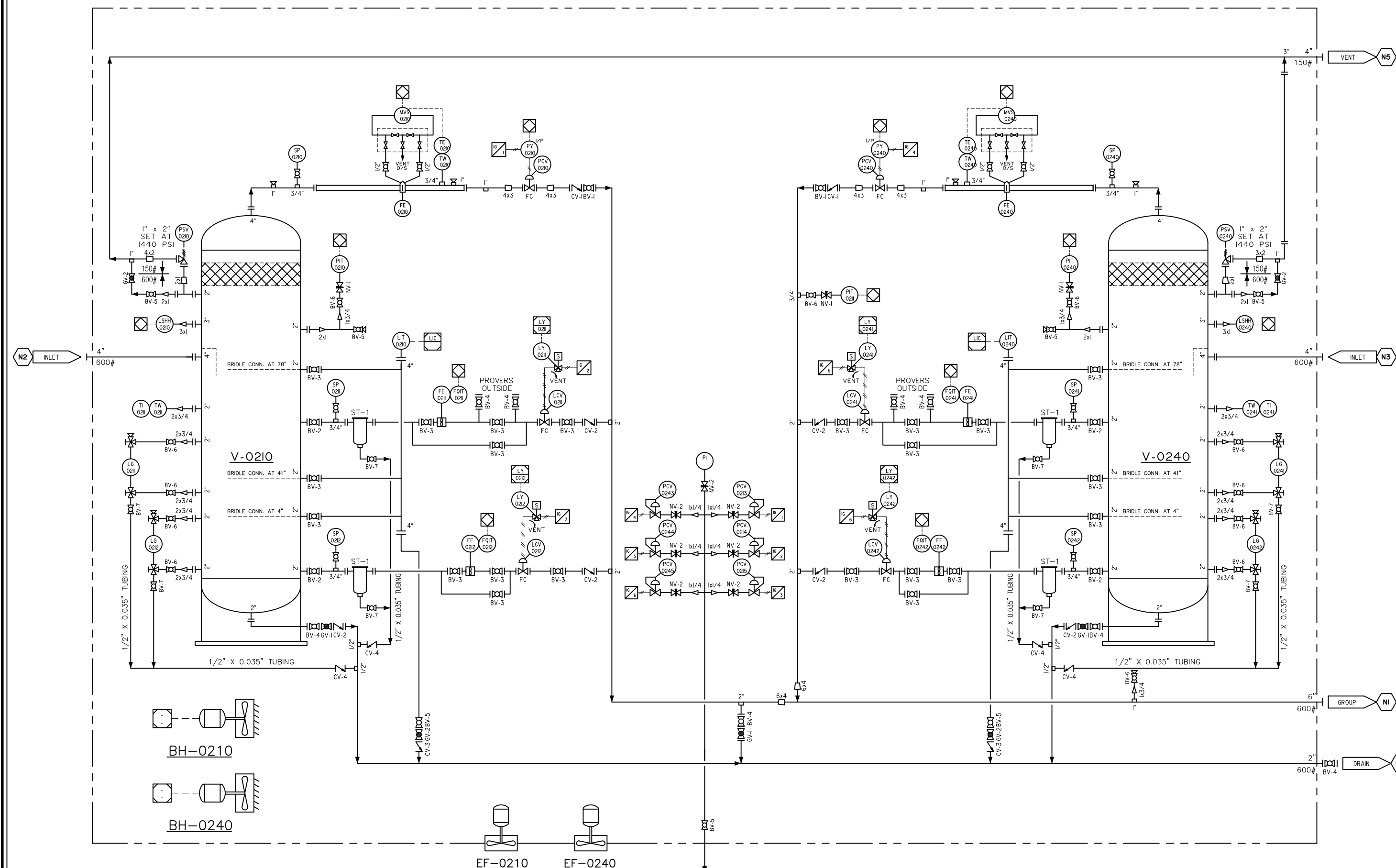
TAG No.	DESCRIPTION
BH-0210/0240	RUFFNECK ELECTRIC HEATER, MODEL FX512-240160-100-W-T, 1" NPT CONNECTIONS, EXP. PROOF
V-0210/0240	36"OD X 10'-0"S/S X 1440 PSI VERTICAL SEPARATOR, SOUR
EF 0210/0240	EXPLOSION PROOF BUILDING FAN TO PROVIDE 12 ACPH, IIS/208-230VAC, 1PH, 60Hz, 1/4 HP
FE 0210/0240	(CUSTOMER SUPPLIED)
FE/FQIT 0210/0212	SURFLO TURBINE METER, 2" 600 ANSI FLANGED 16" F/F 2" SCH. 160 C/W MAG PICKUP AND MC-III TOTALIZER
FE/FQIT 0241/0242	SURFLO TURBINE METER, 2" 600 ANSI FLANGED 16" F/F 2" SCH. 160 C/W MAG PICKUP AND MC-III TOTALIZER
MVS/TE/TW 0210	(CUSTOMER SUPPLIED)
MVS/TE/TW 0240	(CUSTOMER SUPPLIED)
LCV 0211/0212	FISHER D4 CONTROL VALVE, 2" 600 ANSI CW 1-1/4" TUNGSTEN TRIM, NACE
LY 0211/0212	ASCO SOLENOID 1/4" NPT, MODEL EF8320G202-24VDC
LCV 0241/0242	FISHER D4 CONTROL VALVE, 2" 600 ANSI CW 1-1/4" TUNGSTEN TRIM, NACE
LY 0241/0242	ASCO SOLENOID 1/4" NPT, MODEL EF8320G202-24VDC
LG 0211/0212	QUALITY Q24-T-32 LEVEL GAUGE C/W GAUGE COCKS, NACE
LG 0241/0242	QUALITY Q24-T-32 LEVEL GAUGE C/W GAUGE COCKS, NACE
LIT 0210/0240	ROSEMOUNT 5302 GWR, 4" 600 ANSI, 8' LONG PROBE e/w REMOTE MOUNT CABLES
LSHH 0210/0240	ROSEMOUNT 2120 VIBRATING FORK, 1" NPT
PCV/PY 0210/0240	FISHER 667-ET, 3" 600 ANSI, E0% TRIM, FC C/W DVC-6200 12P/POSITIONER
PCV 0213-0215	FISHER 67CFR, 1/4", 0-35 PSI
PCV 0243-0245	FISHER 67CFR, 1/4", 0-35 PSI
PIT 0210/0240	(CUSTOMER SUPPLIED)
PIT 0211	(CUSTOMER SUPPLIED)
PSV 0210/0240	FARRIS 1" 600 ANSI X 2" 150 ANSI 'E' ORIFICE, MODEL 26EAI3-120/00
SP 0210-0212	WELKER SP-2, 3/4" GAS SAMPLE PROBE
SP 0240-0242	WELKER SP-2, 3/4" GAS SAMPLE PROBE
TI/TW 0211/0241	WGI TI, 3" F X 6" ST, 0/250F C/W WGI TOW, 3/4" X 1/2" X 6", 316SS

VALVES & SPECIAL ITEMS

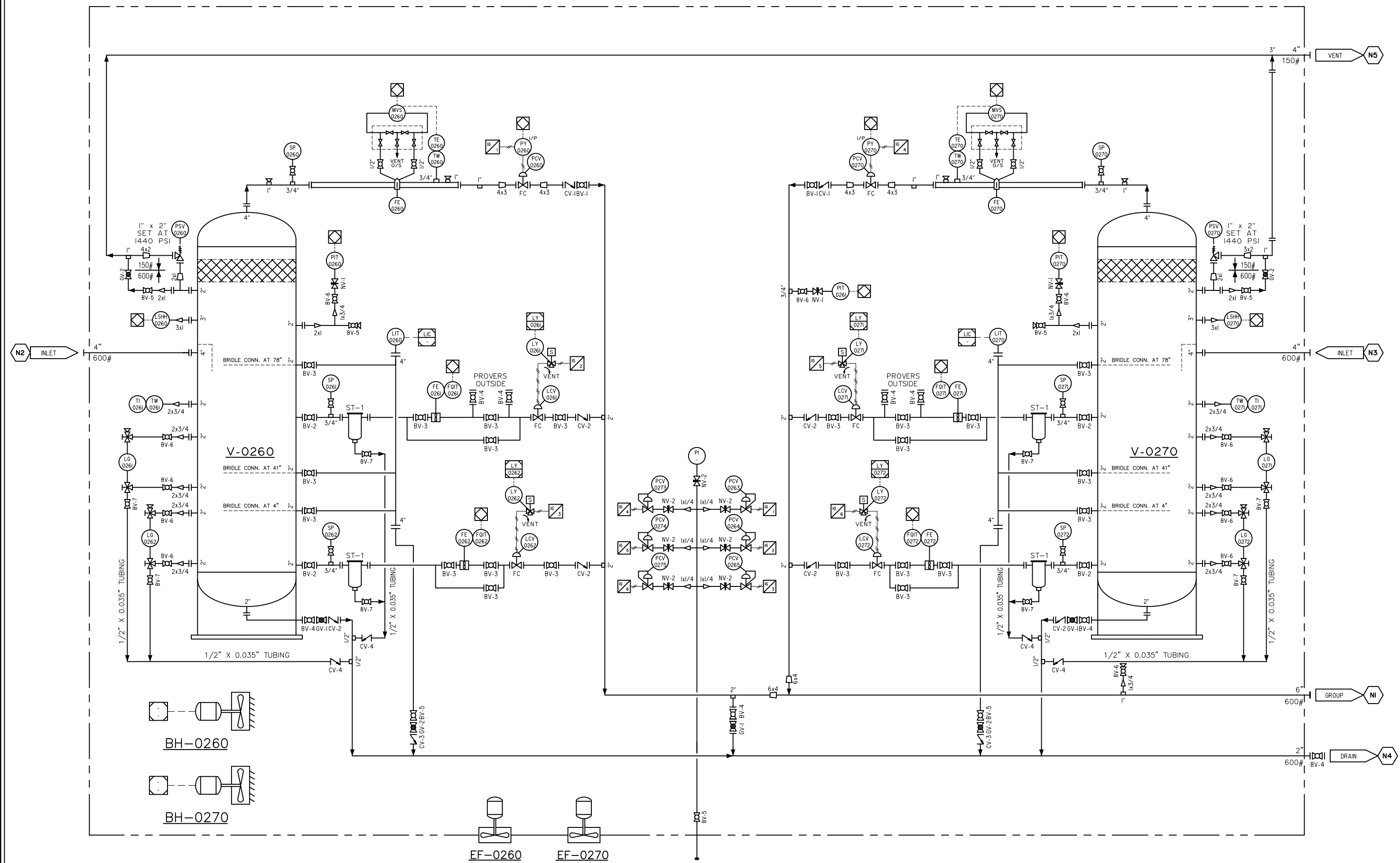
ITEM	QTY.	DESCRIPTION
BV-1	2	WKM BV, 4" 600 ANSI RF FP TRUNION, NACE
BV-2	4	WKM BV, 2" 600 ANSI RF FP DBB FLOATING, NACE
BV-3	20	WKM BV, 2" 600 ANSI RF FP DBB TRUNION, NACE
BV-4	8	WKM BV, 2" 600 ANSI RF FP FLOATING, NACE
BV-5	7	WKM BV, 1" NPT 3M RP, NACE
BV-6	12	WKM BV, 3/4" NPT 3M FP, NACE
BV-7	8	WKM BV, 1/2" NPT 3M FP, NACE
CV-1	2	WHEATLEY CHECK VALVE, 4" 600 ANSI, NACE
CV-2	6	WHEATLEY CHECK VALVE, 2" 600 ANSI, NACE
CV-3	2	WHEATLEY CHECK VALVE, 1" NPT, 3600 PSI, NACE
CV-4	4	WHEATLEY CHECK VALVE, 1/2" NPT, 3600 PSI, NACE
GV-1	2	VELAN GLOBE VALVE, 2" 600 ANSI, NACE
GV-2	4	VELAN GLOBE VALVE, 1" NPT CLASS 800, NACE
NV-1	3	WGI NV, 3/4" X 1/2" MXF, 316SS
NV-2	7	WGI NV, 1/4" MXF, 316SS
ST-1	4	ALTA BASKET STRAINER, 2" 600 ANSI, NACE

1	07	26	18	AS BUILT	CK	.	.
	12	06	17				
REV. No.	MM	DD	YY	DESCRIPTION	BY	CHK'D	SIGN'D

CLIENT		 925 23 Street SW, Medicine Hat, Alberta, Canada T1A 8R1 Ph: (403) 526-3142 Fax: (403) 526-1061 Toll Free (800) 215-9806
ARC RESOURCES LTD.		
PROJECT		
TYPICAL DUAL/TEST SEPARATOR PACKAGE		
TITLE		
P&ID-1		
WO No.:	35528	DATE: MM/DD/YY 07/26/18
DRAWN BY:	C. KARPIUK	REVISION: 2
DATE: MM/DD/YY 10/11/17	SCALE: N.T.S.	CAD No.: 35528-P&ID-1



NOTES:
 ALL TUBING TO BE 316SS
 PROCESS/SENSING: 1/2" X 0.049" W.T. 316SS SMLS TUBING
 INSTRUMENT LINES: 3/8" X 0.035" W.T. 316SS SMLS TUBING
 ALL TUBE FITTINGS TO BE SWAGelok SS
 ALL PROCESS TUBING LINES TO BE HYDRO TESTED AT 1.5 TIMES MAWP
 VENT ALL INSTRUMENTS OUTSIDE
 APPROXIMATE SHIPPING DIMENSIONS ARE 13'-3" X 26'-0" X 14'-6" HIGH
 PACKAGE WEIGHT IS APPROXIMATELY 55,000 LBS
 VENT ALL INSTRUMENTS TO COMMON HEADER
 ALL SOLENOIDS TO BE LOW WATT
 NO BAR STOCK VALVES ALLOWED



NOTES:
 ALL TUBING TO BE 316SS
 PROCESS/SENSING: 1/2" X 0.049" W.T. 316SS SMLS TUBING
 INSTRUMENT LINES: 3/8" X 0.035" W.T. 316SS SMLS TUBING
 ALL TUBE FITTINGS TO BE SWAGelok SS
 ALL PROCESS TUBING LINES TO BE HYDRO TESTED AT 1.5 TIMES MAWP
 VENT ALL INSTRUMENTS OUTSIDE
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 PACKAGE WEIGHT IS APPROXIMATELY 55,000 LBS
 VENT ALL INSTRUMENTS TO COMMON HEADER
 ALL SOLENOIDS TO BE LOW WATT
 NO BAR STOCK VALVES ALLOWED


INSTRUMENTS

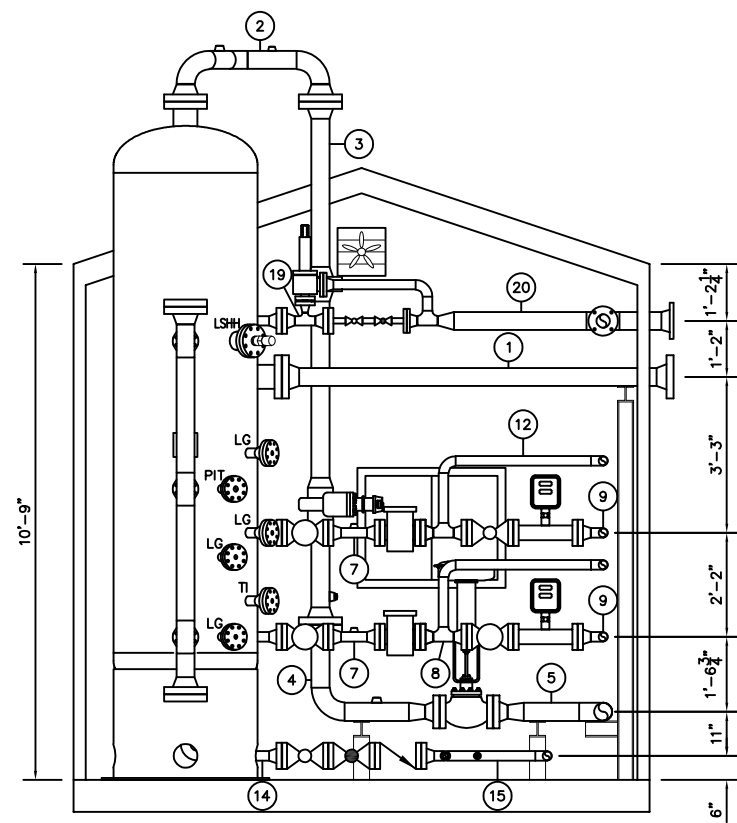
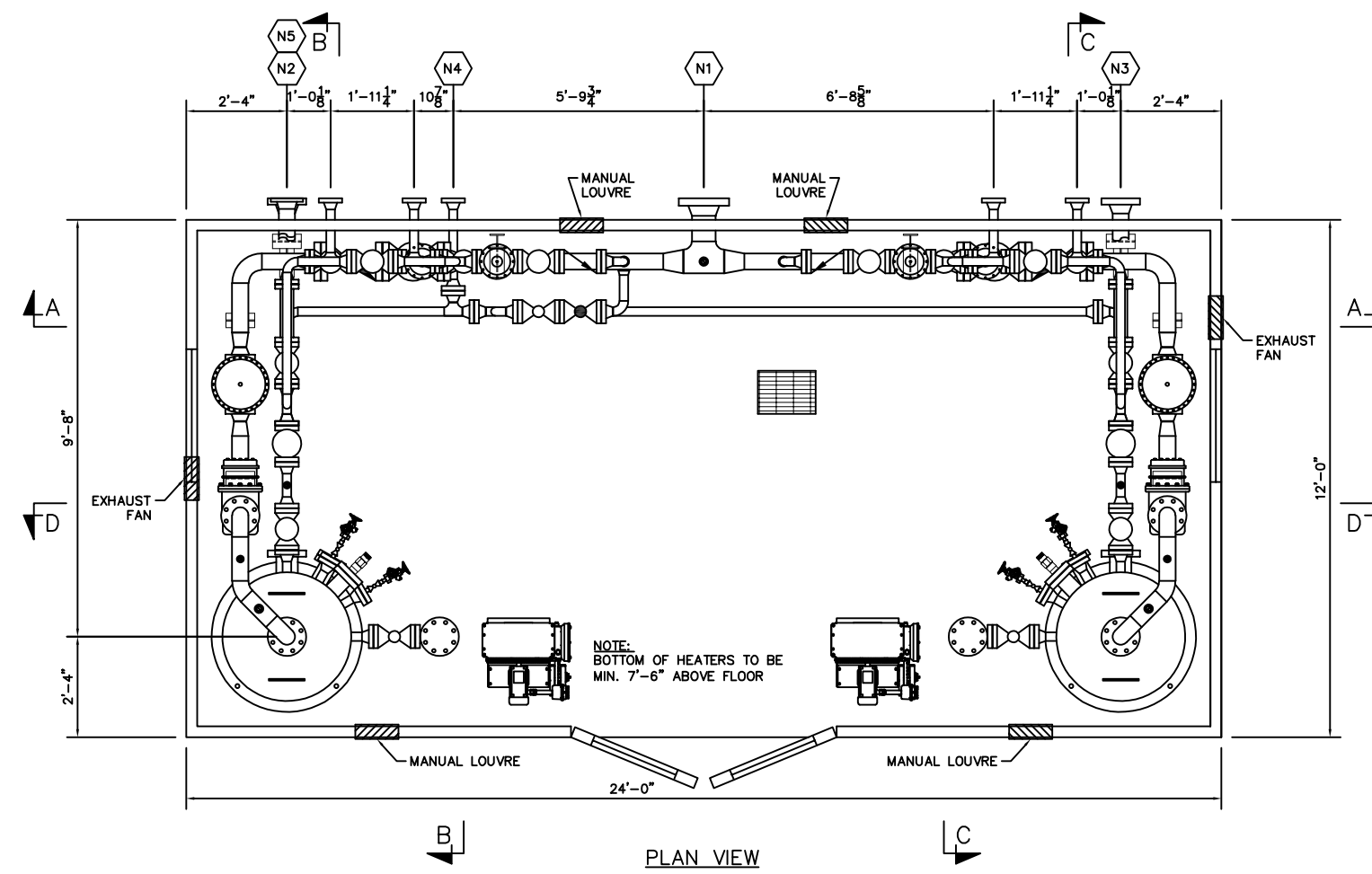
TAG No.	DESCRIPTION
BH-0260/0270	RUFFNECK ELECTRIC HEATER, MODEL FX512-240160-100-W-T, 1" NPT CONNECTIONS, EXP. PROOF
V-0260/0270	36"OD X 10'-0"S/S X 1440 PSI VERTICAL SEPARATOR, SOUR
EF 0260/0270	EXPLOSION PROOF BUILDING FAN TO PROVIDE 12 ACPH, IIS/208-230VAC, 1PH, 60Hz, 1/4 HP
FE 0260/0270	(CUSTOMER SUPPLIED)
FE/FQIT 0261/0262	SURFLO TURBINE METER, 2" 600 ANSI FLANGED 16" F/F 2" SCH. 160 C/W MAG PICKUP AND MC-III TOTALIZER
FE/FQIT 0271/0272	SURFLO TURBINE METER, 2" 600 ANSI FLANGED 16" F/F 2" SCH. 160 C/W MAG PICKUP AND MC-III TOTALIZER
MVS/TE/TW 0260	(CUSTOMER SUPPLIED)
MVS/TE/TW 0270	(CUSTOMER SUPPLIED)
LCV 0261/0262	FISHER D4 CONTROL VALVE, 2" 600 ANSI CW I-1/4" TUNGSTEN TRIM, NACE
LY 0261/0262	ASCO SOLENOID 1/4" NPT, MODEL EF8320G202-24VDC
LCV 0271/0272	FISHER D4 CONTROL VALVE, 2" 600 ANSI CW I-1/4" TUNGSTEN TRIM, NACE
LY 0271/0272	ASCO SOLENOID 1/4" NPT, MODEL EF8320G202-24VDC
LG 0261/0262	QUALITY Q24-T-32 LEVEL GAUGE C/W GAUGE COCKS, NACE
LG 0271/0272	QUALITY Q24-T-32 LEVEL GAUGE C/W GAUGE COCKS, NACE
LIT 0260/0270	ROSEMOUNT 5302 GWR, 4" 600 ANSI, 8' LONG PROBE e/w REMOTE MOUNT CABLES
LSHH 0260/0270	ROSEMOUNT 2120 VIBRATING FORK, 1" NPT
PCV/PVY 0260/0270	FISHER 667-ET, 3" 600 ANSI, E0% TRIM, FC C/W DVC-6200 12P/POSITIONER
PCV 0263-0265	FISHER 67CFR, 1/4", 0-35 PSI
PCV 0273-0275	FISHER 67CFR, 1/4", 0-35 PSI
PIT 0260/0270	(CUSTOMER SUPPLIED)
PIT 0261	(CUSTOMER SUPPLIED)
PSV 0260/0270	FARRIS 1" 600 ANSI X 2" 150 ANSI 'E' ORIFICE, MODEL 26EAI3-120/00
SP 0260-0262	WELKER SP-2, 3/4" GAS SAMPLE PROBE
SP 0270-0272	WELKER SP-2, 3/4" GAS SAMPLE PROBE
TI/TW 0261/0271	WGI TI, 3" F X 6" ST, 0/250F C/W WGI TOW, 3/4" X 1/2" X 6", 316SS

VALVES & SPECIAL ITEMS

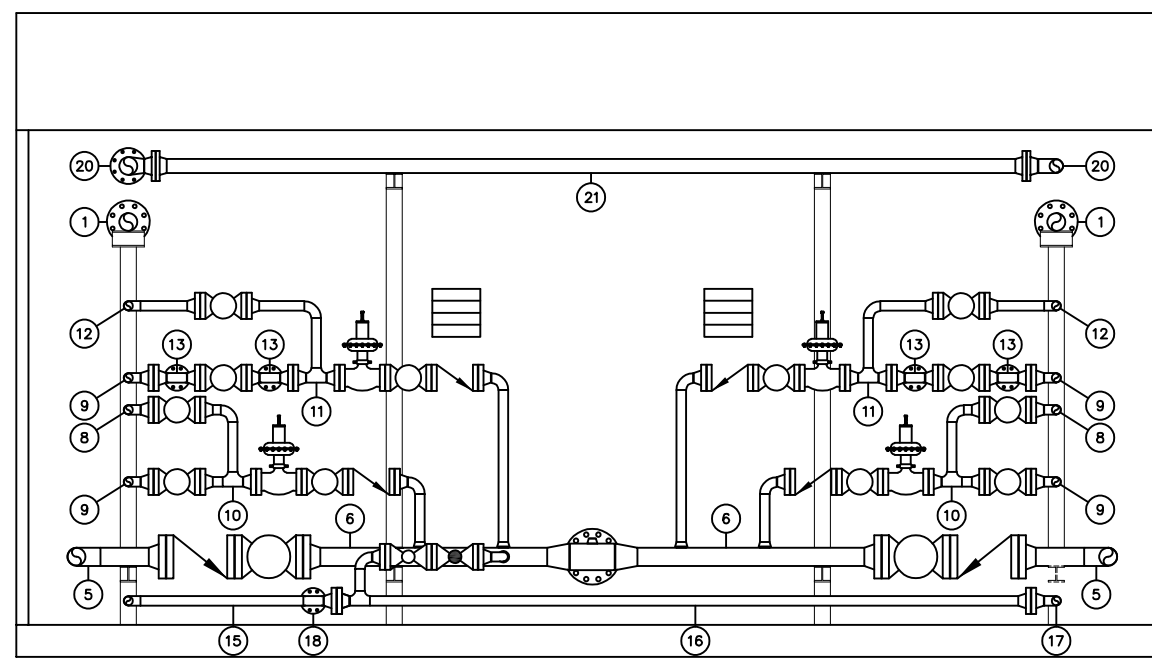
ITEM	QTY.	DESCRIPTION
BV-1	2	WKM BV, 4" 600 ANSI RF FP TRUNION, NACE
BV-2	4	WKM BV, 2" 600 ANSI RF FP DBB FLOATING, NACE
BV-3	20	WKM BV, 2" 600 ANSI RF FP DBB TRUNNION, NACE
BV-4	8	WKM BV, 2" 600 ANSI RF FP FLOATING, NACE
BV-5	7	WKM BV, 1" NPT 3M RP, NACE
BV-6	12	WKM BV, 3/4" NPT 3M FP, NACE
BV-7	8	WKM BV, 1/2" NPT 3M FP, NACE
CV-1	2	WHEATLEY CHECK VALVE, 4" 600 ANSI, NACE
CV-2	6	WHEATLEY CHECK VALVE, 2" 600 ANSI, NACE
CV-3	2	WHEATLEY CHECK VALVE, 1" NPT, 3600 PSI, NACE
CV-4	4	WHEATLEY CHECK VALVE, 1/2" NPT, 3600 PSI, NACE
GV-1	2	VELAN GLOBE VALVE, 2" 600 ANSI, NACE
GV-2	4	VELAN GLOBE VALVE, 1" NPT CLASS 800, NACE
NV-1	3	WGI NV, 3/4" X 1/2" MXF, 316SS
NV-2	7	WGI NV, 1/4" MXF, 316SS
ST-1	4	ALTA BASKET STRAINER, 2" 600 ANSI, NACE

AS BUILT	07	26	18	CK		
ISSUED FOR CONSTRUCTION	II	08	17	CK		
DESCRIPTION	REV.	MM	DD	YY	DATE	BY
DESCRIPTION	BY	CHK'D	SIGN'D			

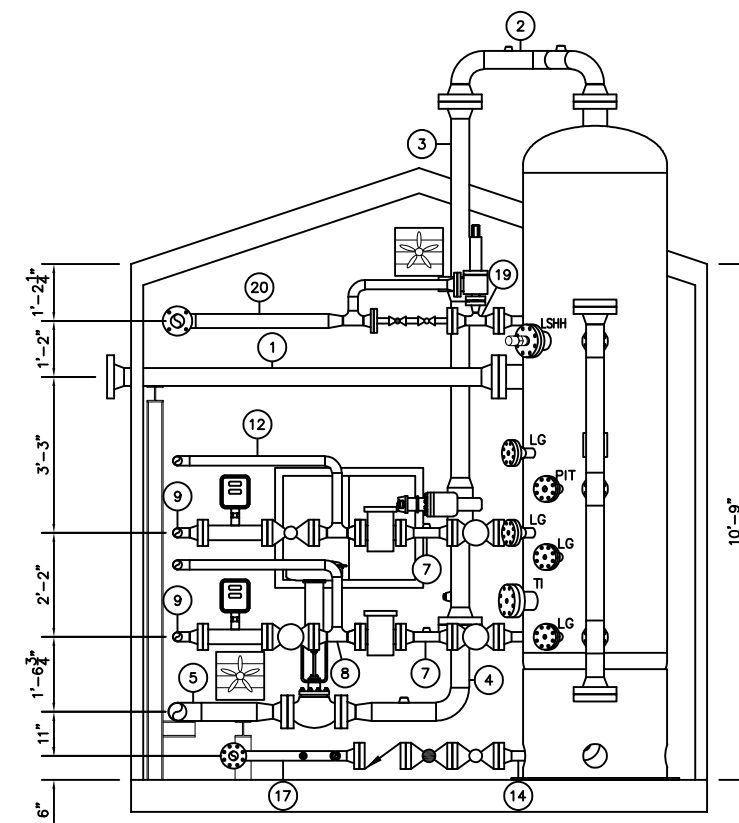
CLIENT		 925 23 Street SW, Medicine Hat, Alberta, Canada T1A 8R1 Ph: (403) 526-3142 Fax: (403) 526-1061 Toll Free (800) 215-9806
ARC RESOURCES LTD.		
PROJECT		TYPICAL DUAL/TEST SEPARATOR PACKAGE
TITLE		P&ID-2
WO No.: 35528	REVISION: 2	DATE: MM/DD/YY 07/26/18
DRAWN BY: C. KARPIUK	SCALE: N.T.S.	CAD No.: 35528-P&ID-2
DATE: MM/DD/YY 10/11/17		



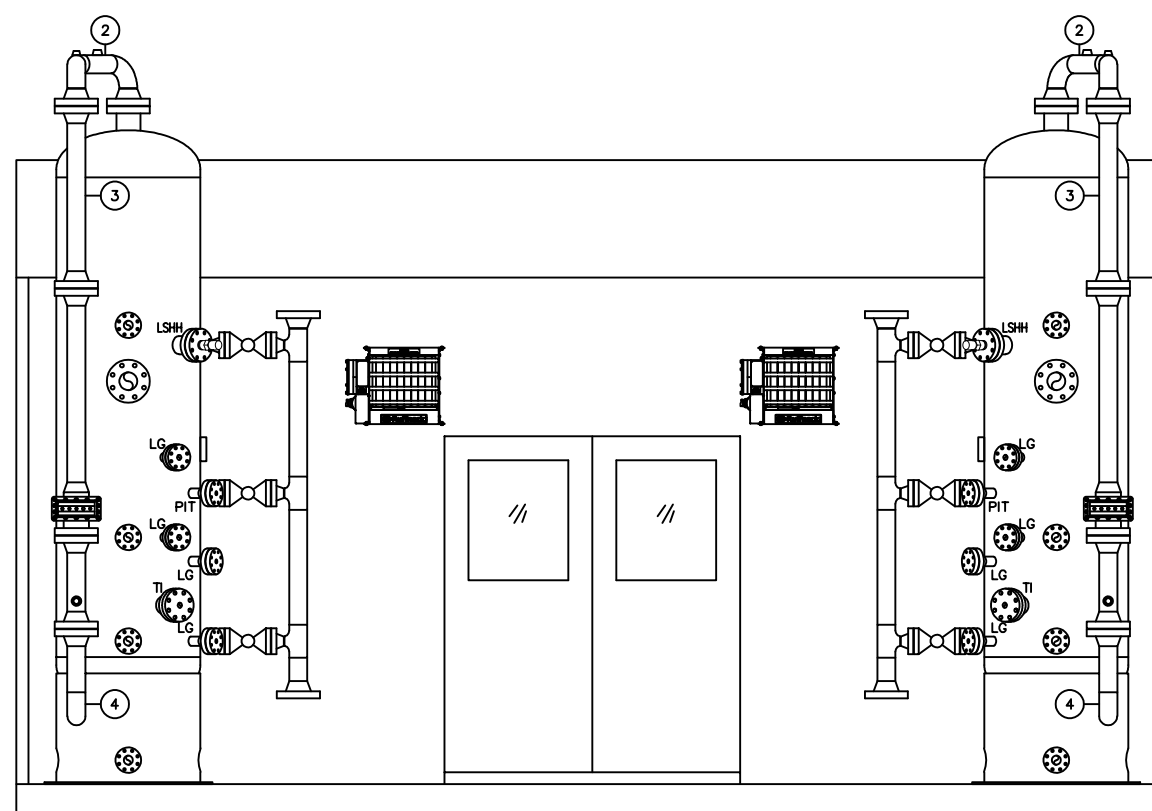
SECTION 'B'



SECTION 'A'



SECTION 'C'



SECTION 'D'

BILL OF MATERIAL

ITEM	QTY.	DESCRIPTION
1	1	SPOOL 1 - SEE DRAWING 35528-SPOOLS-1
2	1	SPOOL 2 - SEE DRAWING 35528-SPOOLS-1
3	1	SPOOL 3 - SEE DRAWING 35528-SPOOLS-1
4	1	SPOOL 4 - SEE DRAWING 35528-SPOOLS-1
5	1	SPOOL 5 - SEE DRAWING 35528-SPOOLS-1
6	1	SPOOL 6 - SEE DRAWING 35528-SPOOLS-1
7	1	SPOOL 7 - SEE DRAWING 35528-SPOOLS-1
8	1	SPOOL 8 - SEE DRAWING 35528-SPOOLS-2
9	1	SPOOL 9 - SEE DRAWING 35528-SPOOLS-2
10	1	SPOOL 10 - SEE DRAWING 35528-SPOOLS-2
11	1	SPOOL 11 - SEE DRAWING 35528-SPOOLS-2
12	1	SPOOL 12 - SEE DRAWING 35528-SPOOLS-2
13	1	SPOOL 13 - SEE DRAWING 35528-SPOOLS-2
14	1	SPOOL 14 - SEE DRAWING 35528-SPOOLS-2
15	1	SPOOL 15 - SEE DRAWING 35528-SPOOLS-2
16	1	SPOOL 16 - SEE DRAWING 35528-SPOOLS-2
17	1	SPOOL 17 - SEE DRAWING 35528-SPOOLS-2
18	1	SPOOL 18 - SEE DRAWING 35528-SPOOLS-2
19	1	SPOOL 19 - SEE DRAWING 35528-SPOOLS-2
20	1	SPOOL 20 - SEE DRAWING 35528-SPOOLS-3
21	1	SPOOL 21 - SEE DRAWING 35528-SPOOLS-3
22	2	RFHB, 4" 600 ANSI TAPPED 1", SA105N
23	2	RFHB, 3" 600 ANSI TAPPED 2", SA105N
24	2	RFHB, 3" 600 ANSI TAPPED 3/4", SA105N
25	4	RFHB, 2" 600 ANSI TAPPED 1", SA105N
26	8	RFHB, 2" 600 ANSI TAPPED 3/4", SA105N
27	2	RFHB, 2" 150 ANSI TAPPED 1", SA105N
28	18	316 SPIRALWIND GSKT, 4" 600 ANSI, NASB
29	8	316 SPIRALWIND GSKT, 3" 600 ANSI, NASB
30	108	316 SPIRALWIND GSKT, 2" 600 ANSI, NASB
31	2	316 SPIRALWIND GSKT, 1" 600 ANSI, NASB
32	2	316 SPIRALWIND GSKT, 3" 150 ANSI, NASB
33	2	316 SPIRALWIND GSKT, 2" 150 ANSI, NASB
34	144	B7M STUD, 7/8" X 5 3/4", SA193-B7M
35	64	B7M STUD, 3/4" X 5", SA193-B7M
36	8	B7M STUD, 3/4" X 4 1/4", SA193-B7M
37	864	B7M STUD, 5/8" X 4 1/4", SA193-B7M
38	16	B7M STUD, 5/8" X 3 1/2", SA193-B7M
39	16	B7M STUD, 5/8" X 3 1/4", SA193-B7M
40	288	2HM HEX NUT, 7/8", SA194-2HM
41	144	2HM HEX NUT, 3/4", SA194-2HM
42	1792	2HM HEX NUT, 5/8", SA194-2HM

NOTES:
 ALL STUD LENGTHS GIVEN ARE THREAD TO THREAD
 ALL PROCESS THREADED PIPING TO BE SCH. XXH
 ALL UTILITY THREADED PIPING TO BE SCH. 80
 ALL THREADED FITTINGS TO BE 3000 PSI
 APPROXIMATE SHIPPING DIMENSIONS ARE 13'-3" X 26'-0" X 14'-6" HIGH
 PACKAGE WEIGHT IS APPROXIMATELY 40,000 LBS

1	07	26	18	AS BUILT	JMR	CK	.
0	12	06	17	ISSUED FOR CONSTRUCTION	CK	CK	.
REV. No.	MM	DD	YY	DESCRIPTION	BY	CHK'D	APP'D

CLIENT: **ARC RESOURCES LTD.**

PROJECT: **TYPICAL GROUP/TEST SEPARATOR PACKAGE**

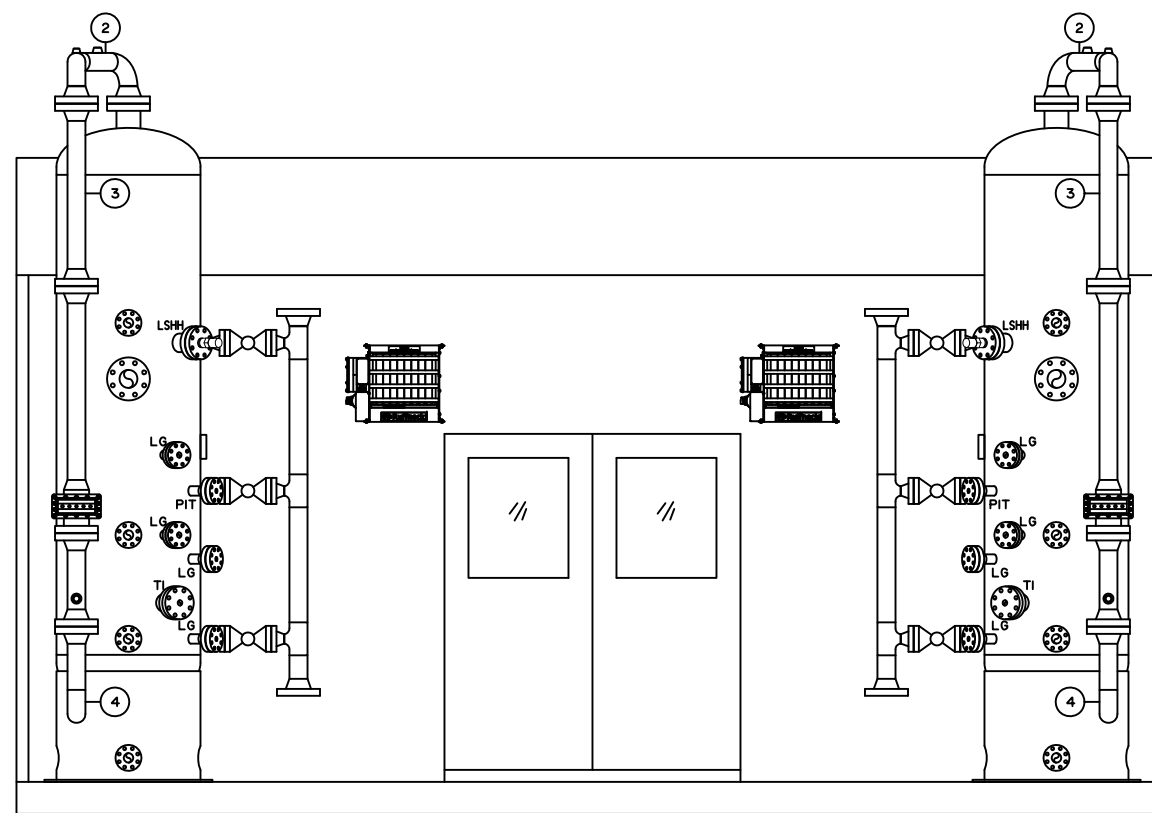
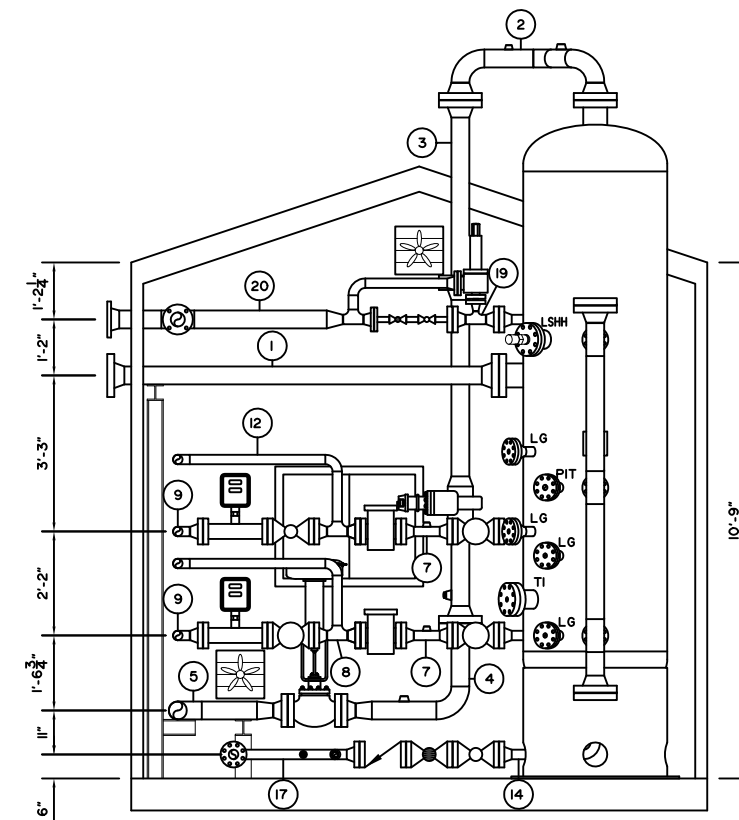
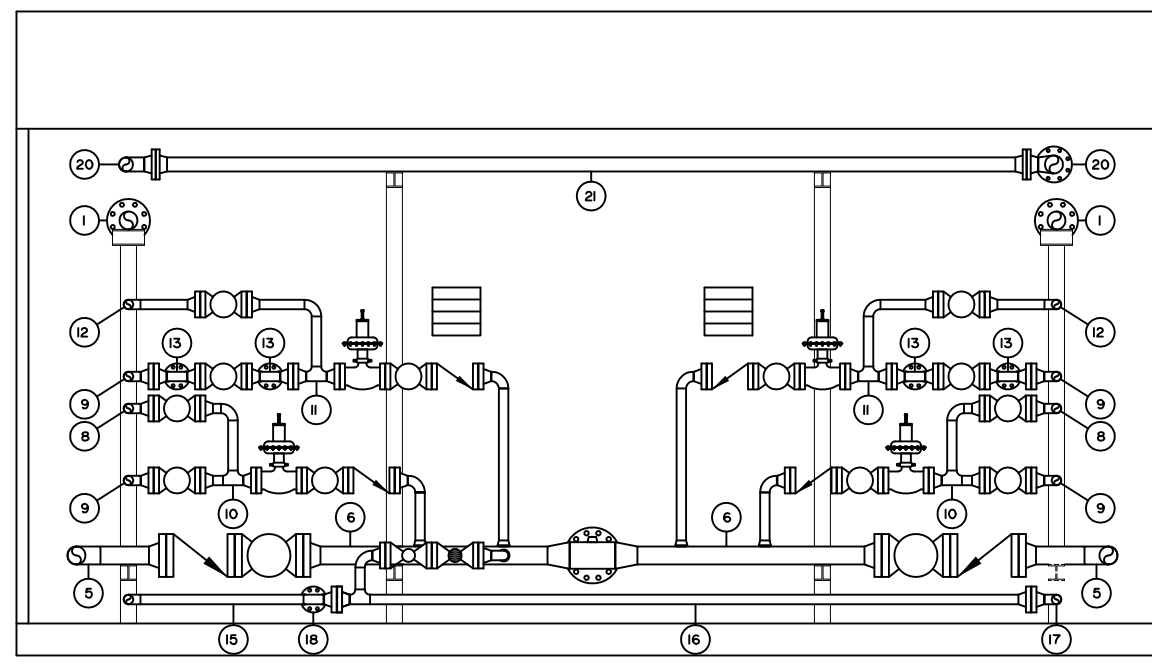
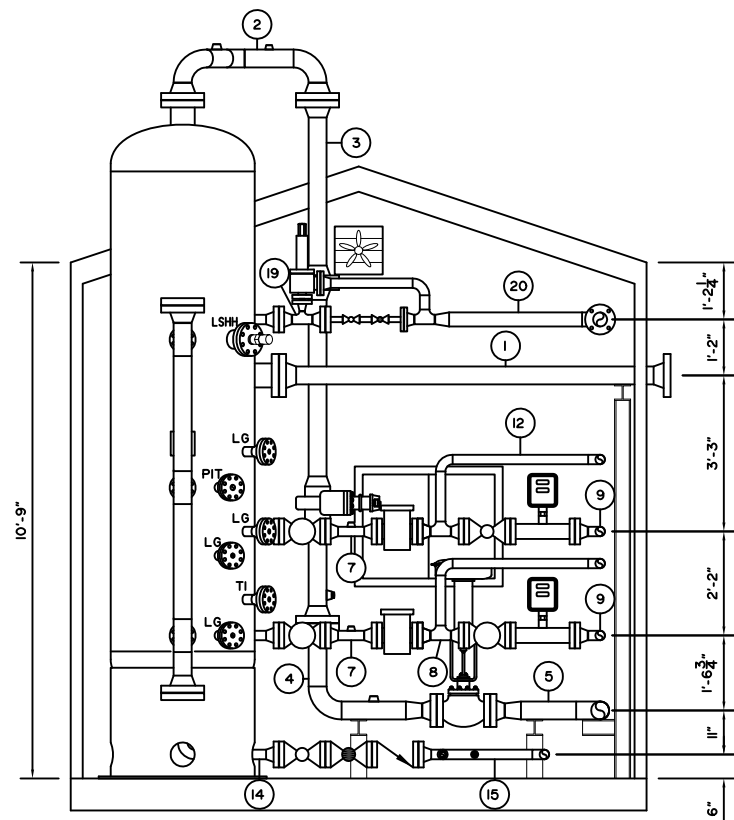
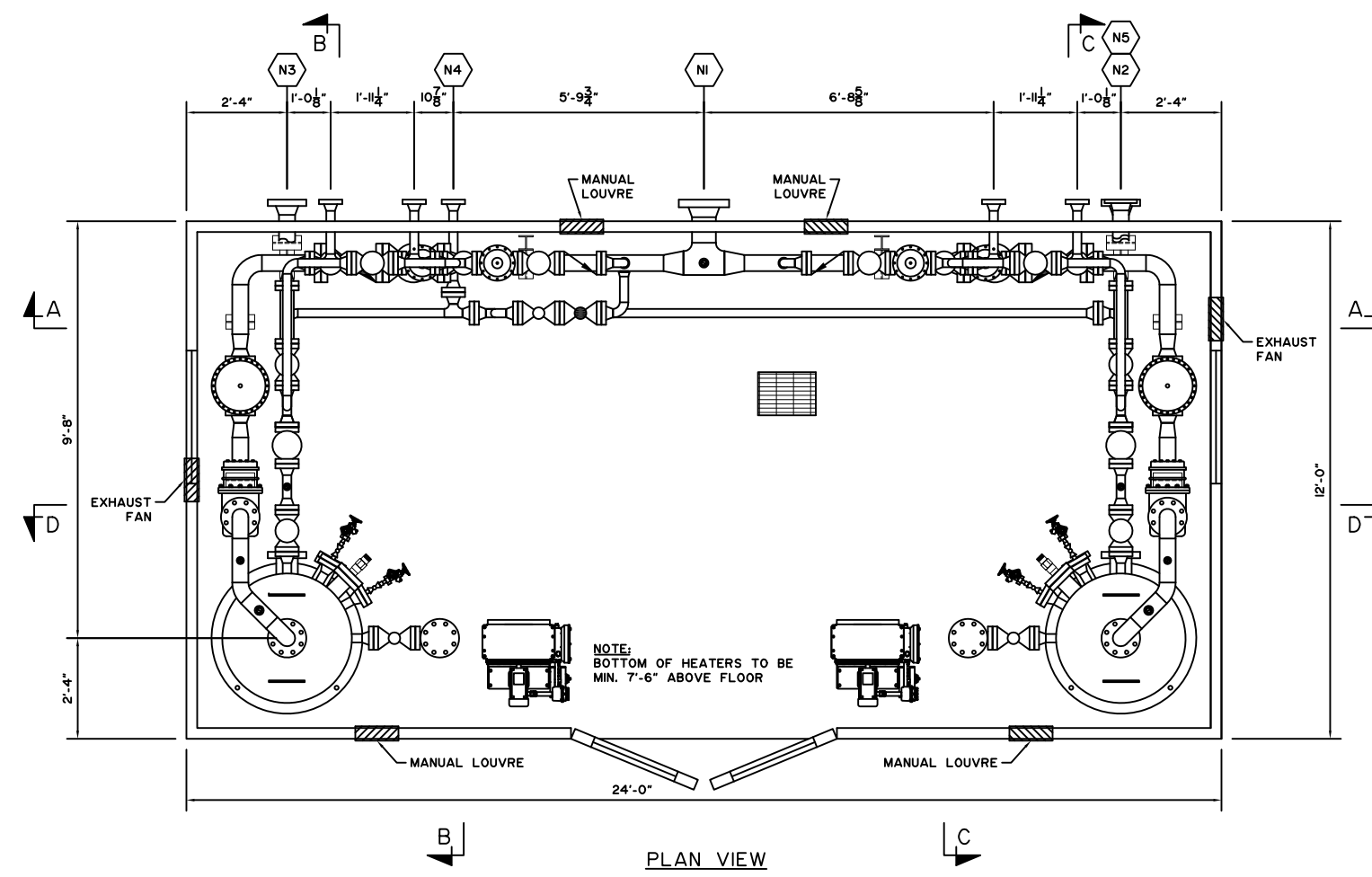
TITLE: **LAYOUT**

Wo No.: 35528
 DRAWN BY: C. KARPIUK
 DATE: MM/DD/YY 12/06/17

REV. No.: 1
 SCALE: 1/4"=1'-0"

DATE: MM/DD/YY 07/26/18
 CAD No.: 35528-LAYOUT

BROMLEY MECHANICAL SERVICES
 A DIVISION OF ARGOS SALES INC
 925 23 Street SW, Medicine Hat, Alberta, Canada T1A 8R1
 Ph: (403) 526-3142 Fax: (403) 526-1061
 Toll Free (800) 215-9806



BILL OF MATERIAL

ITEM	QTY.	DESCRIPTION
1	1	SPOOL 1 - SEE DRAWING 35527-SPOOLS-1
2	1	SPOOL 2 - SEE DRAWING 35527-SPOOLS-1
3	1	SPOOL 3 - SEE DRAWING 35527-SPOOLS-1
4	1	SPOOL 4 - SEE DRAWING 35527-SPOOLS-1
5	1	SPOOL 5 - SEE DRAWING 35527-SPOOLS-1
6	1	SPOOL 6 - SEE DRAWING 35527-SPOOLS-1
7	1	SPOOL 7 - SEE DRAWING 35527-SPOOLS-1
8	1	SPOOL 8 - SEE DRAWING 35527-SPOOLS-2
9	1	SPOOL 9 - SEE DRAWING 35527-SPOOLS-2
10	1	SPOOL 10 - SEE DRAWING 35527-SPOOLS-2
11	1	SPOOL 11 - SEE DRAWING 35527-SPOOLS-2
12	1	SPOOL 12 - SEE DRAWING 35527-SPOOLS-2
13	1	SPOOL 13 - SEE DRAWING 35527-SPOOLS-2
14	1	SPOOL 14 - SEE DRAWING 35527-SPOOLS-2
15	1	SPOOL 15 - SEE DRAWING 35527-SPOOLS-2
16	1	SPOOL 16 - SEE DRAWING 35527-SPOOLS-2
17	1	SPOOL 17 - SEE DRAWING 35527-SPOOLS-2
18	1	SPOOL 18 - SEE DRAWING 35527-SPOOLS-2
19	1	SPOOL 19 - SEE DRAWING 35527-SPOOLS-2
20	1	SPOOL 20 - SEE DRAWING 35527-SPOOLS-3
21	1	SPOOL 21 - SEE DRAWING 35527-SPOOLS-3
22	2	RFHB, 4" 600 ANSI TAPPED 1", SA105N
23	2	RFHB, 3" 600 ANSI TAPPED 2", SA105N
24	2	RFHB, 3" 600 ANSI TAPPED 3/4", SA105N
25	4	RFHB, 2" 600 ANSI TAPPED 1", SA105N
26	8	RFHB, 2" 600 ANSI TAPPED 3/4", SA105N
27	2	RFHB, 2" 150 ANSI TAPPED 1", SA105N
28	18	316 SPIRALWND GSKT, 4" 600 ANSI, NASB
29	8	316 SPIRALWND GSKT, 3" 600 ANSI, NASB
30	108	316 SPIRALWND GSKT, 2" 600 ANSI, NASB
31	2	316 SPIRALWND GSKT, 1" 600 ANSI, NASB
32	2	316 SPIRALWND GSKT, 3" 150 ANSI, NASB
33	2	316 SPIRALWND GSKT, 2" 150 ANSI, NASB
34	144	B7M STUD, 7/8" X 5 3/4", SA193-B7M
35	64	B7M STUD, 3/4" X 5", SA193-B7M
36	8	B7M STUD, 3/4" X 4 1/4", SA193-B7M
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39	16	B7M STUD, 5/8" X 3 1/4", SA193-B7M
40	288	2HM HEX NUT, 7/8", SA194-2HM
41	144	2HM HEX NUT, 3/4", SA194-2HM
42	1792	2HM HEX NUT, 5/8", SA194-2HM

NOTES:
 ALL STUD LENGTHS GIVEN ARE THREAD TO THREAD
 ALL PROCESS THREADED PIPING TO BE SCH. XXH
 ALL UTILITY THREADED PIPING TO BE SCH. 80
 ALL THREADED FITTINGS TO BE 3000 PSI
 APPROXIMATE SHIPPING DIMENSIONS ARE 13'-3" X 26'-0" X 14'-6" HIGH
 PACKAGE WEIGHT IS APPROXIMATELY 40,000 LBS

△	04	23	18	AS BUILT / MIRRORED N3 w/ N2 and N5	JMR	CK	.	
△	0	08	17	ISSUED FOR CONSTRUCTION	CK	CK	.	
REV. No.	MM	DD	YY	DATE	DESCRIPTION	BY	CHK'D	APP'D

CLIENT: **ARC RESOURCES LTD.**

PROJECT: **TYPICAL GROUP/TEST SEPARATOR PACKAGE**

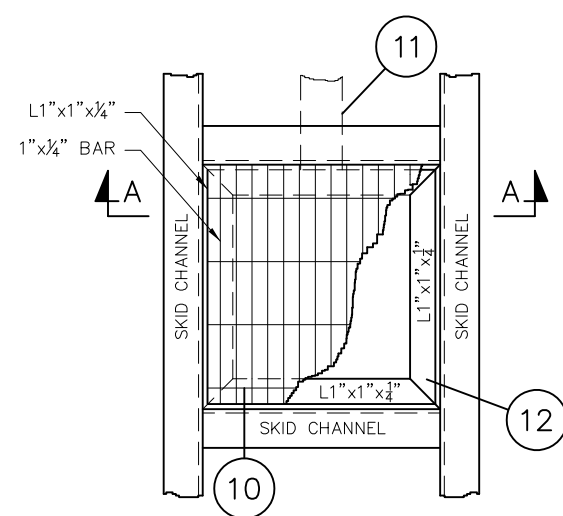
TITLE: **LAYOUT**

Wd No.: 35528
 DRAWN BY: C. KARPIUK
 DATE: MM/DD/YY 10/11/17

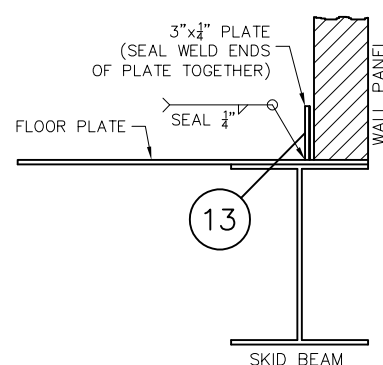
REV. No.: 2
 SCALE: 1/4"=1'-0"

DATE: MM/DD/YY 07/26/18
 CAD No.: 35528-LAYOUT-2

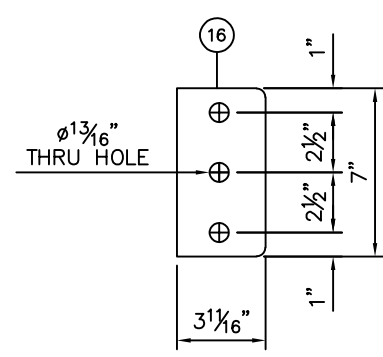
BROMLEY
 MECHANICAL SERVICES
 A DIVISION OF ARGOS SALES INC
 925 23 Street SW, Medicine Hat, Alberta, Canada T1A 8R1
 Ph: (403) 526-3142 Fax: (403) 526-1061
 Toll Free (800) 215-9806



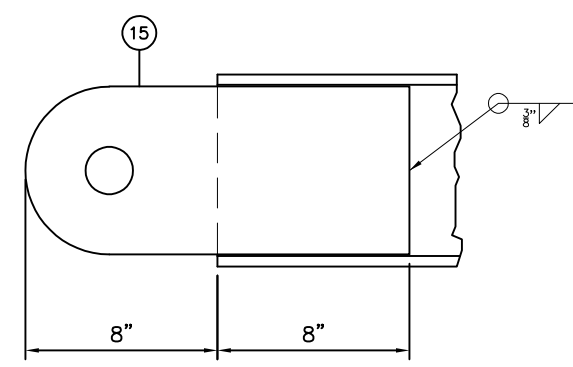
SKID DRAIN DETAIL
N.T.S.



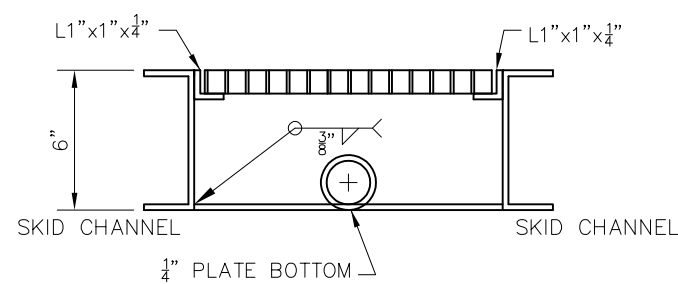
CONTAINMENT BARRIER
N.T.S.



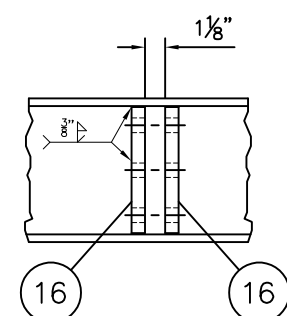
WEB STIFFENER DETAIL
N.T.S.



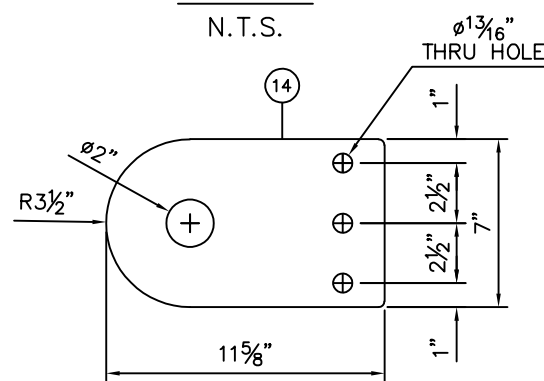
LIFTING LUG PLACEMENT
N.T.S.



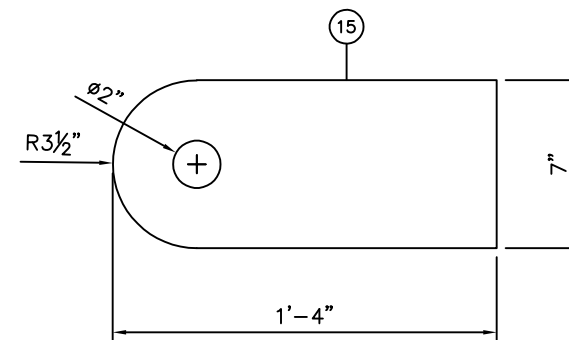
SKID DRAIN SECTION 'A-A'
N.T.S.



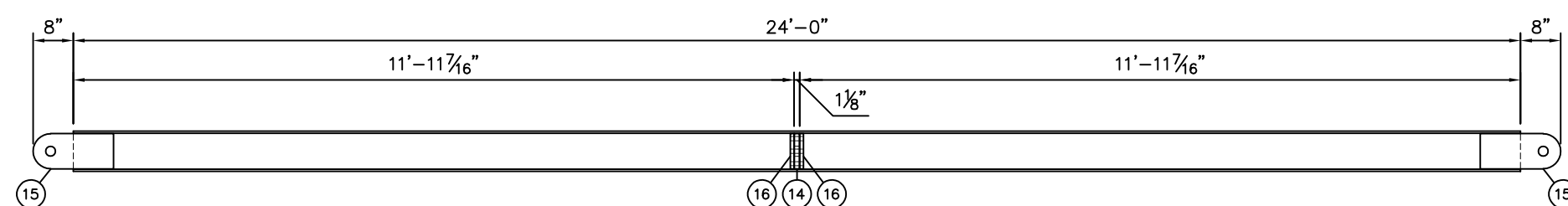
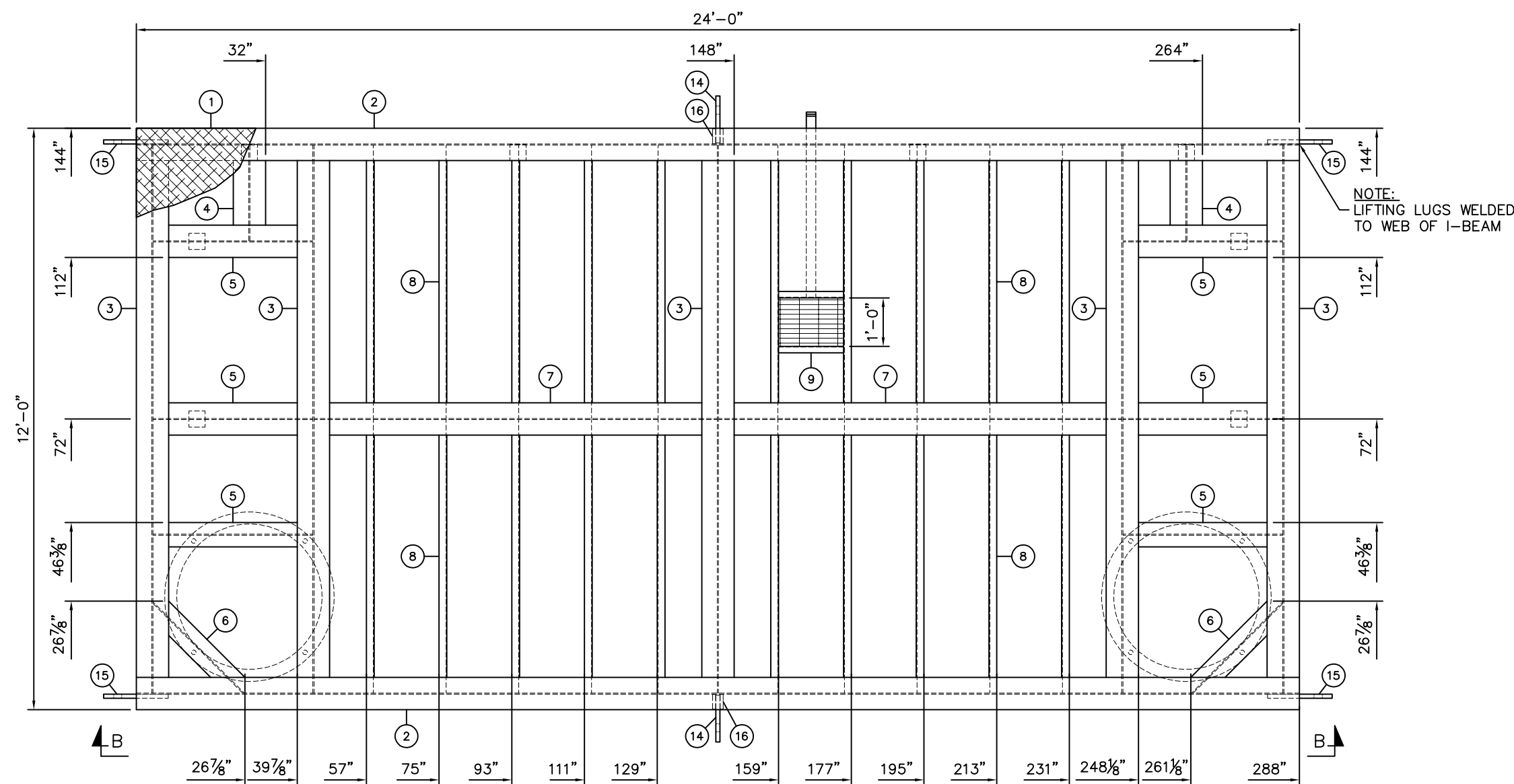
WEB STIFFENER PLACEMENT
N.T.S.



REMOVABLE LIFT LUG DETAIL
N.T.S.



LIFT LUG DETAIL
N.T.S.



SECTION 'B-B'

BILL OF MATERIAL

ITEM	QTY.	DESCRIPTION
1	288'	FLOOR (CHECKER) PLATE, 1/4", A36/44W (12'-0" X 24'-0")
2	2	W8 X 31 LB/FT X 288" LONG, 350W/50W BEAM
3	5	W8 X 31 LB/FT X 135 11/16" LONG, 350W/50W BEAM
4	2	W8 X 31 LB/FT X 23 11/16" LONG, 350W/50W BEAM
5	6	W8 X 31 LB/FT X 39 9/16" LONG, 350W/50W BEAM
6	2	W8 X 31 LB/FT X 31 15/16" LONG, 350W/50W BEAM
7	2	W8 X 31 LB/FT X 99 7/8" LONG, 350W/50W BEAM
8	20	STD CHANNEL, C6 X 8.2 LB/FT X 67 11/16" LONG, A36/44W
9	2	STD CHANNEL, C4 X 5.4 LB/FT X 16 1/16" LONG, A36/44W
10	2'	U BAR GRATING, 1" X 3/16", CS
11	1	PIPE, 2" SCH. 80 (0.218") X 46" LONG, SA106B
12	5'	ANGLE, L1.250" X 1.250" X 1/4", A36/44W
13	72'	FLAT, 1/4" X 3", A36/44W
14	2	REMOVABLE LIFT LUG - PLATE, 1", A36/44W, SEE DETAIL
15	4	LIFT LUG - PLATE, 1", A36/44W, SEE DETAIL
16	4	WEB STIFFENER - PLATE, 3/4", A36/44W, SEE DETAIL

NOTES:

- SKID UNDERSIDE TO HAVE 3" INSULATION
- INSTALL FLAT BAR AT 3 1/2" IN FROM BUILDING EDGE
- SKID WEIGHT IS APPROXIMATELY 9,000 LBS
- SEE BROMLEY INTERNAL DRAWING: "BMS-SKID-FAB: SKID
- WELDING SPECS FOR FURTHER WELDING AND COPING DETAILS
- SKID TO BE PAINTED BLACK

REV.	MM	DD	YY	DESCRIPTION	BY	CHK'D	APP'D
2	07	26	18	AS BUILT	JMR	CK	.
1	11	28	17	LIFTING LUGS RELOCATED (x4) (WELD LUGS TO WEB OF I-BEAM)	CK	CK	.
0	11	06	17	ISSUED FOR CONSTRUCTION	CK	CK	.

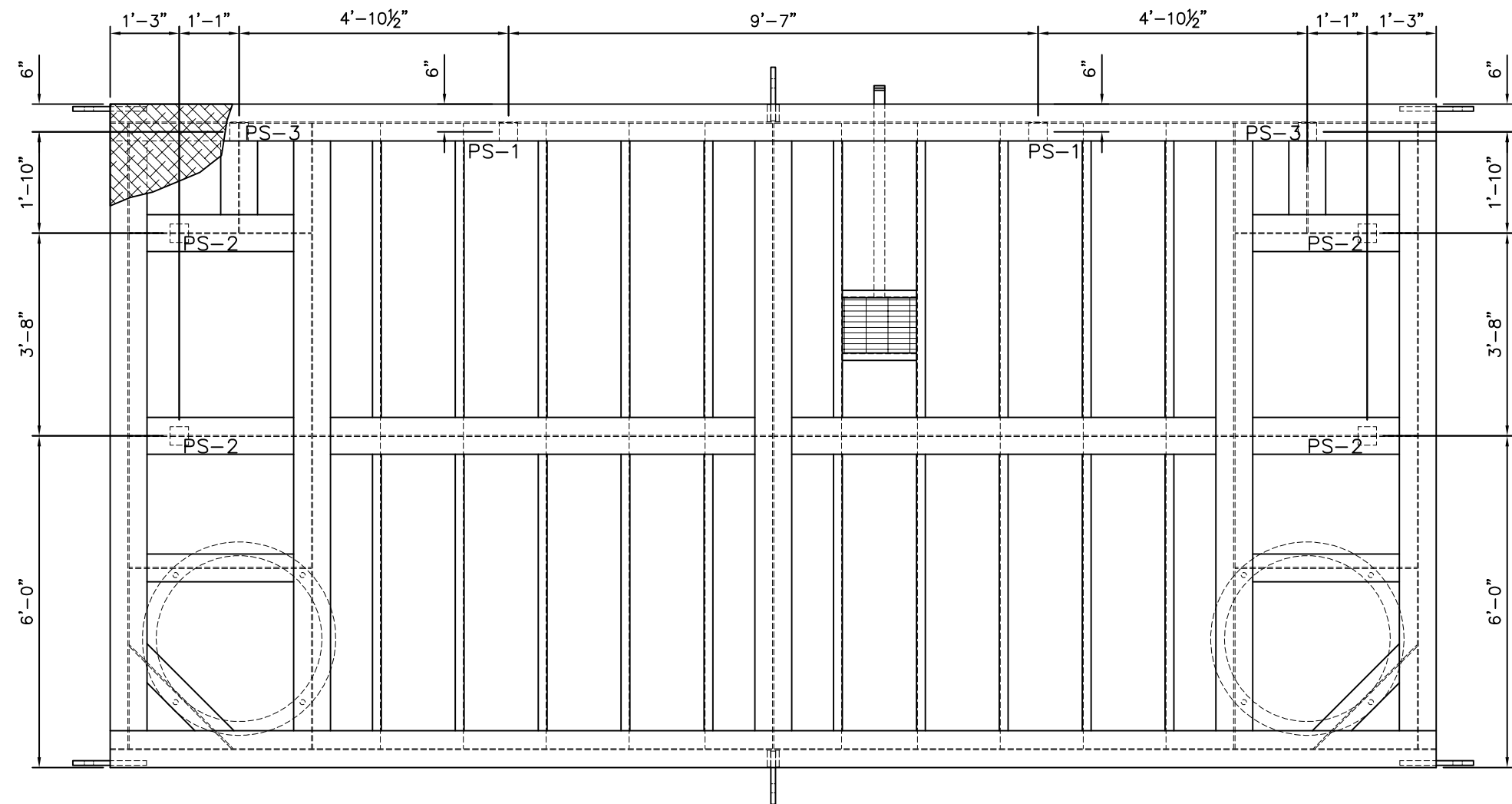
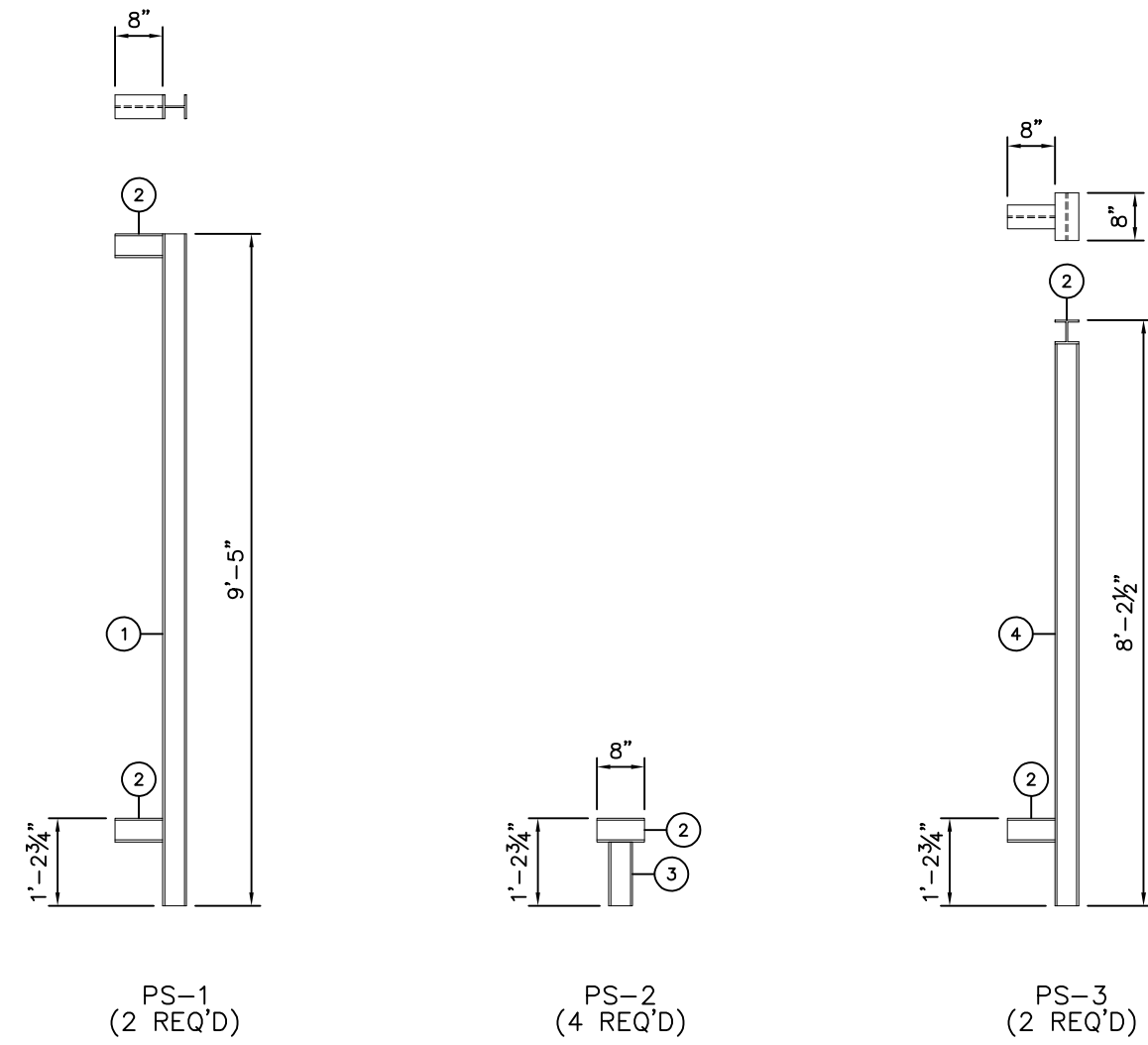
CLIENT: **ARC RESOURCES LTD.**

BROMLEY
MECHANICAL SERVICES
A DIVISION OF ARGOS SALES INC
925 23 Street SW, Medicine Hat, Alberta, Canada T1A 8R1
Ph: (403) 526-3142 Fax: (403) 526-1061
Toll Free (800) 215-9806

PROJECT: TYPICAL DUAL/TEST SEPARATOR PACKAGE

TITLE: SKID

Wd No.:	35528	REV. No.:	2	DATE: MM/DD/YY	07/26/18
DRAWN BY:	C. KARPIUK	SCALE:	3/8"=1'-0"	CAD No.:	35528-SKID
DATE: MM/DD/YY	10/11/17				



BILL OF MATERIAL

ITEM	QTY.	DESCRIPTION
1	2	W4 X 13 LB/FT X 113" LONG, 350W/50W BEAM
2	12	W4 X 13 LB/FT X 8" LONG, 350W/50W BEAM
3	4	W4 X 13 LB/FT X 10 3/4" LONG, 350W/50W BEAM
4	2	W4 X 13 LB/FT X 94 1/2" LONG, 350W/50W BEAM

NOTES:
SEE BROMLEY INTERNAL DRAWING: "BMS-SKID-FAB: SKID
WELDING SPECS FOR FURTHER WELDING AND COPING DETAILS

REV. No.	MM	DD	YY	DATE	DESCRIPTION	BY	CHK'D	APP'D
1	07	26	18		AS BUILT	JMR	CK	.
0	11	06	17		ISSUED FOR CONSTRUCTION	CK	CK	.

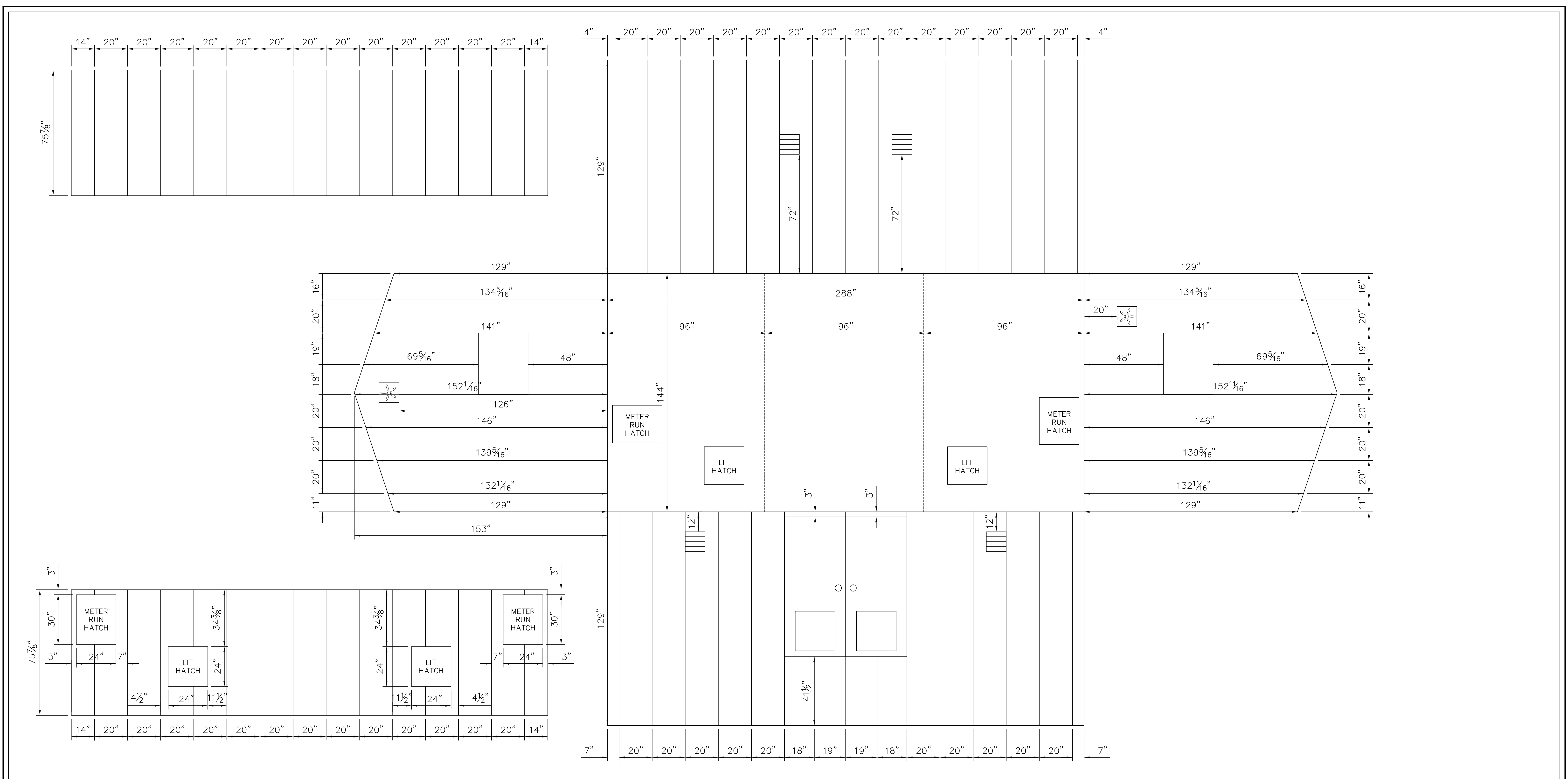
CLIENT: **ARC RESOURCES LTD.**

BROMLEY
MECHANICAL SERVICES
A DIVISION OF FARGO SALES INC
925 23 Street SW, Medicine Hat, Alberta, Canada T1A 8R1
Ph: (403) 526-3142 Fax: (403) 526-1061
Toll Free (800) 215-9806

PROJECT: **TYPICAL DUAL/TEST SEPARATOR PACKAGE**

TITLE: **PIPE SUPPORTS**

Wo No.: 35528	REV. No.: 1	DATE: MM/DD/YY 07/26/18
DRAWN BY: C. KARPIUK	SCALE: 3/8"=1'-0"	CAD No.: 35528-SUPPORT
DATE: MM/DD/YY 10/11/17		



REV. No.	MM	DD	YY	DESCRIPTION	BY	CHK'D	APP'D
1	07	26	18	AS BUILT	JMR	CK	.
0	12	06	17	ISSUED FOR CONSTRUCTION	CK	CK	.

BROMLEY MECHANICAL SERVICES
 925 - 23rd Street S.W., Medicine Hat, Alberta, Canada, T1A 8R1 (403) 526-3142

CLIENT: ARC RESOURCES LTD.

PROJECT: TYPICAL DUAL/TEST SEPARATOR PACKAGE

TITLE: BUILDING

Wo No.: 35528
 DRAWN BY: C. KARPIUK
 DATE: MM/DD/YY 12/06/17

REV. No.: 1
 DATE: MM/DD/YY 07/26/18

CAD No.: 35528-BUILDING



Owner's Manual

FX5 Series

Electric Forced Air Heaters for Hazardous Locations



This manual covers the installation, maintenance, repair and replacement parts.

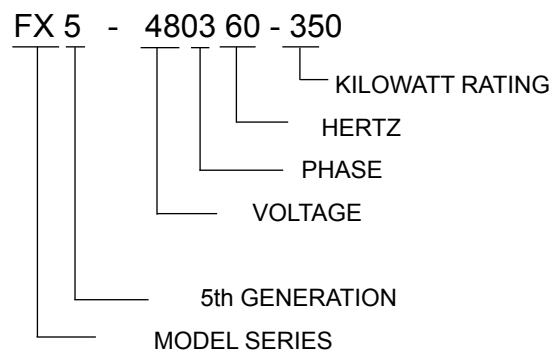
APPROVED LOCATIONS

The Electric Forced Air Heaters are cULus listed certified for the following locations:

Class I, Divisions 1 & 2, Groups C & D;
Class II, Division 1, Groups E, F, & G;
Class II, Division 2, Groups F & G;
Class I, Zones 1 & 2, Groups IIA & IIB;
Temperature Code T3B 165°C (329°F)
(50 Hz & 60 Hz Models)

For details of hazardous locations with potential for explosion, refer to the Canadian Electrical Code, Part 1, Section 18 or National Electrical Code articles 500-516.

MODEL CODING



WARNING!
READ ALL IMPORTANT NOTICES ON PAGE 3.

Part No. 9714-2

Printed in Canada



HEATER MAINTENANCE CHECKLIST

For Electric Forced Air Heaters



Heater Model: _____ Serial No.: _____

Date of Maintenance: _____ Maintenance Done By: _____

Comments: _____

WARNING

Disconnect heater from power supply at integral disconnect or fuse box before opening enclosures or servicing heater.
Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application.
IF INTEGRAL DISCONNECT IS BEING SERVICED, verify that power has been disconnected at fuse box or main panel.
Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application.
This heater should only be serviced by personnel with heating and hazardous location equipment experience.

PERIODIC (before and as required during heating season)

- | | |
|---|---|
| <p>1. CLEAN</p> <ul style="list-style-type: none"><input type="checkbox"/> Finned Tubes<input type="checkbox"/> Fan<input type="checkbox"/> Fan Guard<input type="checkbox"/> Motor<input type="checkbox"/> Louvers | <p>2. CHECK</p> <ul style="list-style-type: none"><input type="checkbox"/> Motor for smooth, quiet operation<input type="checkbox"/> Louvers for proper angle and tightness<input type="checkbox"/> All explosion-proof covers for tightness<input type="checkbox"/> Pressure relief device for signs of leakage. See Figure 1 and refer to the ANNUAL Section (see below) item 2 for further instructions |
|---|---|

**Remove dust using compressed air. Do not spray with water or solvents.
Do not immerse in water or solvents.**

ANNUAL (before heating season)

1. ELECTRICAL
 - Check all terminal connections and conductors.** Tighten loose connections. Conductors with damaged insulation must be replaced.
 - Inspect contactor contacts.** If badly pitted, burned or welded shut, replace with factory supplied contactor. For severe duty conditions such as arctic duty, CCI Thermal recommends the contactor be replaced every two years.
 - Check fuses.** Fuse rating and type are on printed circuit board. Correct fuse must be in the active fuse clip. It is recommended that a spare fuse be stored in the spare fuse clip.
 - Check all explosion-proof conduits.** Replace damaged conduits. All threaded conduit connections must have a minimum 5 turns engagement. Straight threaded conduit must protrude a minimum of 1/16" (1.6mm) inside enclosures. Taper threaded connections must be at least hand tight.
 - Check electrical resistance on all load side legs.** Reading should be balanced ($\pm 5\%$).
2. MECHANICAL
 - Check for fluid leakage.** The heater core is vacuum charged and contains propylene glycol. Inspect the Pressure Relief Valve label indicator for signs of rupture and degradation. If the paper is torn, disintegrated or otherwise compromised this is an indication that fluid has leaked from the core. If any fluid leakage occurs from the heater, disconnect it from the power supply and have the core replaced. A factory supplied exchange core can be shipped immediately from stock. Refer to the "Repair and Replacement" section for details.
 - Check all enclosures.** Interior of enclosures must be clean, dry and free of foreign materials. Threaded covers must be installed and hand tight.
Note: Enclosure joints are metal to metal. Do not use gasket material or sealant in joints. A grease is applied to the joints at the factory and should be left intact.
 - Check motor shaft bearing play.** Replace motor if play is excessive, or if motor does not run quietly and smoothly. Motor bearings are permanently lubricated.
 - Check fan.** Replace immediately if cracked or damaged.
 - Check louvers.** Louver screws should be tight. Louvers shall not be fully closed or override stops.



Heaters for the Harshest Environments

For assistance, please call
Toll Free: 1-800-661-8529 (24 hrs)
U.S. & Canada

- ❑ **Check the tightness of all hardware.** All nuts and bolts, including mounting hardware, must be tight.
- ❑ **Turn heater on for a minimum of five minutes.** Check for warm air exiting heater through louvers. Crackling or pinging noises within heater during start-up are normal.

IMPORTANT NOTICES

WARNING

Read and adhere to the following. Failure to do so may result in severe or fatal injury.
WARRANTY WILL BE VOID

1. Read and follow all instructions in this manual.
2. Heater is to be used only in atmospheres having an ignition temperature higher than the heater's maximum rated operating temperature as shown on the heater data plate. Refer to applicable electrical codes for additional information.
3. Heater to be used only in the hazardous locations indicated on the heater's data plate.
4. Heater is for dry indoor use only. Do not immerse in water. Do not store or use in areas exposed to rain or snow.
5. Heater is to be connected and serviced only by a qualified electrician experienced with hazardous location equipment.
6. Installation and wiring of the heater must adhere to all applicable codes.
7. Disconnect heater from power supply at integral disconnect or fuse box before opening enclosures or servicing heater. Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application. IF INTEGRAL DISCONNECT IS BEING SERVICED, verify that power has been disconnected at fuse box or main panel. Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application.
8. This heater is equipped with a single bimetal overtemperature high-limit. It is of the automatic reset type and therefore the heater may restart without warning. The heater is not to be operated with the high-limit disabled or disconnected from the control circuit.
9. Venting pressure of the pressure relief valve is factory set. Do not tamper with lock nut.
10. Do not tamper or remove warning label indicator on the PRV.
11. Operate the heater only while it is permanently mounted in an upright position. Refer to the "Installation - Mechanical" section for details.
12. Heater must be kept clean. When operating in a dirty environment, regularly clean the finned tubes, fan, and fan guard. Follow the recommended maintenance procedures. Refer to the "Heater Maintenance Checklist" section for details.
13. The heater core is vacuum charged and contains propylene glycol. **If any fluid leakage occurs from the heater, disconnect it from the power supply and have the core replaced with a factory supplied core. Refer to the "Repair and Replacement" section for details.**
14. Do not operate the heater with any of the louvers fully closed or overriding their stops.
15. Do not operate the heater in atmospheres corrosive to steel or aluminum.
16. Do not operate heater in ambient temperatures above 40°C (104°F).
17. Use factory approved replacement parts only.
18. See applicable electrical codes for seal requirements in field installed conduits. Factory installed conduits require no further sealing.
19. Crackling or pinging noises within the heater core during start up may occur. This is normal.
20. Air discharge near the bottom of the heater may be warmer than the top. This is normal.
21. If there are any questions or concerns regarding the heater, contact the factory. Refer to the last page of this manual for details.

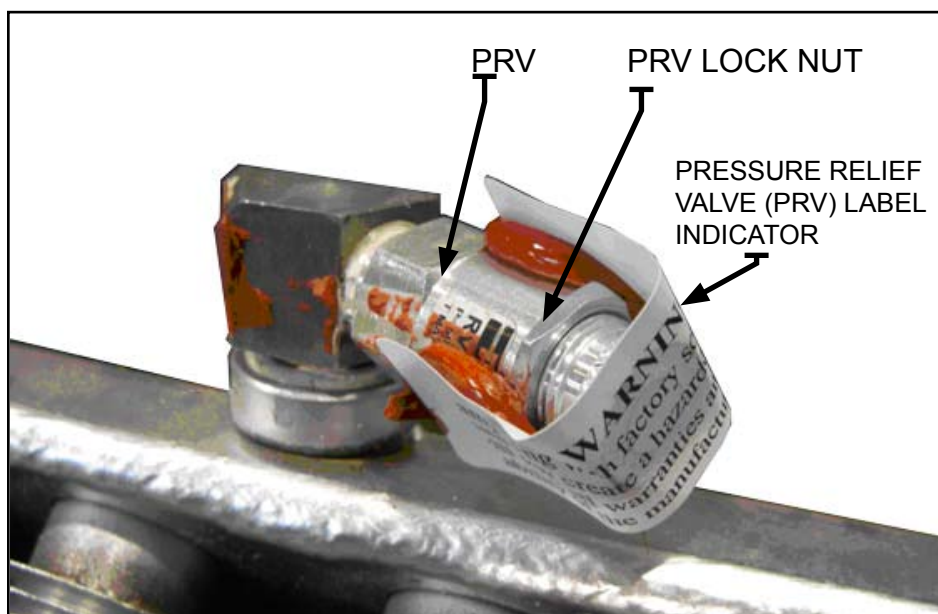


FIGURE 1

TROUBLESHOOTING TIPS

- 1.0 **Heater is not operating**
 - 1.1 Check all fuses in heater control box.
 - 1.2 Check remote disconnect switch and circuit breaker.
 - 1.3 Check voltage supplied to the heater – refer to the heater data plate for voltage requirements.
 - 1.4 Check thermostat by turning it and check continuity with a multimeter.
 - 1.5 Check the condition of the disconnect switch if the heater is so equipped. Measure continuity through the disconnect by engaging the switch.
 - 1.6 Verify that there is a jumper wire present between terminals 5 and 6 on the terminal block located in the control box.
- 2.0 **Contactor is chattering**
 - 2.1 Check supply voltage.
 - 2.2 Check wiring connections. Tighten all loose electrical connections.
 - 2.3 Check thermostat for continuity (See 1.4). If thermostat does not break continuity replace thermostat.
- 3.0 **Contactor is burned or welded**
 - 3.1 Check the contactor for burn marks and blackening. Replace the contactor.
 - 3.2 Check incoming power to the heater to ensure there are no voltage fluctuations.
- 4.0 **Heat exchanger is dirty**
 - 4.1 Clean the heat exchanger using compressed air.
- 5.0 **PRV has released**
 - 5.1 If there are signs that the PRV has released fluid, PRV indicator is broken, blackening around the PRV exit hole, or there are fluid stains visible on the top louver, shut the unit down immediately.
 - 5.2 Check for restricted air flow, bad motor, broken thermostat or malfunctioned high limit.
- 6.0 **Heater is cold on top and warm on bottom**
 - 6.1 The core may have lost its vacuum. Check the PRV for signs of loss of fluid and verify that the PRV label indicator is not broken. If PRV has released, send the unit in for repair or replace the core.
 - 6.2 If the PRV does not indicate loss of fluid, the heater should operate normally. Check for loss of fluid on a weekly basis as a minimum.
 - 6.3 The ambient temperature may be too low. If the ambient temperature is very cold the top of the core will be colder than the bottom – this is normal.
- 7.0 **Unit cycles on high limit – unit turns on and turns off within less than 5 minutes.**
 - 7.1 Check and see if the PRV has released fluid. Core may have lost most or all of its fluid. If PRV has released, send the unit in for repair or replace core.
 - 7.2 The core may be dirty, fan may not be working or may be turning the wrong way (the fan must rotate clockwise as seen from the front of the unit) objects may be stuck in the heat exchanger for drying or warming up – remove any items from the exchanger.
- 8.0 **The Ground Fault Interrupter (GFI) trips on the main panel, or heater blows fuses.**
 - 8.1 Check that you have a fuse of the proper amperage rating.
 - 8.2 Check for loose or frayed wiring.
 - 8.3 If condition is not observable, send heater in for repair.
 - 8.4 Change sensitivity of GFI.
- 9.0 **The fan is turning but very little air comes from the front of the heater.**
 - 9.1 Check fan rotation and ensure that the fan turns clockwise as seen from the front of the heater. Refer to the Installation section below for more information.
 - 9.2 Check motor winding resistance and verify that they are balanced.
 - 9.3 Check fan blade set screws to ensure fan blade is not loose on the motor shaft.

INSTALLATION

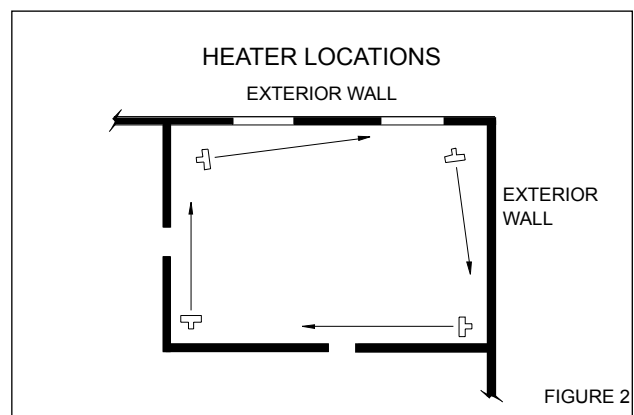
The installation instructions provide a general guideline for the installation and wiring of the heater.
All applicable codes must be adhered to.

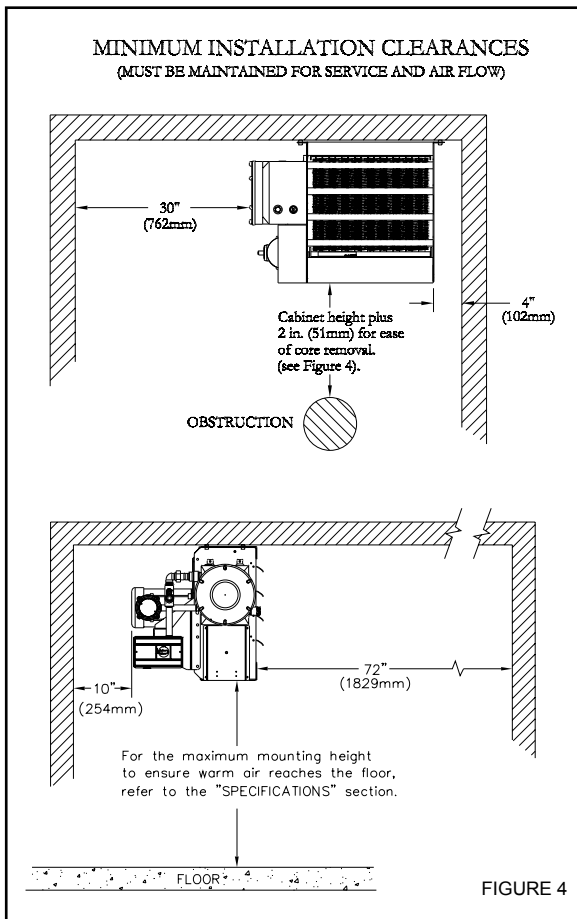
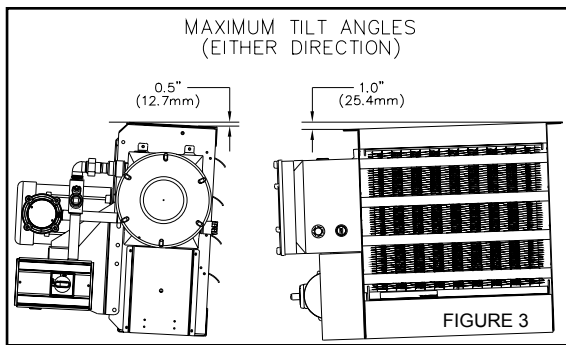
MECHANICAL

LOCATION

For optimum heating, the heater should be installed as follows:

1. There are no obstructions that may impede the heater's air inlet or discharge.
2. The air discharge is directed into open areas and not at occupants.
3. The air discharge is not directed at a thermostat.
4. The air discharge is directed across areas of heat loss, such as doors and windows (see Figure 2).
5. The air discharge is directed along and at a slight angle toward exterior walls (see Figure 2).
6. If equipment freeze protection is important, direct air discharge at equipment.
7. Air discharge streams support each other and create a circular air flow. It is not required that the heater's air throw reaches the next heater (see Figure 2).





MOUNTING

- The heater must be permanently mounted in a level, upright position for operation. See Figures 3, 4, and 5 for maximum tilt angles, installation clearances, and physical dimensions. For ease of installation, a variety of mounting kits are available from the factory.
- The mounting structure must be strong enough to:
 - support the heater's weight, refer to the "Specifications" section,
 - provide sufficient stiffness to prevent excessive vibration, and
 - withstand harsh situations such as transportable installations.

DIM.	kW	DIM. TOL. ±		
		2.5-10	12.5-20	20.9-35
A	in.	8-7/16	8-7/16	8-7/16
	mm	215	215	215
B	in.	18-3/16	22-5/16	26-1/4
	mm	462	566	667
C	in.	27	31	35
	mm	686	787	889
D	in.	18-1/2	22-1/2	26-1/2
	mm	470	572	674
E	in.	19-7/16	23-7/16	27-7/16
	mm	494	596	697
F	in.	17-1/2	19-1/2	21-13/16
	mm	444	495	554

DIMENSIONAL TOLERANCES $\pm 1/8"$ [$\pm 3\text{mm}$]
UNLESS OTHERWISE SPECIFIED.

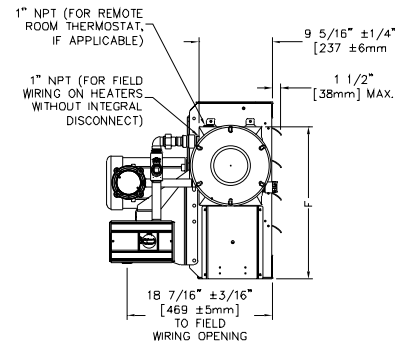
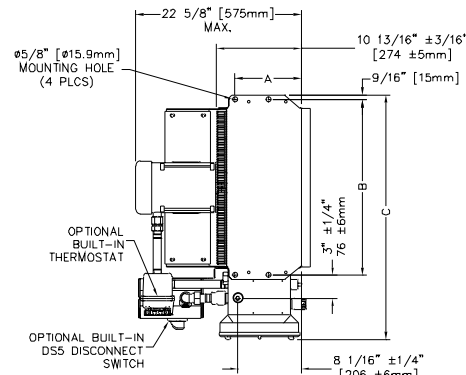
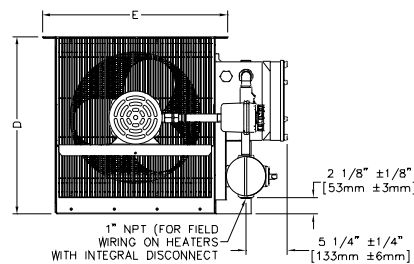


FIGURE 5

ELECTRICAL

WARNING

Disconnect heater from power supply at integral disconnect or fuse box before opening enclosures or servicing heater. Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application. IF INTEGRAL DISCONNECT IS BEING SERVICED, verify that power has been disconnected at fuse box or main panel. Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application. Installation and wiring of the heater must adhere to all application codes.

GENERAL

- Use only copper conductors and approved explosion-proof wiring methods during installation. Refer to the "Technical Data" table and heater data plate for conductor rating.
- External overcurrent protection is required. Refer to the "Technical Data" table and heater data plate for voltage, frequency amperage, and phase. Supply voltage is to be within 10% of the data plate voltage.
- The heater must be installed by qualified personnel in strict compliance with electrical codes.
- All heaters come factory prewired and ready for direct connection to the power supply leads.
- The heater must be individually fused, preferably with Class J time-delay fuses for maximum safety. Unless stated otherwise in your local code, fuse size shall be 125% of line current or next size larger.

FIELD WIRING

- The supply conductors, ground conductor, and room thermostat conductors (see point 2, page 5) all pass through the 1" NPT opening (see Figure 6) and are to be wired into the control enclosure (see Figure 7A).
- Heater may be supplied with a factory installed built-in room thermostat (see Figure 8). On heaters not supplied with this option, it is recommended that a remote room thermostat be used. Connect the remote room thermostat conductors to the printed circuit board terminal block marked "TSTAT". Any thermostat used with this heater must:
 - be of an explosion-proof type,
 - be rated 125 V minimum,
 - have a minimum 2 amp capacity, and
 - open on temperature rise.

3. Heater may be supplied with a factory installed built-in integral disconnect. (See Figure 7B)

Field Wiring for Integral Disconnect:

- a. Power Supply conductors and Ground conductor pass through 1"NPT opening of Disconnect Enclosure (see Figure 7B). Supply conductors to be wired to Disconnect Switch inside. Ground conductor to be wired to Ground Lug fastened to inside of Disconnect Enclosure.
- b. If applicable, Remote Room Thermostat conductors pass through 3/4"NPT opening (see Figure 7b) and are to be wired to printed circuit board terminals marked "T'STAT".
- c. To reduce risk of ignition of hazardous atmospheres, conduit runs must have a sealing fitting connected within 18 inches (457 mm).

Factory installed conduits require no further sealing. Integral Disconnect is sealed at factory.

4. The internal grounding terminal in the control enclosure (or in the integral disconnect enclosure when this option is provided) shall be used as the equipment grounding means. An external bonding terminal is provided for a supplementary bonding connection where local authorities permit or require such a connection.

FINAL INSPECTION

1. Before application of electrical power:
 - a. Check that all connections are secured and comply with the applicable wiring diagram (see Figure 9) and code requirements,
 - b. Confirm that the power supply is compatible with the data plate rating of the heater,
 - c. Remove any foreign objects from the heater,
 - d. Install all covers and verify that all enclosures are well secured, and
 - e. Ensure that the fan rotates freely. See Figure 6 for proper direction of fan rotation.

Control Enclosure & Field Wiring

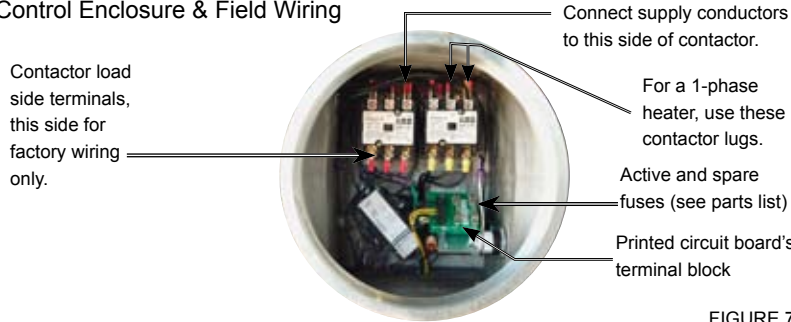
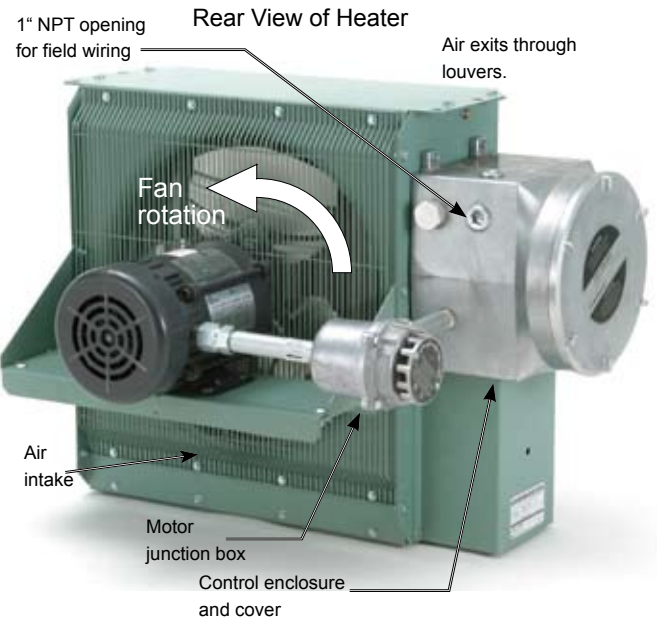


FIGURE 7A



Do not install conduit below heater (see Figure 3).

FIGURE 6

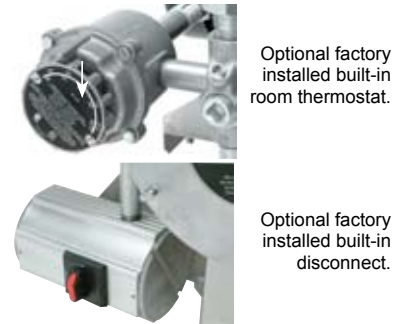


FIGURE 8

Optional Built-in Disconnect & Field Wiring

Sealed at Factory

Switch load side terminals, this side for factory wiring only.

1" NPT (Power Supply)



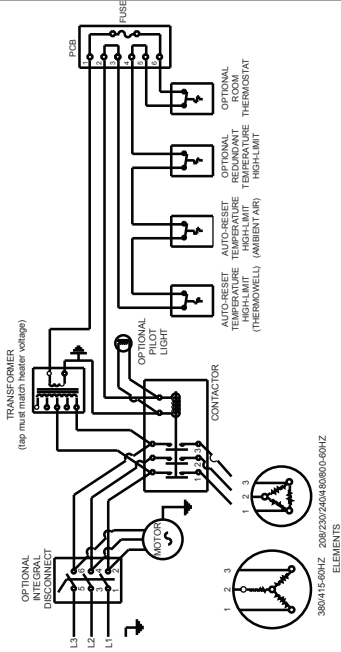
3/4" NPT (Remote Room Thermostat if applicable)

Terminals marked "T'STAT"

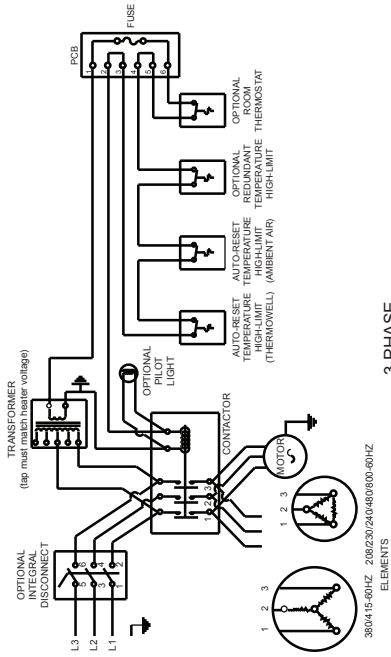
For a 1-phase heater use these Switch terminals

Connect Supply Conductors to this side of Switch

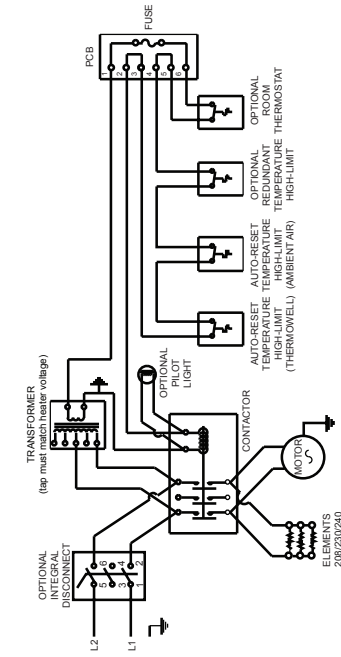
FIGURE 7B



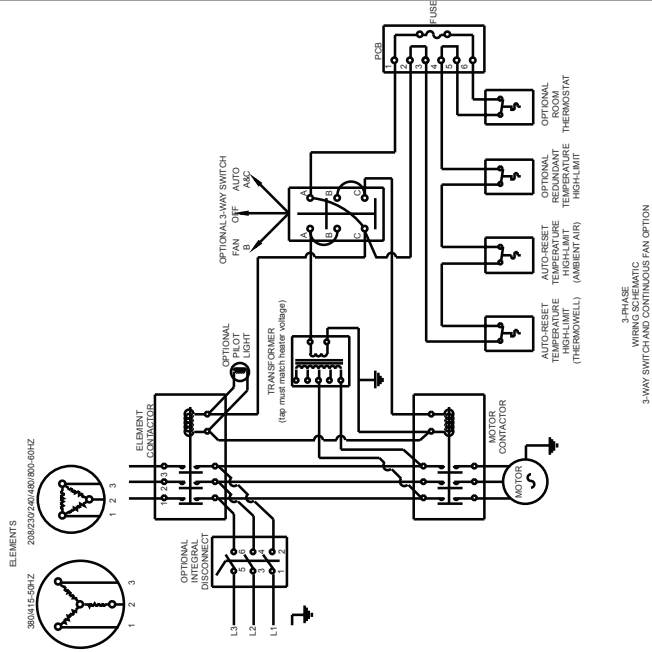
3-PHASE
WIRING SCHEMATIC
CONTINUOUS FAN OPTION



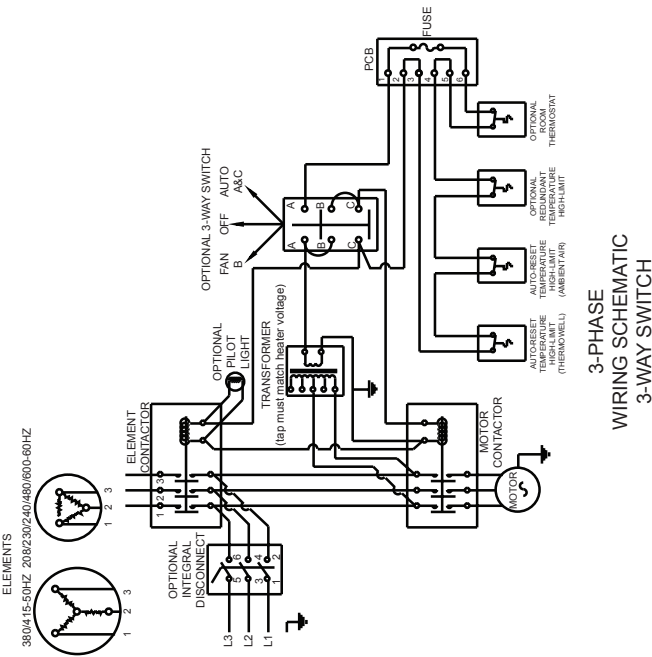
3-PHASE
WIRING SCHEMATIC



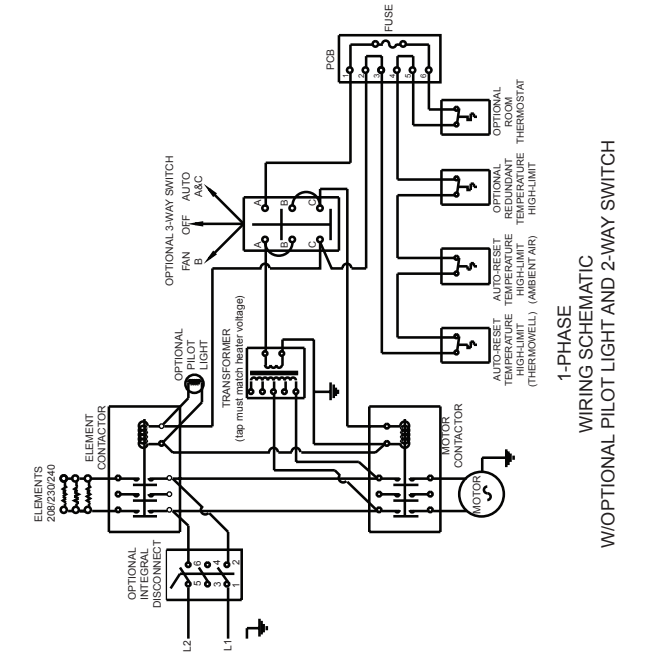
1-PHASE
WIRING SCHEMATIC



3-PHASE
WIRING SCHEMATIC
3-WAY SWITCHING CONTINUOUS FAN OPTION



3-PHASE
WIRING SCHEMATIC
3-WAY SWITCH



1-PHASE
WIRING SCHEMATIC
W/OPTIONAL PILOT LIGHT AND 2-WAY SWITCH



FX5 TECHNICAL DATA FOR 50 HZ ELECTRIC AIR HEATERS

MODEL	NOTE	AIR FLOW (CFM)	NOMINAL WATTAGE		PHASE	MAX. MOTOR NAMEPLATE CURRENT (A)	HEATER WATTAGE (W)	TOTAL CURRENT (A)	MINIMUM CIRCUIT AMPACITY (A)	SUPPLY WIRE SIZE (AWG)	MAXIMUM FUSE SIZE (A)	TEMPERATURE RISE		CORE PART NUMBER	CONTACTOR PART NUMBER
			(V)	(kW)								°F	°C		
FX5-220150-025		700	220	2.5	1	2.7	2,270	11.4	14.3	14	15	11.3	6.3	9529	3618
FX5-220150-042		700	220	4.2	1	2.7	3,950	19.1	23.9	10	25	19.0	10.5	9530	3618
FX5-220150-063		700	220	6.3	1	2.7	6,050	28.6	35.8	8	40	28.5	15.8	9531	3618
FX5-220150-084		700	220	8.4	1	2.7	8,140	38.2	47.8	6	50	37.9	21.1	9532	3619
FX5-220150-126*		1450	220	12.6	1	1.4	12,100	57.3	71.6	2	75	27.5	15.3	9533	3619
FX5-230150-028		700	230	2.8	1	2.7	2,480	12.2	15.3	12	20	12.6	7.0	9529	3618
FX5-230150-046		700	230	4.6	1	2.7	4,310	20.0	25.0	10	25	20.8	11.5	9530	3618
FX5-230150-069		700	230	6.9	1	2.7	6,610	30.0	37.5	8	40	31.2	17.3	9531	3618
FX5-230150-138*		1450	230	13.8	1	1.4	13,200	59.9	74.9	2	80	30.1	16.7	9533	3619
FX5-380350-025		700	380	2.5	3	0.7	2,270	3.8	4.8	16	5	11.3	6.3	9529	3618
FX5-380350-042		700	380	4.2	3	0.7	3,950	6.4	8.0	16	10	19.0	10.5	9530	3618
FX5-380350-063		700	380	6.3	3	0.7	6,050	9.6	12.0	14	15	28.5	15.8	9531	3618
FX5-380350-084		700	380	8.4	3	0.7	8,140	12.8	16.0	12	20	37.9	21.1	9532	3618
FX5-380350-125		1450	380	12.5	3	0.7	12,100	19.0	23.8	10	25	27.3	15.1	9533	3618
FX5-380350-209		3000	380	20.9	3	1.0	20,300	31.8	39.8	8	40	22.0	12.2	9535	3618
FX5-400350-028		700	400	2.8	3	0.7	2,480	4.0	5.0	16	5	12.6	7.0	9529	3618
FX5-400350-046		700	400	4.6	3	0.7	4,310	6.6	8.3	16	10	20.8	11.5	9530	3618
FX5-400350-069		700	400	6.9	3	0.7	6,610	10.0	12.5	14	15	31.2	17.3	9531	3618
FX5-400350-093		700	400	9.3	3	0.7	8,900	13.4	16.8	12	20	42.0	23.3	9532	3618
FX5-400350-139		1450	400	13.9	3	0.7	13,200	20.1	25.1	10	30	30.3	16.8	9533	3618
FX5-400350-185		1450	400	18.5	3	0.7	17,800	26.7	33.4	8	35	40.3	22.4	9534	3618
FX5-400350-231		3000	400	23.1	3	1.0	22,200	33.3	41.6	8	45	24.3	13.5	9535	3618
FX5-415350-037		700	415	3.7	3	0.7	3,510	5.1	6.4	16	10	16.7	9.3	9537	3618
FX5-415350-075		700	415	7.5	3	0.7	7,240	10.4	13.0	14	15	33.9	18.8	9539	3618
FX5-415350-149		1450	415	14.9	3	0.7	14,500	20.7	25.9	10	30	32.5	18.1	9541	3618
FX5-415350-224		3000	415	22.4	3	1.0	21,800	31.2	39.0	8	40	23.6	13.1	9543	3618
FX5-440350-042		700	440	4.2	3	0.7	3,950	5.5	6.9	16	10	19.0	10.5	9537	3618
FX5-440350-084		700	440	8.4	3	0.7	8,140	11.0	13.8	14	15	37.9	21.1	9539	3618
FX5-440350-168		1450	440	16.8	3	0.7	16,300	27.5	34.4	8	35	36.6	20.4	9541	3618
FX5-440350-209		3000	440	20.9	3	1.0	20,300	27.5	34.4	8	35	22.1	12.3	9542	3618

NOTES:

- * Exceeds the 48 Amp Circuit limit of NEC 424-22. DS5 not available for these units.
- 1. Minimum conductor size for 30°C (86°F) ambient. Derate conductor for ambient temperature. Use minimum 90°C (194°F) insulation.
- 2. Heater is functioning normally if at rated voltage the amp draw is within 10% of the value in this table.
- 3. Operation at lower voltages will result in reduced heat output and amp draw
- 4. Add "T" to model number when adding a built-in thermostat
- 5. Add "D" to model number when adding a built-in disconnect switch
- 6. Add "P" to model number when adding a built-in pilot light
- 7. Add "S" to model number when adding a 3-way switch
- 8. Add "H" to model number for units with high "off" (deenergized) ambient temperatures
- 9. Add "U" to model number for units with continuous fan option
- 10. Add "A" to model number for units with stainless steel cabinet.



FX5 TECHNICAL DATA FOR 60 HZ ELECTRIC AIR HEATERS



MODEL	NOTE	VOLTAGE (V)	NOMINAL WATTAGE (kW)	PHASE	MAX. MOTOR NAMEPLATE CURRENT (A)	HEATER WATTAGE (W)	TOTAL CURRENT (A)	MINIMUM CIRCUIT AMPACITY (A)	SUPPLY WIRE SIZE (AWG)	MAXIMUM FUSE SIZE (A)	TEMPERATURE RISE		CORE PART NUMBER	CONTACTOR PART NUMBER	
											°F	°C			
FX5-208160-030	*	208	3.0	1	2.7	2,700	14.4	18.0	12	20	11.2	6.2	9523	3618	
FX5-208160-050		208	5.0	1	2.7	4,700	24.0	30.0	10	30	18.6	10.3	9524	3618	
FX5-208160-075		208	7.5	1	2.7	7,200	36.1	45.1	6	50	27.9	15.5	9525	3619	
FX5-208160-100		208	10.0	1	2.7	9,690	48.1	60.1	4	70	37.2	20.7	9526	3619	
FX5-208360-030		208	3.0	3	1.4	2,700	8.3	10.4	14	15	11.2	6.2	9523	3618	
FX5-208360-050		208	5.0	3	1.4	4,700	13.9	17.4	12	20	18.6	10.3	9524	3618	
FX5-208360-075		208	7.5	3	1.4	7,200	20.8	26.0	10	30	27.9	15.5	9525	3618	
FX5-208360-100		208	10.0	3	1.4	9,700	27.8	34.8	8	35	37.2	20.7	9526	3618	
FX5-240160-030	*	240	3.0	1	2.7	2,700	12.5	15.6	12	20	11.2	6.2	9529	3618	
FX5-240160-050		240	5.0	1	2.7	4,700	20.8	26.0	10	30	18.6	10.3	9530	3618	
FX5-240160-075		240	7.5	1	2.7	7,200	31.3	39.1	8	40	27.9	15.5	9531	3618	
FX5-240160-100		240	10.0	1	2.7	9,700	41.7	52.1	6	60	37.2	20.7	9532	3619	
FX5-240160-150		240	15.0	1	1.4	14,400	62.5	78.1	2	80	27.1	15.1	9533	3619	
FX5-240360-030		240	3.0	3	1.4	2,700	7.2	9.0	14	15	11.2	6.2	9529	3618	
FX5-240360-050		240	5.0	3	1.4	4,700	12.0	15.0	14	15	18.6	10.3	9530	3618	
FX5-240360-075		240	7.5	3	1.4	7,200	18.0	22.5	10	25	27.9	15.5	9531	3618	
FX5-240360-100		240	10.0	3	1.4	9,700	24.1	30.1	8	35	37.2	20.7	9532	3618	
FX5-240360-150		240	15.0	3	1.4	14,400	36.1	45.1	6	50	27.1	15.1	9533	3619	
FX5-480160-030	°	480	3.0	1	1.3	2,700	6.3	7.9	14	15	11.2	6.2	9536	3618	
FX5-480160-050		480	5.0	1	1.3	4,700	10.4	13.0	14	15	18.6	10.3	9537	3618	
FX5-480160-075		480	7.5	1	1.3	7,200	15.6	19.5	12	20	27.9	15.5	9538	3618	
FX5-480160-100		480	10.0	1	1.3	9,700	20.8	26.0	10	30	37.2	20.7	9539	3618	
FX5-480160-150		480	15.0	1	1.3	14,400	31.3	39.1	8	40	27.1	15.1	9540	3618	
FX5-480160-200		480	20.0	1	1.3	19,400	41.7	52.1	6	60	36.1	20.1	9541	3619	
FX5-480360-030		480	3.0	3	0.7	2,700	3.6	4.5	14	15	11.2	6.2	9536	3618	
FX5-480360-050		480	5.0	3	0.7	4,700	6.0	7.5	14	15	18.6	10.3	9537	3618	
FX5-480360-075		480	7.5	3	0.7	7,200	9.0	11.3	14	15	27.9	15.5	9538	3618	
FX5-480360-100		480	10.0	3	0.7	9,700	12.0	15.0	14	15	37.2	20.7	9539	3618	
FX5-480360-150		480	15.0	3	0.7	14,400	18.0	22.5	10	25	27.1	15.1	9540	3618	
FX5-480360-200		480	20.0	3	0.7	19,400	24.1	30.1	8	35	36.1	20.1	9541	3618	
FX5-480360-250		480	25.0	3	1.0	24,200	30.1	37.6	8	40	45.2	25.1	9542	3618	
FX5-480360-300		480	30.0	3	1.0	29,200	36.1	45.1	6	50	26.4	14.6	9543	3619	
FX5-480360-350		480	35.0	3	1.0	34,200	42.1	52.6	6	60	30.7	17.1	9544	3619	
FX5-600360-030			600	3.0	3	0.6	2,700	2.9	3.6	14	15	11.2	6.2	9545	3618
FX5-600360-050			600	5.0	3	0.6	4,700	4.8	6.0	14	15	18.6	10.3	9546	3618
FX5-600360-075			600	7.5	3	0.6	7,200	7.2	9.0	14	15	27.9	15.5	9547	3618
FX5-600360-100	600		10.0	3	0.6	9,700	9.6	12.0	14	15	37.2		9548	3618	
FX5-600360-150	600		15.0	3	0.6	14,400	14.4	18.0	12	20	27.1	15.1	9549	3618	
FX5-600360-200	600		20.0	3	0.6	19,400	19.2	24.0	10	25	36.1	20.1	9550	3618	
FX5-600360-250	600		25.0	3	0.8	24,200	24.1	30.1	8	35	45.2	25.1	9551	3618	
FX5-600360-300	600		30.0	3	0.8	29,200	28.9	36.1	8	40	26.4	14.6	9552	3618	
FX5-600360-350	600		35.0	3	0.8	34,200	33.7	42.1	8	45	30.7	17.1	9553	3619	

- * Exceeds the 48 Amp Circuit limit of NEC 424-22. DS5 not available for these units.
- ° 480 1 Phase units are certified Class I, Div.1, Group D and Class II, Div. 1 Groups F & G.

NOTES:

1. Minimum conductor size for 30°C (86°F) ambient. Derate conductor for ambient temperature. Use minimum 90°C (194°F) insulation.
2. Heater is functioning normally if at rated voltage the amp draw is within 10% of the value in this table.
3. Operation at lower voltages will result in reduced heat output and amp draw
4. Add "T" to model number when adding a built-in thermostat
5. Add "D" to model number when adding a built-in disconnect switch
6. Add "P" to model number when adding a built-in pilot light
7. Add "S" to model number when adding a 3-way switch
8. Add "H" to model number for units with high "off" (deenergized) ambient temperatures

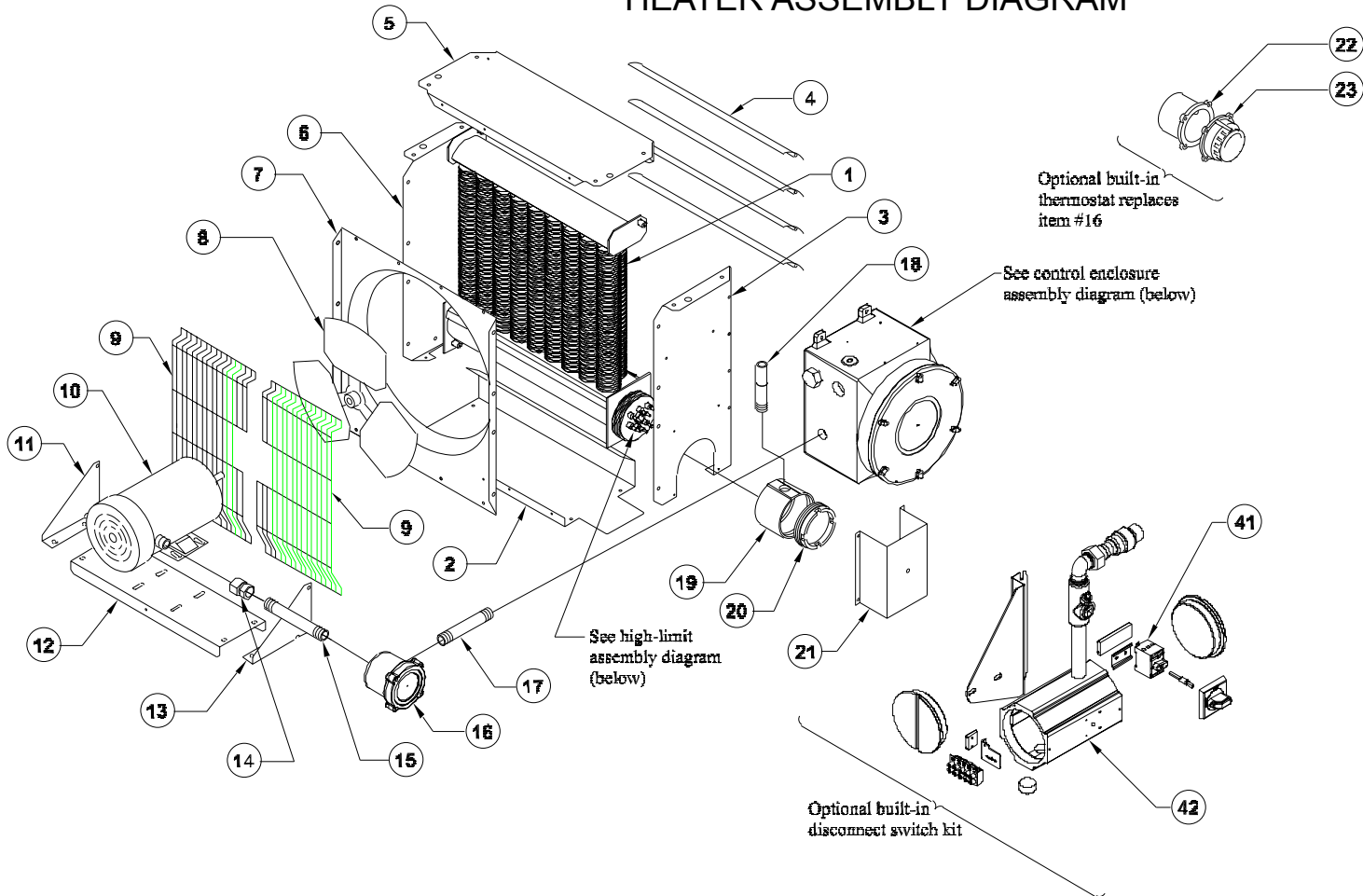
SPECIFICATIONS FOR ALL 60 HZ MODEL

		Nominal kW	3	5	7.5	10	15	20	25	30	35
Max. Altitude		(ft.)	12,000	8,000	10,000	7,000	10,000	7,000	10,000	7,000	6,000
		(m)	3,658	2,438	3,048	2,134	3,048	2,134	3,048	2,134	1,829
Air Flow @ 70°F		(CFM)	850				1750		3600		
@ 21°C		(m ³ /hr.)	1444				2973		6116		
Horizontal Air Throw		(ft.)	30				40		70		
		(m)	9.1				12.2		21.3		
Max. Mounting Height		(ft.)	10				10		20		
(to underside)		(m)	3.0				3.0		6.1		
Motor Power		(HP)	1/2				1/2		1/2		
(min)		(kW)	0.373				0.373		0.373		
Fan Diameter		(in.)	12				16		20		
		(mm)	305				406		508		
Net Weight	without	(lbs.)	140				168		201		
	DS5	(kg)	63.5				76.2		91.2		
	with	(lbs.)	152				180		213		
	DS5	(kg)	78.9				81.6		96.6		
Shipping Weight	without	(lbs.)	194				218		252		
	DS5	(kg)	88				98.9		114.3		
	with	(lbs.)	206				230		264		
	DS5	(kg)	93.4				104.3		119.7		
Temperature Code Rating		T3B 165°C (329°F) Class I & II.									
Enclosures		NEMA Type 7 & 9. For dry, indoor use only. Do not immerse in water. Do not store or use in areas exposed to rain or snow.									
Motor Type		Explosion-proof. Thermally protected. Permanently lubricated ball bearings. 1725 RPM									
Fan		Aluminum blade. Steel spider and hub with 5/8 in. (15.875 mm) bore.									
Fan Guard		Split design with close wire spacing. 1/4 in. (6.3 mm) dia. probe will not enter.									
Mounting Holes		Four 9/16 in. (14.3 mm) diameter holes at top of heater.									
Heating Elements		Three long-life, low watt-density, high grade metal-sheathed elements.									
Temperature High-Limit		Automatic reset type, snap-action bimetal, open on temperature rise. Rated 100,000 cycles at 10 amps, handles 0.128 amps.									
Control Circuit		120 Volts, 0.128 amps, 15VA. (Grounded)									
Optional Built-in Thermostat		Explosion-proof. 2°C to 28°C (36°F to 82°F)									
Optional Built-in Disconnect Switch		DS5 for use only on heaters with total current not exceeding 48-Amps. Lockout bar accepts 1/4" diameter padlock shackle.									
Optional Three Way Switch		Fan only, Off, Auto									
Optional Pilot Light		Indicates heat-on cycle									
Control Transformer		Multi-tap primary, 120 V secondary, 25 VA.									
Contactor		40 or 75 amp. Rated for 500,000 mechanical operations. 120 Volts, 15VA coil (separately fuse-protected).									
Heat Transfer Fluid		Long life formulated propylene glycol and water, freeze protected to -45°C (-49°F).									
Cabinet Material		14 ga. (0.075 in.) (1.90 mm) steel. Epoxy coated with five-stage pretreatment, including iron phosphate. Optional stainless steel.									
Core		Steel with integral aluminum fins, vacuum charged and hermetically sealed.									
Conduit Material		Heavy walled, 0.122 in. (3.1 mm) steel.									
Overpressure Protection		Preset 100 psig (690 kPa) seep pressure relief valve, aluminum body, no field serviceable parts.									
Operational Temperature Limitations		-45°C to 40°C (-49°F to 104°F)									
Storage Limitations		-45°C to 80°C (-49°F to 176°F), short term to 120°C (248°F). Do not immerse in water. Do not exposed to rain or snow.									

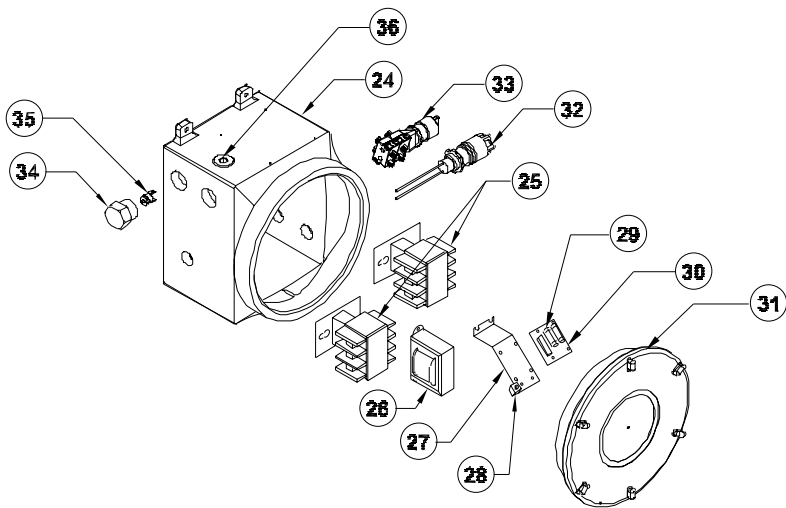
SPECIFICATIONS FOR ALL 50 HZ MODEL

		Nominal kW	2.5	3.7&4.2	6.3&7.5	8.4	12.5&12.6	14.9&16.7	20.9	22.4
Max. Altitude	(ft.)		12,000	8,000	10,000	7,000	10,000	7,000	10,000	7,000
	(m)		3,658	2,438	3,048	2,134	3,048	2,134	3,048	2,134
Air Flow	@ 70°F (CFM)		700			1450			3000	
	@ 21°C (m ³ /hr.)		1189			2463			5096	
Horizontal Air Throw	(ft.)		25			35			60	
	(m)		7.6			10.7			18.2	
Max. Mounting Height (to underside)	(ft.)		10			10			20	
	(m)		3.0			3.0			6.1	
Motor Power (min)	(HP)		1/4			1/4			1/2	
	(kW)		0.187			0.187			0.373	
Fan Diameter	(in.)		12			16			20	
	(mm)		305			406			508	
Net Weight	without (lbs.)		140			168			201	
	DS5 (kg)		63.5			76.2			91.2	
	with (lbs.)		152			180			213	
Shipping Weight	without (lbs.)		194			218			252	
	DS5 (kg)		88			98.9			114.3	
	with (lbs.)		206			230			264	
	DS5 (kg)		93.4			104.3			119.7	
Temperature Code Rating		T3B 165°C (329°F) Class I & II.								
Enclosures		NEMA Type 7 & 9. For dry, indoor use only. Do not immerse in water. Do not store or use in areas exposed to rain or snow.								
Motor Type		Explosion-proof. Thermally protected. Permanently lubricated ball bearings. 1725 RPM								
Fan		Aluminum blade. Steel spider and hub with 5/8 in. (15.875 mm) bore.								
Fan Guard		Split design with close wire spacing. 1/4 in. (6.3 mm) dia. probe will not enter.								
Mounting Holes		Four 9/16 in. (14.3 mm) diameter holes at top of heater.								
Heating Elements		Three long-life, low watt-density, high grade metal-sheathed elements.								
Temperature High-Limit		Automatic reset type, snap-action bimetal, open on temperature rise. Rated 100,000 cycles at 10 amps, handles 0.128 amps.								
Control Circuit		120 Volts, 0.128 amps, 15VA. (Grounded)								
Optional Built-in Thermostat		Explosion-proof. 2°C to 28°C (36°F to 82°F)								
Optional Built-in Disconnect Switch		DS5 for use only on heaters with total current not exceeding 48-Amps. Lockout bar accepts 1/4" diameter padlock shackle.								
Optional Three Way Switch		Fan only, Off, Auto.								
Optional Pilot Light		Indicates heat-on cycle.								
Control Transformer		Multi-tap primary, 120 V secondary, 25 VA.								
Contactor		40 or 75 amp. Rated for 500,000 mechanical operations. 120 Volts, 15VA coil (separately fuse-protected).								
Heat Transfer Fluid		Long life formulated propylene glycol and water, freeze protected to -45°C (-49°F).								
Cabinet Material		14 ga. (0.075 in.) (1.90 mm) steel. Epoxy coated with five-stage pretreatment, including iron phosphate. Optional stainless steel.								
Core		Steel with integral aluminum fins, vacuum charged and hermetically sealed.								
Conduit Material		Heavy walled, 0.122 in. (3.1 mm) steel.								
Overpressure Protection		Preset 100 psig (690 kPa) seep pressure relief valve, aluminum body, no field serviceable parts.								
Operational Temperature Limitations		-45°C to 40°C (-49°F to 104°F)								
Storage Limitations		-45°C to 80°C (-49°F to 176°F), short term to 120°C (248°F). Do not immerse in water. Do not exposed to rain or snow.								

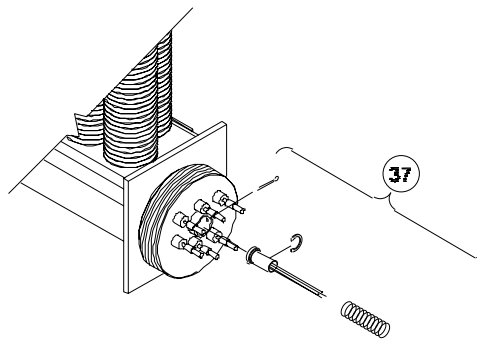
HEATER ASSEMBLY DIAGRAM



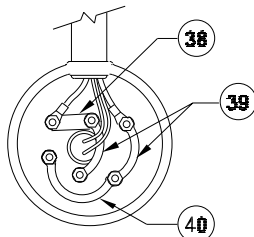
CONTROL ENCLOSURE ASSEMBLY DIAGRAM



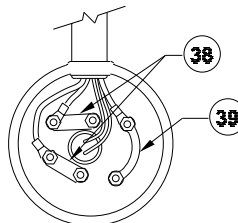
HIGH LIMIT ASSEMBLY DIAGRAM



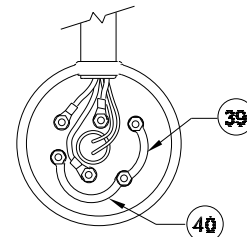
US-BAR CONFIGURATION ALL 1-PHASE MODELS



BUS-BAR CONFIGURATION FOR ALL 3-PHASE (EXCEPT 380 50 HERTZ)



BUS-BAR CONFIGURATION 3-PHASE 380 VOLT 50 HERTZ MODELS



PARTS LIST
FORCED AIR ELECTRIC HEATERS

	PART NUMBERS			Please have model and serial number available before calling
ITEM	2.5 - 10 kW	12.5 - 20 kW	20.9 - 35 kW	DESCRIPTION
1	**	**	**	Core
2	Painted: 9203 S.S.: 9507	Painted: 9204 S.S.:9508	Painted: 9205 S.S.: 9509	Panel, Bottom
3	Painted: 9191 S.S.: 9192	Painted: 9193 S.S.: 9194	Painted: 9195 S.S.: 9196	Panel, Left Side
4	4075	4076	4077	Louver Kit, c/w Screws
5	Painted: 9200 S.S.: 9513	Painted: 9201 S.S.: 9514	Painted: 9202 S.S.: 9505	Panel, Top
6	Painted: 9197 S.S.: 9510	Painted: 9198 S.S.: 9511	Painted: 9199 S.S.: 9512	Panel, Right Side
7	Painted: 3782 S.S.: 9212	Painted: 3783 S.S.: 9213	Painted: 3784 S.S.: 9214	Panel, Fan Shroud
8	4023	4024	4025	Fan
9	Painted: 4078 S.S.: 9504	Painted: 4079 S.S.: 9505	Painted: 4080 S.S.: 9506	Fan Guard Kit
10	208/240V 60HZ 1 PH: 220 V 50 HZ 1 PH: 480V 60 HZ 1 PH: 208/240/480V 60 HZ 3 PH: 380/415V 50 HZ 3 PH: 600V 60 HZ 3 PH:	1979 1979 2396 9082 9082 9294		Motor, Explosion-Proof
11	Painted: 3789 S.S.: 9112	Painted: 3789 S.S.: 9112	Painted: 3789 S.S.: 9112	Bracket, Motor Mount Right
12	Painted: 3785 S.S.: 9206	Painted: 3786 S.S.: 9207	Painted: 3787 S.S.: 9208	Channel, Motor Mount
13	Painted: 3788 S.S.: 9111	Painted: 3788 S.S.: 9111	Painted: 3788 S.S.: 9111	Bracket, Motor Mount Left
14	-	-	-	Coupling, Motor Mount
15	3813	3814	3815	Conduit, Motor
16	5371	5371	5371	Cover, Thermostat Enclosure
17	-	-	-	Conduit, Control Enclosure
18	9314	9315	9316	Conduit, Element Enclosure
19	3793	3793	3793	Enclosure, Element
20	3510	3510	3510	Cover, Element Enclosure
21	Painted: 9354 S.S.: 9516	Painted: 9355 S.S.: 9517	Painted: 9356 S.S.: 9518	Panel, Element Enclosure Guard
22	4983	4983	4983	Enclosure, Thermostat
23	5032	5032	5032	Thermostat, Built-in Kit
24	9156	9156	9156	Enclosure, Control
25	**	**	**	Contactors
26	60 HZ: 3812	50 HZ: 4416		Transformer
27	3809	3809	3819	Bracket, Printed Circuit Board
28	1876	1876	1876	Terminal, 6-14 ga. Screw Lug
29	3519	3519	3519	Fuse, 1/4 Amp
30	3514	3514	3514	Printed Circuit Board Assembly
31	9158	9158	9158	Cover, Control Enclosure
32	9279	9279	9279	Light, Explosion-Proof Pilot
33	9283	9283	9283	Switch, Explosion-proof 3-way
34	9267	9267	9267	Thermowell, Ambient High-Limit
35	9303	9303	9303	High Limit Ambient Temperature
36	9289	9289	9289	Plug, 1" NPT Explosion-Proof
37	4082	4082	4082	Temperature High Limit Kit
38	3816	3816	3816	Bus-Bar, Straight
39	3817	3817	3817	Bus-Bar, Small Curved
40	3818	3818	3818	Bus-Bar, Large Curved
41	6471	6471	6471	Switch, Disconnect Rotary
42	Painted: 9273 S.S.: 9520	Painted: 9498 S.S.: 9521	Painted: 9499 S.S.: 9522	Kit, DS5 Assembly

**See technical data table for part numbers. NOTE: For items not shown, contact factory

REPAIR & REPLACEMENT

WARNING

Disconnect heater from power supply at integral disconnect or fuse box before opening enclosures or servicing heater. Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application. IF INTEGRAL DISCONNECT IS BEING SERVICED, verify that power has been disconnected at fuse box or main panel. Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application. Heater surfaces may be hot.

- After repairing any component:
 - check that electrical connections are correct and secure (see Figure 9),
 - remove any foreign material from enclosures,
 - install and secure all covers,
 - ensure that all fasteners are tight,
 - remove all foreign objects from heater, and
 - ensure air exits through louvers and fan rotates counterclockwise when viewed from rear of heater (see Figure 14).

CORE

The heater core is vacuum charged and not field repairable.

For core removal:

- Remove cabinet bottom and element enclosure cover.
- Disconnect all wires entering element enclosure (see Figure 10).
- Slightly loosen all cabinet bolts shown in Figure 10, to prevent the core from binding.
- With an assistant supporting the weight of the core, remove the 3 core mounting bolts. Carefully lower the core out of the cabinet (see Figure 11).
- To return core to factory, use crate supplied with exchange core to protect the element terminals and plate threads.
- To reinstall, lift the core up into cabinet while an assistant guides the element wires into the element enclosure conduit.
- Position the core and tighten the 3 core mounting bolts. Tighten the remaining cabinet bolts.

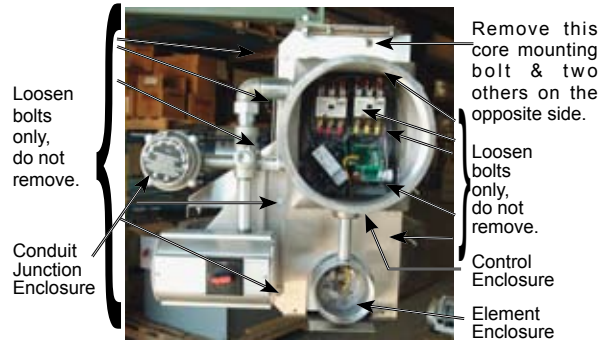


FIGURE 10



FIGURE 11



FIGURE 12

TEMPERATURE HIGH-LIMIT

- Remove temperature high-limit assembly and clean the inside of the thermowell (see Figure 12). A clean thermowell will ensure good thermal contact.
- Use only a factory supplied temperature high-limit to ensure safe operation. (refer to the instructions that accompany the replacement Temperature High-Limit Kit).
- Reinstall the temperature high-limit assembly with the snap ring and spring into the thermowell without damaging the insulating tube. Secure in place with the cotter pin (see Figure 13).



FIGURE 13

MOTOR, FAN & FAN GUARD

- Remove bolts holding the motor to the motor mount. On units with a built in thermostat, remove the bolts on the back of the thermostat enclosure.
- Remove conduit #1 located between motor junction box and control enclosure by turning it in the direction illustrated (see Figure 14). Note conduits #1 and #2 are not interchangeable and have left hand threads on one end, this end is indicated by a machined groove.
- Remove the 2 piece fan guard assembly (see Figure 15).
- Lift the motor assembly off the motor mount.
- Before removing the fan, measure and record the location of the fan hub on the motor shaft (see Figure 16). If difficult to remove, use a gear puller on the fan hub.
- To reassemble, place motor assembly onto motor mount and fasten the fan guard to cabinet.
- Simultaneously engage and tighten both ends of conduit #1 into enclosures. Leave a 1/16" to 3/16" (1.6 to 4.8 mm) gap between the motor and fan guard (see Figure 16). Adjust conduit #2 to center the fan in the shroud.
- To ensure a minimum 5 thread engagement, threaded ends of conduits must protrude a minimum of 1/16" (1.6mm) into enclosures. The groove on conduit #2 must not be more than 7/8" (22mm) from motor coupling (see Figure 14).
- Bolt motor to motor mount. Manually spin the fan blade to ensure fan rotates freely.
- Air must exit through louvers and fan must rotate counterclockwise when viewed from rear of heater (see Figure 14).

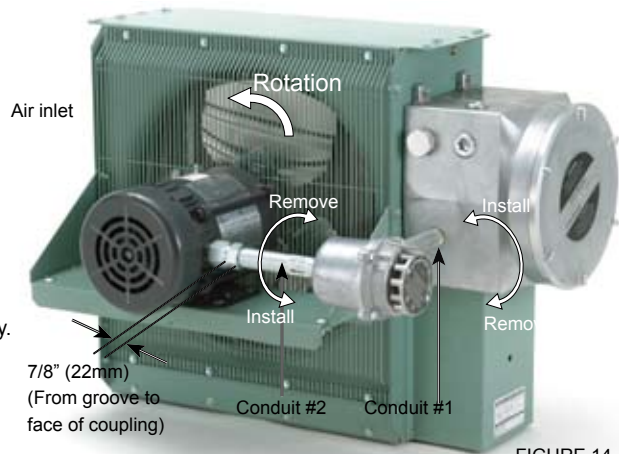


FIGURE 14



FIGURE 15



FIGURE 16

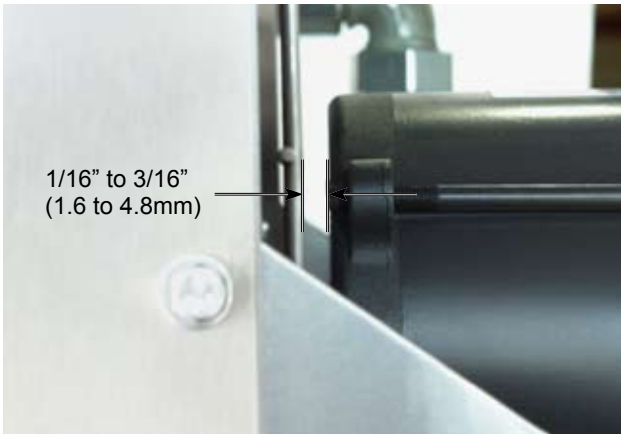


FIGURE 17

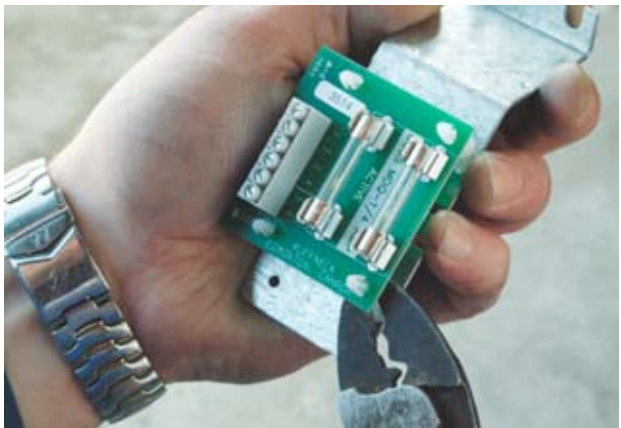


FIGURE 18

PRINTED CIRCUIT BOARD

1. After removing the printed circuit board (P.C. Board) bracket assembly from the control enclosure, separate the P.C. Board from the bracket by cutting off the plastic spacers (see Figure 18).
2. Reinstall a new factory supplied P.C. Board onto the mounting bracket using new non-conducting spacers of the same length. Spacers are supplied with a new P.C. Board. Reinstall the control circuit ground wire to the printed circuit board bracket (see Figure 9).

CONTACTOR

1. Loosen, but do not remove contactor mounting screws. Slide contactor off mounting screws.
2. Replace with a factory supplied contactor of the same rating.

TRANSFORMER

1. Replace with a factory supplied transformer of the same rating.
2. On the new transformer, select primary wires to match heater voltage. Ensure that the correct transformer secondary lead is grounded (see Figure 9). Individually terminate all unused wires using closed end connectors.

FUSE

Replace fuse with one of the same type and rating as indicated on P.C. Board or refer to parts list. An extra fuse should be stored in the clips marked "SPARE".

HEATING ELEMENTS

Heating elements are an integral part of the vacuum charged core. A factory exchange core can be shipped immediately from stock. Refer to "Core" section for details.

CABINET PANELS

Bolt-on cabinet panels are individually replaceable.



**5918 Roper Road
Edmonton, Alberta,
Canada T6B 3E1
Phone: (780) 466-3178
Fax: (780) 468-5904
www.ccithermal.com**

PLEASE ADHERE TO INSTRUCTIONS PUBLISHED IN THIS MANUAL.
Failure to do so may be dangerous and may void certain provisions of your warranty.
For further assistance, please call:

24 Hr. Hotline: 1-800-661-8529

(U.S.A. and Canada)

Please have model and serial numbers available before calling.



LIMITED 3 YEAR WARRANTY

CCI Thermal Technologies warrants all RuffneckTM FX5 Series Explosion-Proof Electric Fan Forced Air Heaters against defects in materials and workmanship for a period of three (3) years from date of purchase on the following terms:

1. We will provide replacement parts free of charge as necessary to restore any unit to operating condition, provided that the inoperative parts be returned to us freight prepaid and that the replacement parts be accepted freight collect.
2. The complete heater may be returned to our plant for repair or replacement (at our discretion), provided that all related freight costs be borne by the customer.
3. Corrosion and contamination by dirt, dust, etc. will not be considered as defects and, therefore, are not warrantable.
4. The heater must not be modified in any way.
5. The heater must be installed, used and stored only in accordance with the owner's manual and placarded information.

This warranty shall be limited to the actual equipment involved and, under no circumstances, shall include or extend to installation or removal costs, or to consequential losses or damages.



SOPER'S SUPPLY LTD.

EXPLOSION Proof Direct Drive Wall Fans



These sidewall propeller fans are the ideal choice for commercial/industrial applications where high volumes of air and relatively low pressures are required for hazardous locations. Fan sizes range from 8" to 48". Performance spans the range of 300 CFM to 54,000 CFM, with static pressures up to 1" WG (249 PA). Fans are direct drive, therefore requiring little or no maintenance. Available in either exhaust or supply configurations.

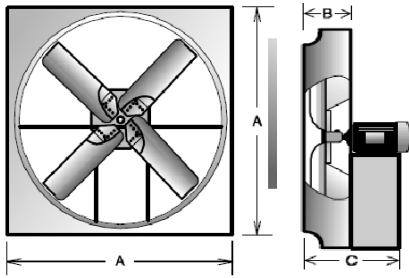
Construction & Design Features:

- Cast aluminum spark proof blades (except where noted).
- Fan blades are tested in accordance with AMCA standard 210.
- OSHA approved finger guards.
- Heavy gauge steel fan panel with deep inlet venturi, distributes air uniformly for efficient performance.
- Motors are CSA certified and UL listed.
- Fractional HP motors are rated Explosion Proof, Class I and II, Groups C, D, F and G with a T3B temperature code (165C or 329F).
- Integral HP motors are rated Explosion Proof, Class I and II, Groups D, F, G with a T3B temperature code (165C or 329F).

Options Available:

- Custom sizes and performances.
- 50 Hz or ATEX approved motors.
- VFD compatible motors.
- Division 2 motors are available on integral HP's.
- Dampers, control dampers and louvers.
- Sleeves, cabinets and back guards.
- Corrosion resistant coating.
- Weather Hoods.
- Disconnect switches.
- Thermostats

www.SopersSupply.com



Model	A	B	C	Wall Opening
12"	16 ¹ / ₈ "	2 ¹ / ₂ "	9 ¹ / ₂ "	17 ¹ / ₈ "
16"	20 ¹ / ₈ "	3 ¹ / ₂ "	10 ¹ / ₂ "	21 ¹ / ₈ "
18"	22 ¹ / ₈ "	3 ¹ / ₂ "	10 ¹ / ₂ "	23 ¹ / ₈ "
20"	24 ¹ / ₈ "	3 ³ / ₄ "	10 ³ / ₄ "	25 ¹ / ₈ "
24"	29 ¹ / ₈ "	6 ⁵ / ₈ "	13 ¹ / ₂ "	30 ⁷ / ₈ "
30"	35 ¹ / ₈ "	6 ³ / ₄ "	13 ³ / ₄ "	36 ⁷ / ₈ "
36"	41 ¹ / ₈ "	7 ¹ / ₄ "	14"	42 ⁷ / ₈ "

Blade Diameter	Model #			RPM	H.P.	Pitch	# Blades	dBA @ 5 ft.	Weight (Lbs)	CFM @ Static Pressure									
	Single Phase	Three Phase								0"	0.125"	0.25"	0.375"	0.50"	0.625"	0.75"	0.875"	1"	1.125"
	115/230 V	208-230/460 V	575 V																
8"	V8X1L1/46			1140	1/4	35°	6	50.1	35.4	293	94.3	-	-	-	-	-	-	-	-
		V8X3M1/36		1140	1/3	35°	6	50.1	33.2	293	94.3	-	-	-	-	-	-	-	-
	V8X1L1/4	V8X3M1/4	V8X3H1/4	1725	1/4	35°	6	59.1	33.4	443	358	163	67.4	-	-	-	-	-	-
10"	V10X1L1/46			1140	1/4	25°	6	54.0	38.0	397	273	56.7	-	-	-	-	-	-	-
		V10X3M1/36		1140	1/3	25°	6	54.0	35.8	397	273	56.7	-	-	-	-	-	-	-
	V10X1L1/4	V10X3M1/4	V10X3H1/4	1725	1/4	25°	6	63.0	36.0	601	536	445	256	160	29.8	-	-	-	-
12"	V12X1L1/46			1140	1/4	30°	3	55.0	40.0	795	440	-	-	-	-	-	-	-	-
		V12X3M1/36		1140	1/3	30°	3	55.0	37.8	795	440	-	-	-	-	-	-	-	-
	V12X1L1/4	V12X3M1/4	V12X3H1/4	1725	1/4	30°	3	64.0	34.0	1200	1010	761	341	114	-	-	-	-	-
16"	V16X1L1/46			1140	1/4	30°	6	62.1	42.0	1780	1470	959	342	-	-	-	-	-	-
		V16X3M1/36		1140	1/3	30°	6	62.1	39.8	1780	1470	959	342	-	-	-	-	-	-
	V16X1L1/4	V16X3M1/4	V16X3H1/4	1725	1/4	30°	6	71.1	38.0	2690	2500	2290	2050	1720	1210	797	470	144	-
18"	V18X1L1/46			1140	1/4	30°	4	61.7	41.7	2360	1860	962	183	-	-	-	-	-	-
		V18X3M1/36		1140	1/3	30°	4	61.7	41.8	2360	1860	962	183	-	-	-	-	-	-
	V18X1L1/3	V18X3M1/3	V18X3H1/3	1725	1/3	30°	4	70.7	42.3	3570	3260	2920	2500	1880	1160	675	222	-	-
20"	V20X1L1/46			1140	1/4	30°	4	65.8	46.0	2990	2360	1440	305	-	-	-	-	-	-
		V20X3M1/36		1140	1/3	30°	4	65.8	43.8	2990	2360	1440	305	-	-	-	-	-	-
	V20X1L1/2	V20X3M1/2	V20X3H1/2	1725	1/2	30°	4	74.8	64.0	4530	4140	3710	3240	2630	1810	1070	389	-	-
24"	V24X1L1/46			1140	1/4	25°	8	71.8	41.6	3460	2990	2450	1680	963	-	-	-	-	-
		V24X3M1/36		1140	1/3	25°	8	71.8	54.0	3460	2990	2450	1680	963	-	-	-	-	-
	V24X1L3/4	V24X3M3/4	V24X3H3/4	1725	3/4	25°	8	80.8	105.2	5240	4910	4610	4280	3920	3530	3030	2470	1920	1510
30"	PLEASE CONTACT SOPER'S SUPPLY FOR MORE INFORMATION ON THESE SIZES.																		
36"																			
42"																			
48"																			

dBA ratings shown are measured at 0" static pressure and should be used as a guideline only.



Edmonton, AB
 10519 - 114 St.
 T5H 3J6
 Ph: 780-423-4066
 Fax: 780-425-8579

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 Ph: 604-590-1667
 Fax: 604-590-5501

Vancouver, BC
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 V5Y 1K6
 Ph: 604-566-9370
 Fax: 604-566-9371

WARRANTY INFORMATION

SUR-FLO METERS & CONTROLS LTD. warrants our products against defects in material and workmanship for a period of one year from the date the product was shipped by Sur-Flo to the original purchaser. During the one year period (provided the original purchaser continues to own the product) Sur-Flo will, at its sole option, repair any defects, replace the product or repay the purchase price.

This warranty will be void if the purchaser fails to observe the procedures for installation, operation or service of the product as set forth in the Operating Manual; or if the defect is caused by tampering or physical misuse of the product.

SUR-FLO METERS & CONTROLS LTD. specifically disclaims all implied warranties including those of merchantability or fitness for a particular purpose. Under no circumstances will Sur-Flo be liable for incidental damages of any kind whatsoever.

In the event of a malfunction of the product, please consult your Sur-Flo Representative.

SUR-FLO METERS & CONTROLS LTD. has a policy of continued product improvement and reserves the right to change specifications without notice.

FACTORY LOCATION:

4520 – 50 Avenue SE
Calgary, AB T2B 3R4
Web Site: www.sur-flo.net
Ph: (403) 207-9715
Fx: (403) 207-9440



Sur-Flo Meters & Controls Ltd.
Design & Manufacturing

SF1015 TURBINE METER

Operating Manual

“A New Spin on Metering”

4520 – 50 Avenue SE Calgary, AB T2B 3R4
Phone: (403) 207-9715 Fax: (403) 207-9440
Toll Free: 1-877-527-8977
Email: sur-flo@tetusplanet.net

COMPANY INFORMATION

At Sur-Flo Meters & Controls Ltd. we endeavor to design our equipment to be user friendly, reliable and most of all cost effective. Our primary goals are customer satisfaction and quality second to none. We strive to understand our customers' needs and expectations.

Sur-Flo Meters & Controls Ltd. has been designing and manufacturing products for the oil and gas industry since 1990 and has been in operation since 1979. Our products include turbine meters, pressure control valves as well as meter runs.

Sur-Flo Meters & Controls Ltd. market and sell its products through distributors, representatives, agents as well as direct sales. For more details on our products, please feel free to contact us and we will be happy to help you or provide you with a list of representatives in your area.



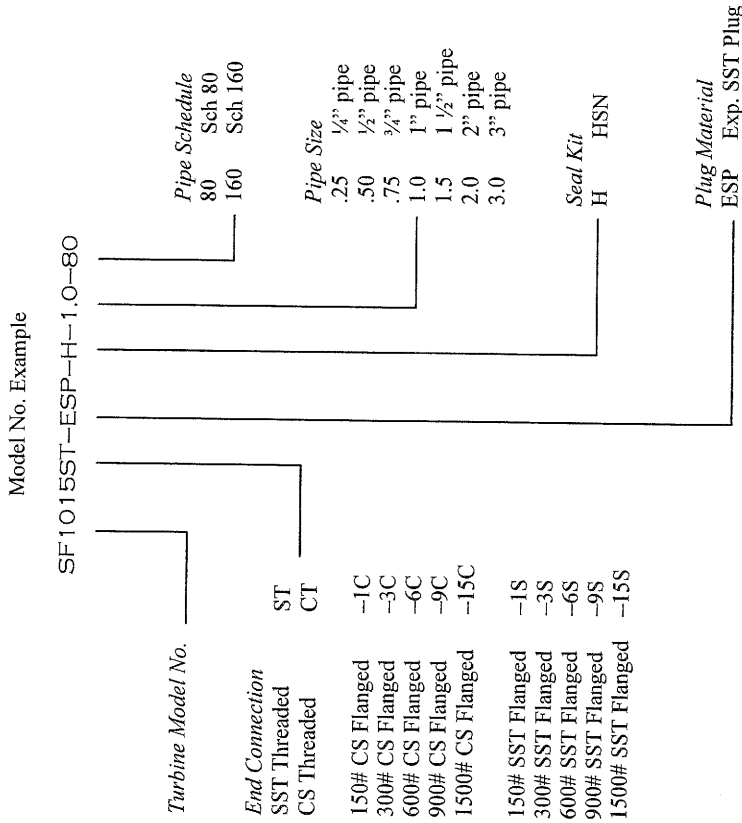
Proudly Canadian

DATE: February 19, 2003	NOTE:	DRN: D.N.
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ITEM	PART NO.	DESCRIPTION	QUANTITY
1	TM1002	SF1015 Top Plug	1
2	TM1003	SF1015 Seal Kit	3
3	TM1004	SF1015 Support Bearing	1
4	TM1005	SF1015 Carbide Shaft	1
5	TM1006	SF1015 Shaft Allen Screw	1
6	TM1007	SF1015 Rotor	1
7	TM1007B	SF1015 Rotor Bushing	1
8	TM-HOUSING	SF1015 Housing	1
9	Pipe	SF1015 Nipple	1

<p style="font-size: small;">TOLERANCES UNLESS OTHERWISE STATED .X ±0.100" .XX ±0.030" .XXX ±0.015" SURFACE FINISH 63 Ra ALL DIMENSIONS ARE IN INCHES BREAK ALL SHARP EDGES</p>	REV	DESCRIPTION	SUR-FLO METERS & CONTROLS LTD. CALGARY, ALBERTA		
		CRN: 01879.2			
				SCALE: 1:1	APPD.
				TITLE: SF1015 Exploded View	
	MATERIAL:		DWG. NO: SF1015-EXP	REV: 0	

SF1015 ORDERING MATRIX



Note: For special orders please contact Sur-Flo or your nearest supplier

SF1015 OPERATIONS

Regarding Installation:

- All meters are bi-directional!
- It is recommended to have a straight section of pipe ten pipe diameters upstream and five pipe diameters downstream of the meter.
- The SF1015 may be used with any pulse drawn totalizer. The totalizer is connected to the turbine meter with the use of a Sur-Flo totalizer adapter and a standard magnetic pickup coil.

Calibration:

- The SF1015 is calibrated in the same fashion as all conventional turbine meters and should be re-calibrated using the same time schedule.

Maintenance and Inspection Procedures:

- Inspection and repairs on the SF1015 can be made while the meter is still in line.
- Pressure MUST be bled off line before servicing the meter.
- DO NOT remove plug assembly while system is under pressure!
- To check the support bearing, rotor or shaft the meter can remain in line. Firstly, remove the pickup coil and plug assembly. Then, using pullers (which screw into the existing position of the pickup coil) pull the support bearing out through the neck of the meter.
- The shaft retaining screw is removed thus allowing the shaft to be pushed out of the support bearing using any rod from the opposite side of the retaining screw. Caution must be taken not to over tighten the retaining screw or the shaft could be damaged.
- When installing the support bearing ensure the rotor is lined up with the window slot in the meter body. Approx. 30 ft. lbs. of torque is required to tighten properly.
- When installing the pickup coil ensure that it bottoms out against the support bearing (back it off a ¼ turn and set lock nut). DO NOT over tighten or damage may occur to the support bearing.
- Complete repair kits and individual replacement parts are available upon request. It is recommended that the seal kit be replaced whenever the support bearing is removed.

SPECIFICATIONS

FLOW RATES

Line Size - Pipe Sch.	LINEAR FLOW RANGE			Nominal Calibration	Maximum ΔP
	gal/min	bl/d	m ³ /d		
1/4" - 80 (6mm)	.9 - 7.3	31 - 250	5 - 40	2082	170
3/8" - 80 (10mm)	1.5 - 13	50 - 440	8 - 70	1457	156
1/2" - 80 (13mm)	2.8 - 18	94 - 629	15 - 100	700	165
3/4" - 80 (19mm)	7.5 - 52	250 - 1824	40 - 290	310	130
1" - 160 (25mm)	6.5 - 64	377 - 2200	60 - 350	284	132
1" - 80 (25mm)	10 - 92	503 - 3145	80 - 500	208	160
1 1/2" - 160 (38mm)	18 - 174	629 - 5975	100 - 950	83	92
1 1/2" - 80 (38mm)	27 - 185	1132 - 6919	180 - 1100	68	115
2" - 160 (51mm)	27 - 275	943 - 9435	150 - 1500	49	125
2" - 80 (51mm)	45 - 367	1572 - 12580	250 - 2000	38	120
3" - 80 (76mm)	119 - 734	4277 - 27675	650 - 4400	11	82
3" - 160 (76mm)	92 - 661	3145 - 22643	500 - 3600	13	82
4" - 80 (102mm)	200 - 1400	6856 - 48000	1090 - 7630	5	115
4" - 160 (102mm)	156 - 1120	5346 - 38368	850 - 6100	6	115
6" - 80 (152mm)	400 - 2850	13712 - 97492	2180 - 15500		
8" - 80 (203mm)	700 - 4990	23900 - 171083	3800 - 27200		

General Specifications

Max Operating Pressure:	150 - 2500 ANSI
Standard Meter Sizes:	Up to 4" Meter Sizing*
Flow Rates:	5-6000m ³ /day, 0.9-1100 gpm
Operating Temperature:	-40 to +550 degrees Celsius
Accuracy:	± 2%
Repeatability:	± 0.5%
Meter Connection:	NPT threaded or flanged

* for larger sizes contact Sur-Flo

Face to Face Dimensions

0.25" to 2" NPT Threaded:	154.2mm / 6.0" face to face
3" NPT Threaded:	304.8mm / 12.0" face to face
4" NPT Threaded:	304.8mm / 12.0" face to face
Flanged (all sizes):	406.4mm / 16.0" face to face

Straightening Pipe Dimensions

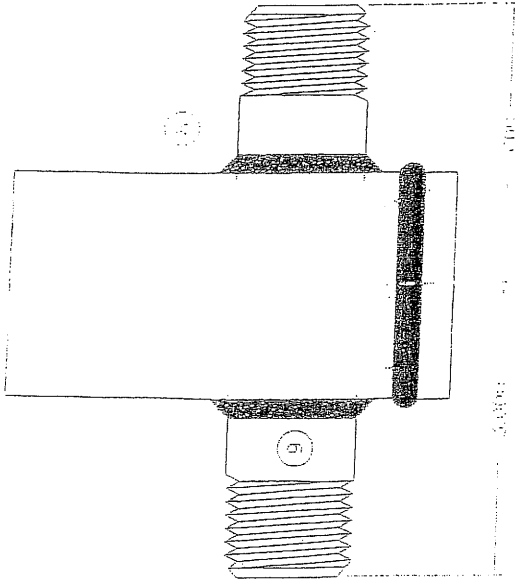
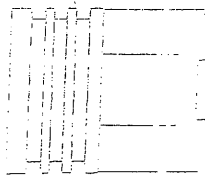
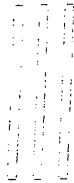
P1 Straightening Pipe:	10 pipe diameters minimum
P2 Straightening Pipe:	5 pipe diameters minimum

Note: Recommended maximum viscosity is 5.0 centipoise

DATE: February 19, 2006

NOTE

DRN D.N



ITEM	PART NO.	DESCRIPTION	QUANTITY
1	TM1002	SF 1015 Top Plug	1
2	TM1003	SF 1015 Seal Kit	1
3	TM1004	SF 1015 Support Bearing	1
4	TM1005	SF 1015 Carbide Shaft	1
5	TM1006	SF 1015 Shaft Allen Screw	1
6	TM1007	SF 1015 Rotor	1
7	TM1007B	SF 1015 Rotor Bushing	1
8	TM-HOUSING	SF 1015 Housing	1
9	Pipe	SF 1015 Nipple	1

REV	DESCRIPTION
	CRN OF 1979.2

SUR-FLO METERS & CONTROLS LTD.
CALGARY, ALBERTA

SCALE: 1:1 APPD. TITLE: SF1015 Exploded View

DWG. NO: SF1015-EXP REV: 0

MATERIAL:

Fisher® D4 Control Valve Assembly

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Figure 1. Fisher D4 Control Valve



W8531

Introduction

Scope of Manual

This instruction manual provides installation, maintenance, and parts information for the Fisher D4 control valve.

Do not install, operate, or maintain a D4 control valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your Emerson Process Management sales office before proceeding.

Description

The D4 control valve is a compact, rugged valve designed primarily for high-pressure throttling applications. This valve is ideal for use on pressure and flow control applications within the oil and gas production industry. The D4 valve also makes an excellent dump valve for high-pressure separators and scrubbers.

The D4 control valve meets the metallurgical requirements of NACE MR0175/ISO 15156 without environmental limits for temperatures below 135°C (275°F). If the temperature is above 135°C (275°F), the N07718 Belleville washers will impose some limits, as shown in table 3.



Table 1. Specifications

<p>Available Configurations Spring-to-Close Spring-to-Open</p> <p>Valve Body Sizes and End Connection Styles⁽¹⁾ See table 2</p> <p>Maximum Inlet Pressures and Temperatures⁽¹⁾ If the valve nameplate shows an ASME pressure-temperature class, maximum inlet pressure and temperature is consistent with the applicable class per ASME B16.34. If the nameplate does not show an ASME class, it will show a maximum cold working pressure at 38°C (100°F) (for example, 293 bar [4250 psi])</p> <p>Maximum Pressure Drops⁽¹⁾ See tables 4, 5, 6, and 7</p> <p>Input Signal to Actuator See tables 4, 5, 6, and 7</p> <p>Actuator Maximum Casing Pressure⁽¹⁾ 3.4 bar (50 psig)</p> <p>Shutoff Classification per ANSI/FCI 70-2 and IEC 60534-4 Class IV</p>	<p>Material Temperature Capabilities⁽¹⁾ Actuator Assembly: -40 to 93°C (-40 to 200°F) Valve Body Assembly: <i>Standard Bonnet O-Ring:</i> -46 to 149°C (-50 to 300°F) <i>Optional Fluorocarbon Bonnet O-Ring:</i> -23 to 204°C (-10 to 400°F)</p> <p>Flow Characteristic Equal percentage</p> <p>Flow Direction Flow up only</p> <p>Port Diameters See table 2</p> <p>Valve Plug Travel 19 mm (0.75 inch)</p> <p>Valve Plug Style Micro-Form valve plug</p> <p>Actuator Diaphragm Effective Area 452 cm² (69 inches²)</p> <p>Actuator Pressure Connection Size 1/4 NPT internal</p>
--	--

1. The pressure or temperature limits in the referenced tables and any applicable ASME code limitations should not be exceeded.

Specifications

Table 1 lists specifications for the D4 control valve. Some of the specifications for a given control valve as it originally comes from the factory are stamped on a nameplate located on the actuator spring barrel.

Table 2. Valve Sizes and Connection Styles

VALVE SIZE, NPS	PORT DIAMETER, (INCHES)	SCREWED	RAISED FACE (RF) FLANGED				RING TYPE JOINT (RTJ) FLANGED	
		4250 psi	CL150	CL300	CL600	CL900 and CL1500	CL600	CL900 and CL1500
1	0.25, 0.375, 0.5, 0.75	X	X	X	X	X	X	X
2	0.25, 0.375, 0.5, 0.75, 1, 1.25	X	X	X	X	X	X	X

X = Available construction.

Table 3. D4 Environmental Limits for NACE MR0175/ISO 15156 with Sour Trim

MAXIMUM TEMPERATURE		MAXIMUM H ₂ S PARTIAL PRESSURE		COMPATIBLE WITH ELEMENTAL SULFUR?
°C	°F	MPa	psia	
232	450	0.2	30	No
204	400	1.4	200	No
199	390	2.3	330	No
191	375	2.5	360	No
149	300	2.8	400	No
135	275	No Limit		Yes

Table 4. Maximum Shutoff Pressure Drops⁽¹⁾ for Fisher D4 Control Valves (Spring-to-Close) When Used with Typical Control Instrumentation⁽²⁾

INPUT SIGNAL TO ACTUATOR		0 to 1.2 Bar (0 to 18 Psig)		0 to 1.4 Bar (0 to 20 Psig)		0 to 2.0 Bar (0 to 30 Psig)		0 to 2.3 Bar (0 to 33 Psig)		0 to 2.4 Bar (0 to 35 Psig)		0 to 3.4 Bar (0 to 50 Psig)	
SPRING		Light Rate						Heavy Rate					
INITIAL SPRING SETTING		0.77 Bar (11.2 Psig)		0.77 Bar (11.2 Psig)		0.85 Bar (12.4 Psig)		1.05 Bar (15.3 Psig)		1.18 Bar (17.1 Psig)		1.18 Bar (17.1 Psig)	
PORT DIAMETER		Maximum Pressure Drop											
mm	Inches	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi
6.4	0.25	293 ⁽³⁾	4250 ⁽³⁾	293 ⁽³⁾	4250 ⁽³⁾	293	4250	293	4250	293	4250	293	4250
9.5	0.375	293 ⁽³⁾	4250 ⁽³⁾	293 ⁽³⁾	4250 ⁽³⁾	293	4250	293	4250	293	4250	293	4250
12.7	0.5	191	2765	191	2765	219	3180	288	4180	293	4250	293	4250
19.1	0.75	80	1160	80	1160	92	1340	123	1785	143	2080	143	2080
25.4	1	42	610	42	610	49	715	67	965	78	1130	78	1130
31.8	1.25	25	365	25	365	30	430	41	590	48	700	48	700

1. The pressure or temperature limits in the referenced tables and any applicable ASME code limitations should not be exceeded.
 2. For example, use the column marked 0-1.4 bar (0-20 psig) for a 0.21-1.0 bar (3-15 psig) pneumatic controller with 1.4 bar (20 psig) supply pressure.
 3. For applications with downstream pressure in excess of 196 bar (2845 psig), use 196 bar (2845 psig) for Maximum Shutoff Pressure.

Table 5. Maximum Shutoff Pressure Drops⁽¹⁾ for Fisher D4 Control Valves (Spring-to-Close) When Used with Instrumentation with Restricted Output Range⁽²⁾

INPUT SIGNAL TO ACTUATOR		0.4 to 2.0 Bar (6 to 30 Psig)				0.14 to 2.3 Bar (2 to 33 Psig)			
SPRING		Heavy Rate				Heavy Rate			
INITIAL SPRING SETTING		0.97 Bar (14.0 Psig)				1.17 Bar (17.0 Psig)			
PORT DIAMETER		Maximum Pressure Drop							
mm	Inches	Bar		Psi		Bar		Psi	
6.4	0.25	293 ⁽³⁾		4250 ⁽³⁾		293		4250	
9.5	0.375	210 ⁽³⁾		3045 ⁽³⁾		293		4250	
12.7	0.5	113		1635		282		4095	
19.1	0.75	45		655		120		1750	
25.4	1	23		330		65		945	
31.8	1.25	13		185		39		580	

1. The pressure or temperature limits in the referenced tables and any applicable ASME code limitations should not be exceeded.
 2. For example, an Electro-Pneumatic Transducer calibrated for 0.4-2.0 bar (6-30 psig) output pressure.
 3. For applications with downstream pressure in excess of 118 bar (1715 psig), use 118 bar (1715 psig) for Maximum Shutoff Pressure.

Table 6. Maximum Shutoff Pressure Drops⁽¹⁾ for Fisher D4 Control Valves (Spring-to-Open) When Used with Typical Control Instrumentation⁽²⁾

INPUT SIGNAL TO ACTUATOR		0 to 1.2 Bar (0 to 18 Psig)		0 to 1.4 Bar (0 to 20 Psig)		0 to 2.0 Bar (0 to 30 Psig)		0 to 2.3 Bar (0 to 33 Psig)		0 to 2.4 Bar (0 to 35 Psig)		0 to 3.4 Bar (0 to 50 Psig)	
SPRING		Light Rate						Heavy Rate					
INITIAL SPRING SETTING		0.23 Bar (3.4 Psig)		0.23 Bar (3.4 Psig)		0.28 Bar (4.0 Psig)		0.28 Bar (4.0 Psig)		0.28 Bar (4.0 Psig)		0.28 Bar (4.0 Psig)	
PORT DIAMETER		Maximum Pressure Drop											
mm	Inches	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi
6.4	0.25	293 ⁽³⁾	4250 ⁽³⁾	293 ⁽³⁾	4250 ⁽³⁾	293	4250	293	4250	293	4250	293	4250
9.5	0.375	293 ⁽³⁾	4250 ⁽³⁾	293 ⁽³⁾	4250 ⁽³⁾	293	4250	293	4250	293	4250	293	4250
12.7	0.5	187	2715	233	3380	293	4250	293	4250	293	4250	293	4250
19.1	0.75	78	1135	99	1430	147	2130	178	2575	198	2875	293	4250
25.4	1	41	600	53	765	80	1160	97	1410	109	1575	195	2830
31.8	1.25	24	355	32	465	49	715	60	875	68	985	123	1785

1. The pressure or temperature limits in the referenced tables and any applicable ASME code limitations should not be exceeded.
2. For example, use the column marked 0-1.4 bar (0-20 psig) for a 0.21-1.0 bar (3-15 psig) pneumatic controller with 1.4 bar (20 psig) supply pressure.
3. For applications with downstream pressure in excess of 190 bar (2760 psig), use 190 bar (2760 psig) for Maximum Shutoff Pressure.

Table 7. Maximum Shutoff Pressure Drops⁽¹⁾ for Fisher D4 Control Valves (Spring-to-Open) When Used with Instrumentation with Restricted Output Range⁽²⁾

INPUT SIGNAL TO ACTUATOR		0.4 to 2.0 Bar (6 to 30 Psig)				0.14 to 2.3 Bar (2 to 33 Psig)			
SPRING		Heavy Rate							
INITIAL SPRING SETTING		0.69 Bar (10.0 Psig)				0.42 Bar (6.1 Psig)			
PORT DIAMETER		Maximum Pressure Drop							
mm	Inches	Bar		Psi		Bar		Psi	
6.4	0.25	293 ⁽³⁾		4250 ⁽³⁾		293		4250	
9.5	0.375	293 ⁽³⁾		4250 ⁽³⁾		293		4250	
12.7	0.5	196		2845		293		4250	
19.1	0.75	82		1195		156		2265	
25.4	1	43		630		85		1235	
31.8	1.25	26		380		52		765	

1. The pressure or temperature limits in the referenced tables and any applicable ASME code limitations should not be exceeded.
2. For example, an Electro-Pneumatic Transducer calibrated for 0.4-2.0 bar (6-30 psig) output pressure.
3. For applications with downstream pressure in excess of 202 bar (2925 psig), use 202 bar (2925 psig) for Maximum Shutoff Pressure.

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage caused by bursting of pressure-retaining parts or by uncontrolled process fluid, be certain the service conditions do not exceed the limits shown on the valve nameplate and in tables 1, 4, 5, 6, and 7. Use pressure-relieving devices required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your Emerson Process Management sales office.

⚠ WARNING

Avoid personal injury or property damage caused by possible actuator failure. The use of a rigidly-mounted support on the actuator casing may cause additional stress on the actuator leading to premature wear and/or failure of the actuator components.

CAUTION

To avoid product damage, inspect the valve before installation for any damage or any foreign material that may have collected in the valve body. Also remove any pipe scale, welding slag, or other foreign material from the pipeline.

1. Before installing the control valve assembly, inspect it for any damage and for any foreign material that may have collected in the valve body.
2. Remove any pipe scale, welding slag, and other foreign material from the pipeline.
3. The control valve can be installed in any position, but normally the actuator is vertical above the valve. Install the valve so the flow direction arrow on the side of the valve indicates the direction of the process flow.
4. Install the valve following local and national piping codes when they apply to the application. For screwed connections, treat the external pipe threads with a good grade pipe compound. For flanged valves, use suitable gaskets between valve and pipeline flanges.
5. If continuous operation is required during maintenance and inspection, install a conventional three-valve bypass around the valve.
6. Connect loading pressure for the Spring-to-Open configuration to the 1/4-18 NPT connection in the upper casing assembly (key 23) as shown in figure 5. The Spring-to-Close configuration loading pressure connection is in the lower casing assembly (key 39) as shown in figure 4.

Spring Adjustment

The spring has a fixed pressure span over which loading pressure will stroke the valve. Adjustment of the spring compression shifts the span so that more or less loading pressure is required to start travel. Since the span does not change, there will be a corresponding increase or decrease in the pressure requirements at the end of the valve stroke.

In order to maximize shutoff pressure drop values, the actuator spring must be accurately adjusted for each Input Signal Pressure Range. If the actuator has been disassembled or pressure conditions have changed, the spring may require adjustment. Refer to tables 2 and 4 to determine the Initial Spring Set values based on the Input Signal range that is available to the actuator. These values include packing friction.

Spring-to-Close

Refer to figure 4.

1. Loosen the adjusting screw nut (key 44).
2. Turn the adjusting screw (key 31) clockwise to compress the spring or counterclockwise to decrease spring compression.
3. After adjustment, tighten the adjusting screw nut (key 44).

Spring-to-Open

Refer to figure 5.

1. Unscrew the spring case assembly (key 27).
2. Turn the adjusting stem nut (key 44) clockwise to compress the spring or counterclockwise to decrease spring compression.
3. After adjustment, replace the spring case assembly (key 27).

Maintenance

Refer to figure 4.

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and maintenance depends on the severity of the service conditions.

⚠ WARNING

Avoid personal injury from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.**
- **Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the power actuator loading pressure and relieve any actuator spring precompression.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

Valve Plug and Seat Ring

The D4 control valve is designed to allow easy access to the valve plug and seat ring without disturbing the packing. Refer to other sections of this instruction manual if additional maintenance is required.

Disassembly

1. Remove the loading pressure tubing and any accessories that may hamper disassembly.
2. Break the hammer nut (key 6) loose with a hammer. Continue turning the hammer nut by using a hammer or a large adjustable wrench, tightened around one ear of the hammer nut. If the bonnet is stuck on the valve, continue to unscrew the hammer nut. The hammer nut will contact the spring pins (key 7) and will force the bonnet out of the valve. Carefully lift the actuator, bonnet, and valve plug assembly from the valve body.

⚠ WARNING

The spring pins must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

3. Use a socket wrench to loosen the seat ring (key 3).
4. Remove the seat ring (key 3) and seat ring gasket (key 9) from the valve body.
5. Inspect parts for wear or damage that would prevent proper operation of the valve body. Carefully clean the seat ring gasket surfaces and seat ring threads.

⚠ WARNING

Be careful to avoid damaging the seating surface on the valve plug or seat ring as damage in these areas will allow excessive leakage at shutoff. Avoid damaging the highly polished valve stem surface. A damaged valve stem could cut the packing and allow process fluid to leak to the atmosphere.

Table 8. Torque for Seat Ring (Key 3)

VALVE SIZE	RECOMMENDED TORQUE	
	NPS	
1	N•m	Lbf•ft
1	407	300
2	698	515

6. **For spring-to-close only:** To remove the valve plug (key 2), drive out the groove pin (key 4) and unscrew the valve plug from the stem (key 47). If the groove pin (key 4) is not exposed, verify that downward movement of the stem is not restricted by instrument linkages attached to the stem (key 47).

If the valve plug cannot be easily unscrewed from the stem, use a punch to keep the stem from turning as the plug is removed.

7. **For spring-to-open only:** To remove the valve plug (key 2), first remove the spring case assembly (key 27). Remove the adjustment screw nut (key 44), the upper spring seat (key 29), and the spring (key 30). Push the adjustment stem (key 31) fully downward until the diaphragm plate (key 40) contacts the cap screws (key 38), exposing the groove pin (key 4) in the plug. If the groove pin (key 4) is not exposed, verify that downward movement of the stem is not restricted by instrument linkages attached to the stem (key 47). Drive out the groove pin (key 4) and unscrew the valve plug from the stem (key 47).

If the valve plug cannot be easily unscrewed from the stem, use a punch to keep the stem from turning as the plug is removed.

Assembly

1. Make sure the bonnet O-ring (key 8) is on the bonnet and lubricated with lithium grease (key 49).

2. Install the plug (key 2) on the stem (key 47) and insert a new groove pin (key 4).
3. Thoroughly clean the seat ring and bonnet threads in the valve body (key 1). Also clean the valve body seat ring gasket surfaces.
4. Apply anti-seize lubricant (key 54) to the threads of the seat ring (key 3), and its mating threads in the valve body.
5. Apply anti-seize lubricant (key 54) to the seat ring gasket (key 9) and install into the valve body.
6. Screw the seat ring into the valve body. Use a socket wrench to tighten the seat ring to the torque values shown in table 8. Remove all excess lubricant after tightening.
7. Lubricate (key 54) the threads on the valve body and hammer nut and the contact surfaces of the bonnet and hammer nut flange. Install the bonnet and actuator assembly with pinned valve plug onto the valve body. Tighten the hammer nut using an adjustable wrench until the nut stops turning. A few hammer blows will be required to ensure that the assembly is tight.
8. See the actuator assembly and spring adjustment sections of this manual.

Valve Packing

Note

These instructions apply to valves manufactured with serial numbers equal to and greater than 18679262. See Appendix A for information on packing constructions with serial numbers less than 18679262.

If your D4 valve assembly has a packing retainer lock ring (see figure 6), proceed to Appendix A.

WARNING

Observe the warning at the start of the Maintenance section.

The valve stem packing can only be accessed from within the valve body. If packing maintenance is required, first disassemble per steps 1, 2, and 6 or 7 in the Valve Plug and Seat Ring Disassembly section of this document.

Disassembly

1. Unscrew the packing retainer (key 10) from the bonnet (key 5).
2. Remove the five Belleville springs (key 11), packing spacer (key 14), packing (key 13), and two anti-extrusion rings (key 12) from the bonnet, using a formed wire hook.
3. Clean and inspect the packing box wall to ensure that the packing surfaces are not damaged. If the surface condition is damaged, and cannot be improved by light sanding, replace the bonnet by contacting your Emerson Process Management sales office.
4. Inspect the valve stem for scratches or wear, and valve plug for wear or damage. Replace if necessary.

Figure 2. Fisher D4 Packing Installation

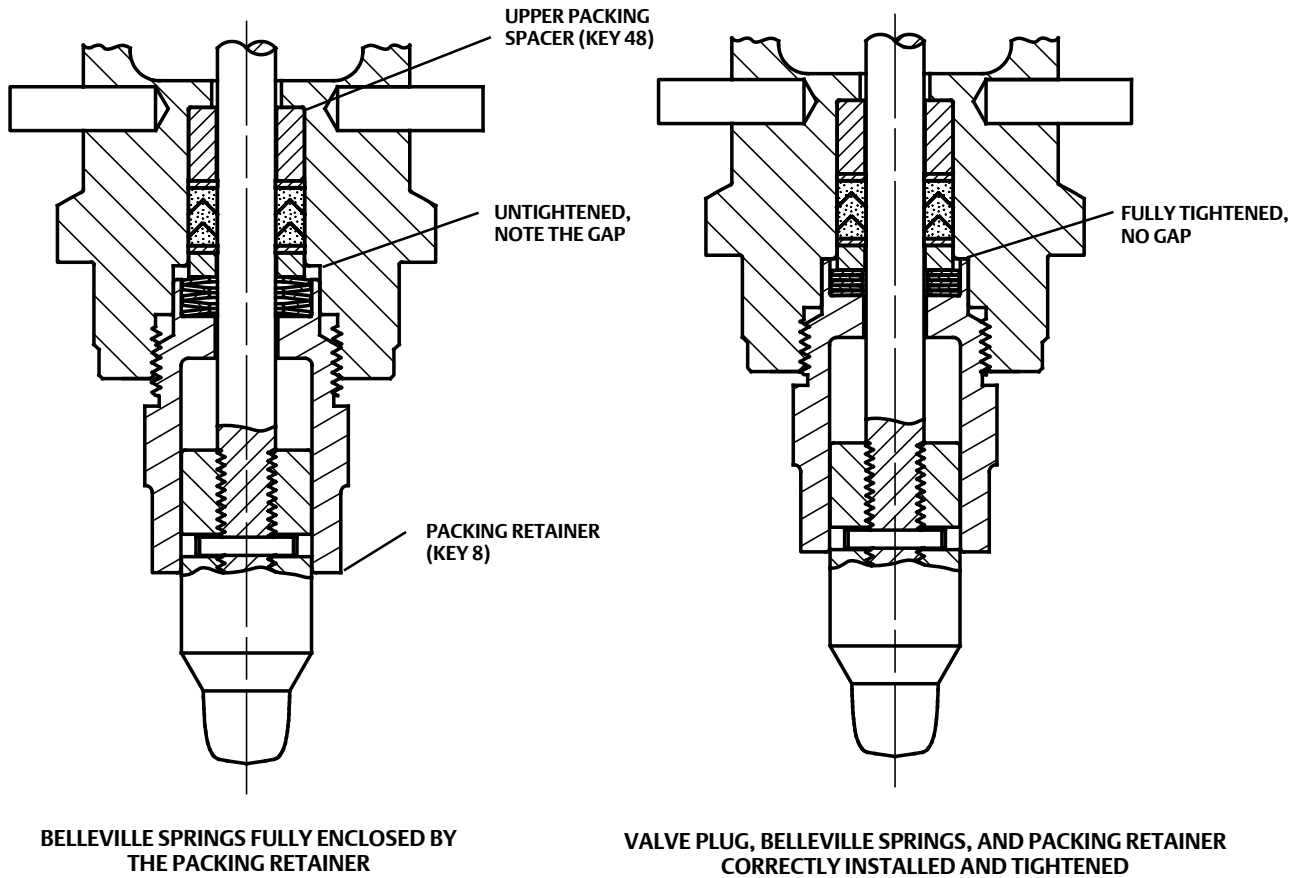
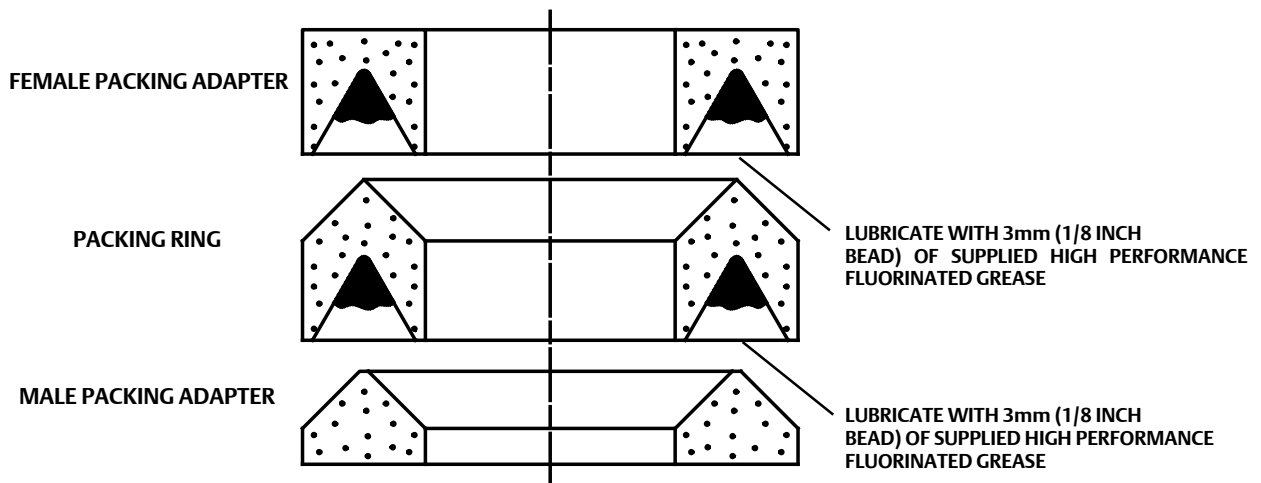


Figure 3. Lubrication Locations on Packing



Assembly

Refer to figures 2, 3, 4, and 5.

Note

If your D4 valve assembly has a packing retainer lock ring (see figure 6), proceed to Appendix A.

1. Ensure the upper packing spacer (key 48) is installed, as shown in figure 2.
2. Using a non-marring installation tool, such as a 12-inch length of 1/2 inch PVC pipe, push the first anti-extrusion washer (key 12) fully into the packing box by hand. Then, use the packing spacer (key 14) to fully seat the anti-extrusion washer by firmly tapping the packing spacer against the anti-extrusion washer with a hammer and the PVC pipe.
3. Remove the packing spacer from the packing bore.

CAUTION

All D4 packing kits include a single use packet of high performance fluorinated grease. This is the only acceptable D4 packing lubricant.

Note

In the following procedure, carefully install each packing ring individually over the valve stem and push completely into the packing box with a non-marring tube. A 12-inch length of 1/2 inch PVC pipe works well for this. It is recommended that the lubricated packing rings be installed individually rather than pushed in as a set.

4. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the female packing adaptor as shown in figure 3 and install over the valve stem (key 16).
5. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the packing ring as shown in figure 3 and install over the valve stem.
6. Install the male packing adaptor, lower anti-extrusion washer (key 10), and lower packing spacer over the valve stem as shown in figure 2.
7. Firmly press all packing parts into the packing bore with a tube.
8. Install the five belleville springs (key 11) over the valve stem. The belleville springs should be single-stacked with the inside diameter of the inner spring contacting the packing spacer (key 14), and the outside diameter of the outer spring contacting the packing retainer (key 10).
9. Lubricate the threads of the packing retainer with anti-seize and install into the bonnet using a 1-5/8 inch wrench. Make sure the Belleville springs are completely enclosed by the packing retainer as shown in figure 2.
10. Torque the packing retainer to 136 N•m (100 lbf•ft). The packing retainer has been installed correctly when a metal-to-metal contact has been made between the packing retainer end and the bonnet (key 5). The packing retainer threads should be completely enclosed by the bonnet.

Actuator (Spring-to-Close)

⚠ WARNING

Observe the warning at the start of the Maintenance section.

Refer to figure 4.

Before disassembling the actuator, disassemble the valve plug, seat ring, and packing according to instructions in this manual.

Disassembly

1. Loosen the adjusting screw nut (key 44) and turn the adjusting screw (key 31) counterclockwise to remove all spring compression.
2. Unscrew the casing cap screws and hex nuts (keys 45 and 46), and remove the upper casing assembly (key 23) from the lower casing (key 39).
3. Remove the spring seat (key 29) and actuator spring (key 30).
4. Lift out the diaphragm, diaphragm plate, and stem assembly. Remove the travel indicator (key 32) when the bottom of the stem enters the yoke window.
5. To replace the diaphragm (key 15), separate the diaphragm assembly by using a wrench on the hex nuts (key 42) to unscrew the assembly.
6. Separate the parts--diaphragm washer, actuator O-ring (keys 41 and 25), diaphragm, and diaphragm plate, (keys 15 and 40).
7. Inspect the diaphragm and the actuator O-ring for damage or deterioration, and replace if necessary. If the diaphragm is replaced, a new O-ring should also be installed.
8. Inspect the stem O-ring (key 19) and bonnet bushing (key 20); replace if necessary. To inspect the casing O-ring (key 18), remove the cap screws (key 38) and lift off the lower casing (key 39). Replace the O-ring if necessary.
9. If the hammer nut needs to be removed from the bonnet, the spring pins (key 7) can be removed with locking pliers.

Assembly

1. Before starting assembly, make sure all parts are clean and in good condition. There should be no burrs or sharp edges on any threads or surfaces that might cut or damage an O-ring, bushing, the packing, or the diaphragm. When replacing O-rings and bushings, be sure the O-ring or bushing groove is clean and undamaged. Using a general purpose lubricant (key 49), lubricate all bushings and O-rings and the threads of parts that have to pass through the bushings and O-rings.

CAUTION

The threads on factory-produced valve stems have been specially machined to avoid O-ring, bushing, or packing damage during trim maintenance. Use of other than a factory-produced valve stem may result in early stem O-ring, bushing, and packing failure.

Note

Do not lubricate cap screws (key 38) before inserting them in the following procedure.

2. Place the hammer nut and spring pins on the bonnet, if removed. Install the casing O-ring (key 18), the stem O-ring (key 19), and the bonnet bushing (key 20). Position the lower casing (key 39) on the bonnet. Insert the nonlubricated cap screws (key 38), and torque to 49 N•m (36 lbf•ft).

⚠ WARNING

The spring pins must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

3. Assemble the diaphragm plate assembly. Place the patterned side of the diaphragm (key 15) against the diaphragm plate (key 40). Be sure to turn the diaphragm washer (key 41) so that the side that is beveled on the inside diameter is against the O-ring (key 25). Also, make sure that it is assembled for installation with the diaphragm on the loading pressure side and the lockwasher (key 43) and lower spring seat (key 28) are on the spring side.
4. Fasten the diaphragm and diaphragm plate assembly on the stem with hex nuts (key 42). Place the diaphragm and diaphragm plate, and stem assembly into the lower casing and bonnet. Install the travel indicator (key 32) on the stem as the bottom of the stem enters the yoke window.

CAUTION

Over-tightening the diaphragm casing cap screws and nuts (keys 45 and 46) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

5. Replace the spring (key 30) on the diaphragm plate (key 40). Replace the upper spring seat (key 29). Position the upper casing (key 23) on the lower casing (key 39). Insert the cap screws (key 45) and tighten the hex nuts (key 46). Torque the casing cap screws evenly to 27 N•m (20 lbf•ft) using a crisscross pattern.
6. Adjust the initial spring set per the Spring Adjustment section in this manual.

Actuator (Spring-to-Open)

⚠ WARNING

Observe the warning at the start of the Maintenance section.

Refer to figure 5.

Before disassembling the actuator, disassemble the valve plug, seat ring, and packing according to instructions in this manual.

Disassembly

1. Unscrew the spring case assembly (key 27). Turn the adjusting screw nut (key 44) counterclockwise to remove all spring compression. Remove the adjusting screw nut, upper spring seat, and spring (keys 44, 29, and 30)
2. Unscrew the casing cap screws and hex nuts (keys 45 and 46), and remove the upper casing assembly (key 23) from the lower casing (key 39). Remove the cotter pin (key 36) and unscrew the adjusting stem (key 31).
3. Lift out the diaphragm (key 15), diaphragm plate (key 40), and stem assembly. Remove the travel indicator (key 32) when the bottom of the stem enters the yoke window.
4. To replace the diaphragm (key 15), separate the diaphragm assembly by using a wrench on the hex nuts (key 42) to unscrew the assembly.
5. Separate the parts--diaphragm washer, actuator O-ring (keys 41 and 25), diaphragm, and diaphragm plate, (keys 15 and 40).
6. Inspect the diaphragm and the actuator O-ring for damage or deterioration, and replace if necessary. If the diaphragm is replaced, a new O-ring should also be installed.
7. Inspect the stem O-ring (key 19) and bonnet bushing (key 20); replace if necessary. To inspect the casing O-ring (key 18), remove the cap screws (key 38) and lift off the lower casing (key 39). Replace the O-ring if necessary. Inspect the adjusting stem bushing (key 26) and actuator stem O-ring (key 53). Replace if necessary.

8. If the hammer nut needs to be removed from the bonnet, the spring pins (key 7) can be removed with locking pliers.

Assembly

1. Before starting assembly, make sure all parts are clean and in good condition. There should be no burrs or sharp edges on any threads or surfaces that might cut or damage an O-ring, bushing, the packing, or the diaphragm. When replacing O-rings and bushings, be sure the O-ring or bushing groove is clean and undamaged. Using a general purpose lubricant (key 49), lubricate all bushings and O-rings and the threads of parts that have to pass through the bushings and O-rings.

CAUTION

The threads on factory-produced valve stems have been specially machined to avoid O-ring, bushing, or packing damage during trim maintenance. Use of other than a factory-produced valve stem may result in early stem O-ring, bushing, and packing failure.

Note

Do not lubricate cap screws (key 38) before inserting them in the following procedure.

2. Place the hammer nut and spring pins on the bonnet, if removed. Install the casing O-ring (key 18), the stem O-ring (key 19), and the bonnet bushing (key 20). Position the lower casing (key 39) on the bonnet. Insert the nonlubricated cap screws (key 38), and torque to 49 N•m (36 lbf•ft).
3. Assemble the diaphragm plate assembly. Place the patterned side of the diaphragm (key 15) against the diaphragm plate (key 40). Be sure to turn the diaphragm washer (key 41) so that the side that is beveled on the inside diameter is against the O-ring (key 25). Also, make sure that it is assembled for installation with the diaphragm on the loading pressure side and the lockwasher (key 43) and diaphragm washer (key 41) are on the upper side.

⚠ WARNING

The spring pins must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

4. Fasten the diaphragm and diaphragm plate assembly on the stem with hex nuts (key 42). Place the diaphragm and diaphragm plate, and stem assembly into the lower casing and bonnet. Install the travel indicator (key 32) on the stem as the bottom of the stem enters the yoke window.
5. Screw the adjusting stem (key 31) onto the stem (key 47) and secure the cotter pin (key 36). Make sure the bushing and O-ring are in place in the upper casing.

CAUTION

Over-tightening the diaphragm casing cap screws and nuts (keys 45 and 46) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

6. Position the upper casing (key 23) on the lower casing (key 39). Insert the cap screws (key 45) and tighten the hex nuts (key 46). Torque the casing cap screws evenly to 27 N•m (20 lbf•ft) using a crisscross pattern.

7. Replace the spring (key 30), spring seat (key 29), and adjusting stem nut (key 44) over the adjusting stem. Replace the spring case assembly (key 27).
8. Adjust the initial spring set per the Spring Adjustment section in this manual.

Parts Ordering

Each D4 control valve is assigned a serial number, which can be found on the nameplate. Refer to the number when contacting your Emerson Process Management sales office for assistance or when ordering replacement parts.

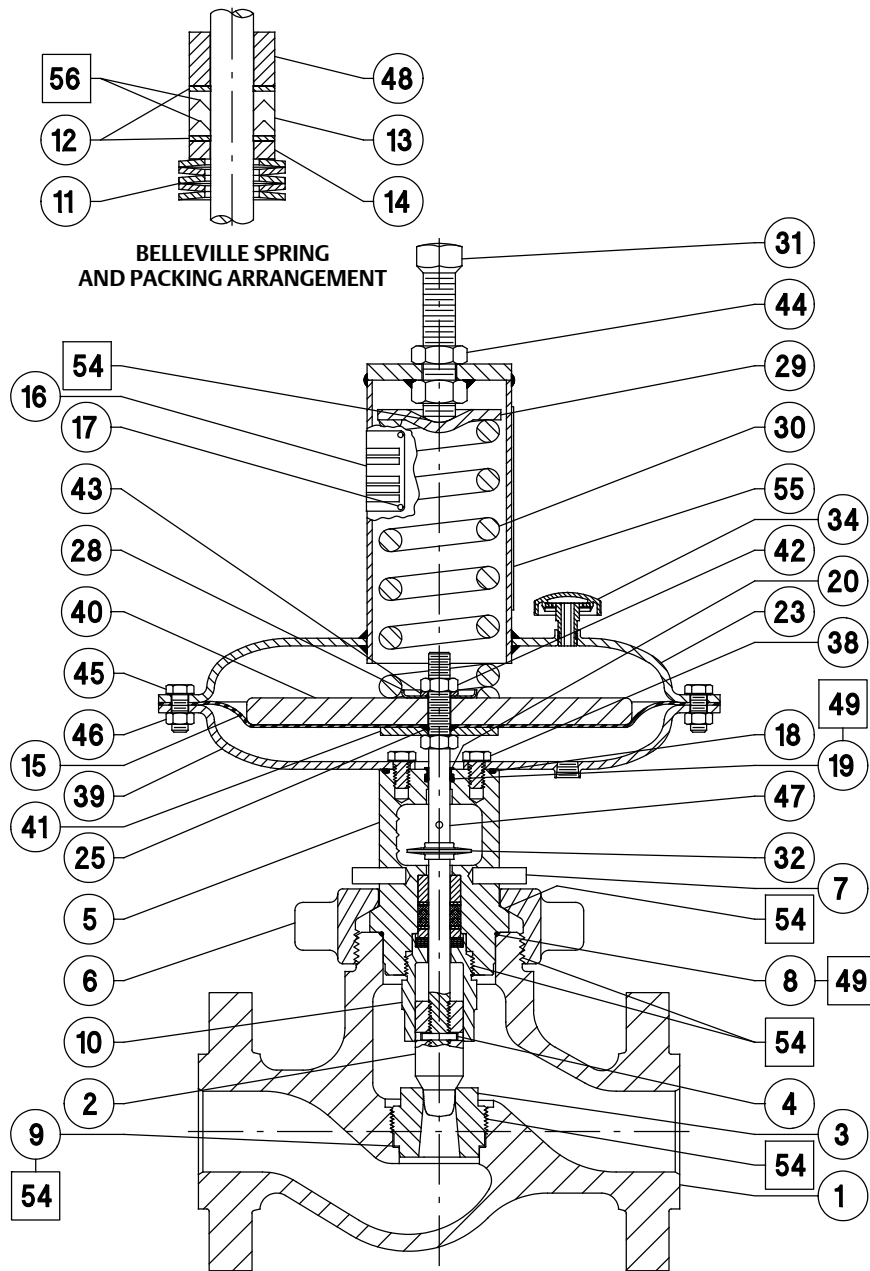
⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Process Management should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Note

Neither Emerson, Emerson Process Management, nor any of their affiliated entities assumes responsibility for the selection, use, or maintenance of any product. Responsibility for the selection, use, and maintenance of any product remains with the purchaser and end-user.

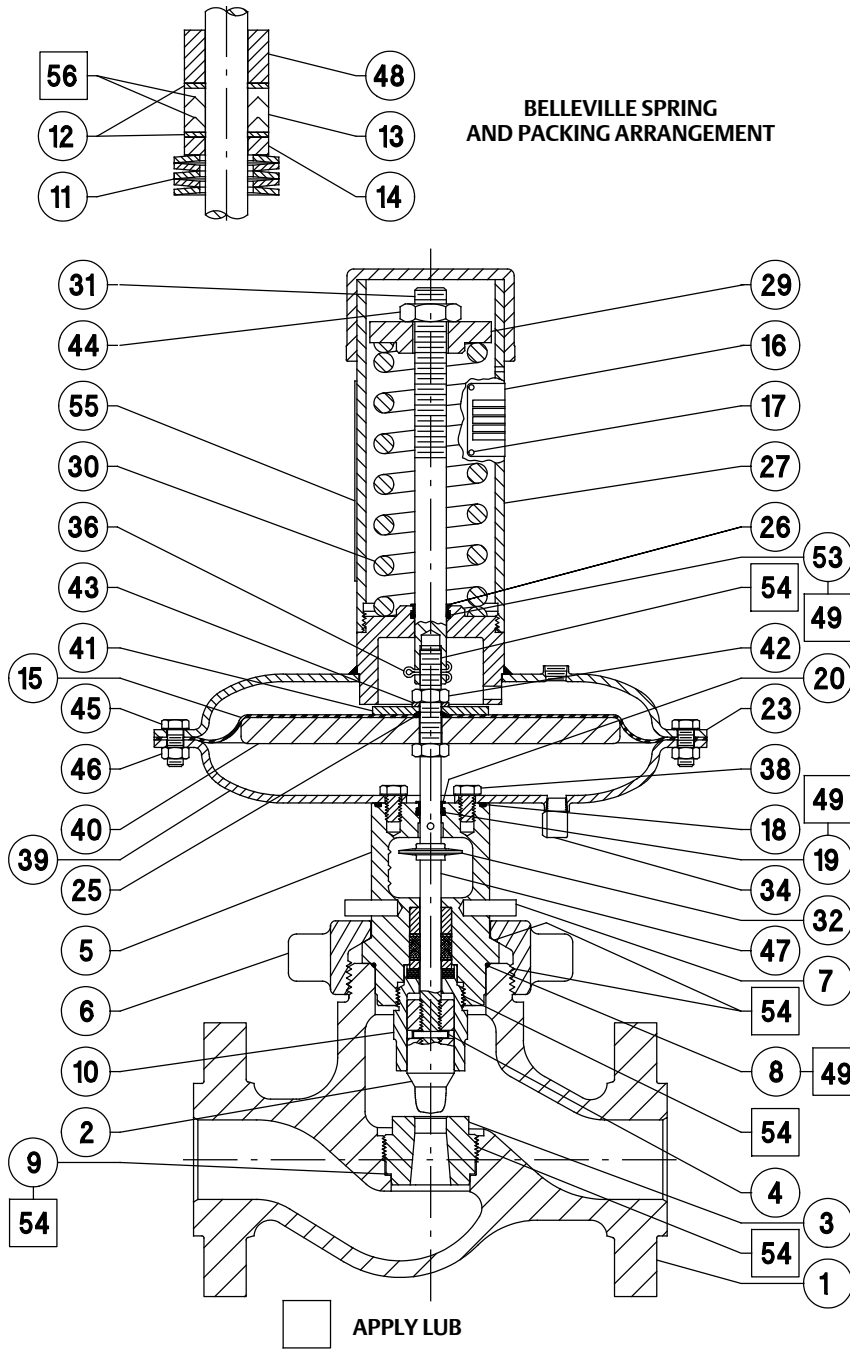
Figure 4. Fisher D4 Valve Assembly (Spring-to-Close)



GE02332-C

□ APPLY LUB

Figure 5. Fisher D4 Valve Assembly (Spring-to-Open)



GE02334-E

Repair Kits

Note

All repair kits are supplied with hydrogenated nitrile bonnet O-ring. FKM (fluorocarbon) bonnet O-ring must be ordered separately when required.

Description	Part Number
* Packing Repair Kit Includes key numbers 4, 8, 12 (2 req'd), 13, and high performance fluorinated grease	RD4X0000012
* Actuator Repair Kit Includes key numbers 4, 8, 12 (2 req'd), 13, 15, 18, 19, 20, 25, 26, 36, 53, and high performance fluorinated grease	RD4X0000022

Parts List

Note

For part numbers not shown, contact your Emerson Process Management sales office.

Key	Description	Part Number
1	Valve Body	
2*	Valve Plug	
	S41000 / S41600 HT	
	NPS 1 valve	
	0.25 inch port diameter	20C3692X012
	0.375 inch port diameter	20C3693X012
	0.5 inch port diameter	20C3694X012
	0.75 inch port diameter	GE01557X012
	NPS 2 valve	
	0.25 inch port diameter	GE00992X012
	0.375 inch port diameter	GE00993X012
	0.5 inch port diameter	GE00994X012
	0.75 inch port diameter	GE01558X012
	1-inch port diameter	GE01561X012
	1.25 inch port diameter	GE01555X012
	S17400 H1150 DbI	
	NPS 1 valve	
	0.25 inch port diameter	20C3692X032
	0.375 inch port diameter	20C3693X032
	0.5 inch port diameter	20C3694X032
	0.75 inch port diameter	GE01557X032
	NPS 2 valve	
	0.25 inch port diameter	GE00992X032
	0.375 inch port diameter	GE00993X032
	0.5 inch port diameter	GE00994X032
	0.75 inch port diameter	GE01558X032
	1-inch port diameter	GE01561X032

Key	Description	Part Number
	1.25 inch port diameter	GE01555X032
	Tungsten Carbide	
	NPS 1 valve	
	0.25 inch port diameter	20C3696X012
	0.375 inch port diameter	20C3697X012
	0.5 inch port diameter	20C3698X012
	0.75 inch port diameter	20C3699X012
	NPS 2 valve	
	0.25 inch port diameter	20C3682X012
	0.375 inch port diameter	20C3683X012
	0.5 inch port diameter	20C3685X012
	0.75 inch port diameter	20C3686X012
	1-inch port diameter	20C3687X012
	1.25 inch port diameter	20C3688X012
3*	Seat Ring	
	S17400 H1150 DbI	
	NPS 1 valve	
	0.25 inch port diameter	GE00982X032
	0.375 inch port diameter	GE00983X032
	0.5 inch port diameter	GE00984X032
	0.75 inch port diameter	GE00985X032
	NPS 2 valve	
	0.25 inch port diameter	GE00986X032
	0.375 inch port diameter	GE00987X032
	0.5 inch port diameter	GE00988X032
	0.75 inch port diameter	GE00989X032
	1-inch port diameter	GE00990X032
	1.25 inch port diameter	GE00991X032
	Tungsten Carbide	
	NPS 1 valve	
	0.25 inch port diameter	GE07347X012
	0.375 inch port diameter	GE07363X012
	0.5 inch port diameter	GE07364X012
	0.75 inch port diameter	GE07365X012
	NPS 2 valve	
	0.25 inch port diameter	GE07389X012
	0.375 inch port diameter	GE07394X012
	0.5 inch port diameter	GE07397X012
	0.75 inch port diameter	GE07398X012
	1-inch port diameter	GE07399X012
	1.25 inch port diameter	GE07406X012
	Groove Pin	GE01163X012
4*	Bonnet	
5	Hammer Nut	
6	Spring Pin	
7	Bonnet O-ring	
8*	Hydrogenated Nitrile	
	-46 to 149°C (-50 to 300°F)	10C3680X012
	FKM, -23 to 204°C (-10 to 400°F)	10C3680X022
9*	Seat Ring Gasket	
	For NPS 1 valve	1B198636042
	For NPS 2 valve	1B198836042
10	Packing Retainer	
11	Belleville Springs, 5 req'd	
12*	Anti-Extrusion Washer, 2 req'd	12B6335X022
13*	Packing Set	12B6667X012
14	Packing Spacer	
15*	Diaphragm	22B3521X012
16	Nameplate	
17	Drive Screw	
18*	Casing O-ring	1F9141X0142
19*	Stem O-ring	1K7561X0072
20*	Bonnet Bushing	17A7112X012
23	Upper Casing Assembly	

* Recommended spare parts

Key	Description	Part Number	Key	Description	Part Number
25*	Actuator O-ring	1K7561X0072	40	Diaphragm Plate	
26*	Adjusting Stem Bushing (spring-to-open only)	17A4059X012	41	Diaphragm Washer	
27	Spring Case Assembly		42	Hex Nut	
28	Lower Spring Seat		43	Lockwasher	
29	Upper Spring Seat		44	Adjustment Screw Nut	
30	Spring		45	Cap Screw	
	Spring-to-Close, Light Rate	1F176827092	46	Hex Nut	
	Spring-to-Close, Heavy Rate	1E792427082	47*	Valve Stem	
	Spring-to-Open, Light Rate	1F176727032		S20910, Reverse Acting	20C3681X022
	Spring-to-Open, Heavy Rate	1F714327092		S20910, Direct Acting	20C3716X022
31	Adjustment Screw or Stem		48	Upper packing spacer	
32	Travel Indicator		49	Lubricant (lithium grease)	
34	Vent Assembly		51	Drive Screw	
36*	Cotter Pin (spring-to-open only)	1C608035022	53*	Actuator Stem O-ring (spring-to-open only)	1C7821X0182
37	Pipe Plug		54	Lubricant (anti-seize)	
38	Cap Screw		55	Spring Setting Label (not shown)	
39	Lower Casing		56	High Performance Fluorinated Grease Packing Lubricant	

Appendix A

Note

These instructions apply to valves manufactured with serial numbers less than 18679262.

Valve Packing

⚠ WARNING

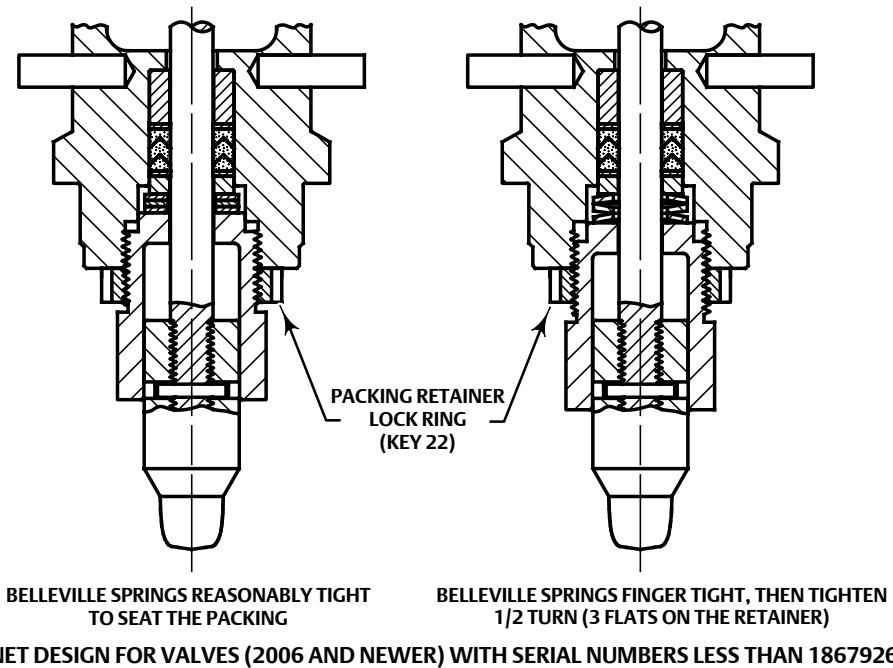
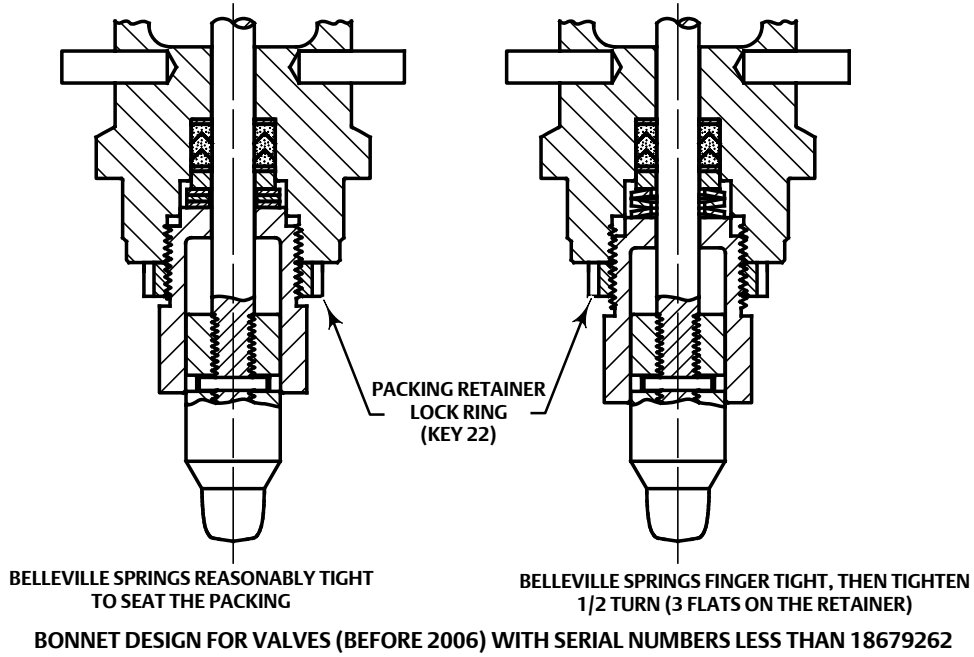
Observe the warning at the start of the Maintenance section.

The valve stem packing can only be accessed from within the valve body. If packing maintenance is required, first disassemble per steps 1, 2, and 6 or 7 in the Valve Plug and Seat Ring Disassembly section of this document.

Disassembly

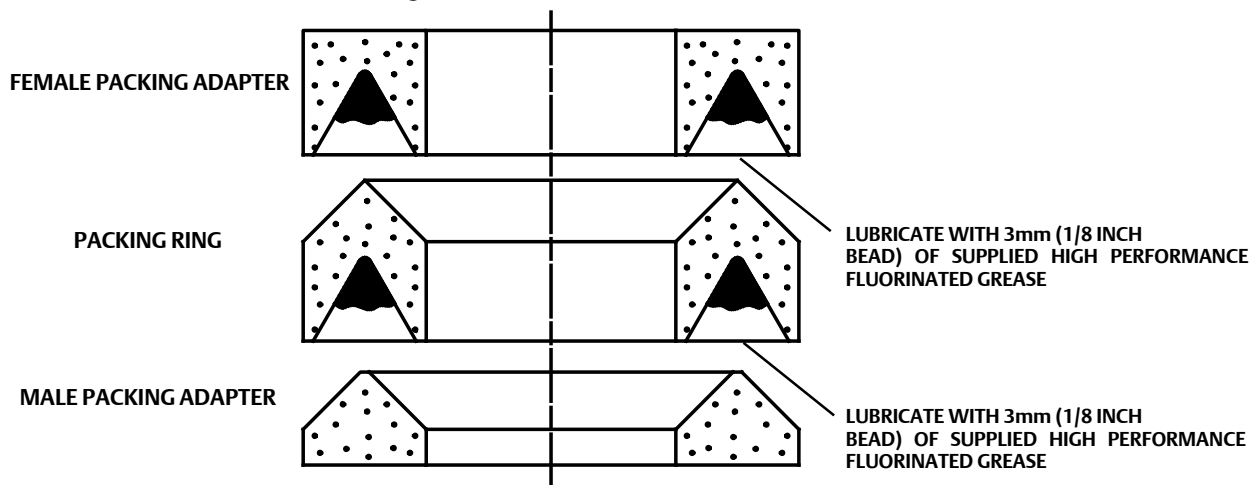
1. Loosen the packing retainer locknut (key 22) with a spanner wrench or with a punch and hammer.
2. Unscrew the packing retainer (key 10) from the bonnet (key 5).
3. Remove the three Belleville springs (key 11), packing spacer (key 14), packing (key 13), and two anti-extrusion rings (key 12) from the bonnet, using a formed wire hook.
4. Clean and inspect the packing box wall to ensure that the packing surfaces are not damaged. If the surface condition is damaged, and cannot be improved by light sanding, replace the bonnet by contacting your Emerson Process Management sales office.
5. Inspect the valve stem for scratches or wear, and valve plug for wear or damage. Replace if necessary.

Figure 6. Fisher D4 Belleville Spring Procedure



NOTE: RECOMMENDED SPARE PARTS, INCLUDING PACKING KITS, ARE THE SAME FOR BOTH BONNET DESIGNS.
NOTE: FOR SERIAL NUMBERS GREATER THAN 18679262, SEE THE STANDARD SECTION OF THIS INSTRUCTION MANUAL.

Figure 7. Lubrication Locations on Packing



Assembly

Refer to figures 6 and 7.

1. Install new packing and Belleville springs according to the packing arrangement shown in figure 6.
2. Using a non-marring installation tool, such as a 12-inch length of 1/2 inch PVC pipe, push the first anti-extrusion washer (key 12) fully into the packing box by hand. Then, use the packing spacer (key 14) to fully seat the anti-extrusion washer by firmly tapping the packing spacer against the anti-extrusion washer with a hammer and the PVC pipe.
3. Remove the packing spacer from the packing bore.

CAUTION

All D4 packing kits include a single use packet of high performance fluorinated grease. This is the only acceptable D4 packing lubricant.

Note

In the following procedure, carefully install each packing ring individually over the valve stem and push completely into the packing box with a non-marring tube. A 12-inch length of 1/2 inch PVC pipe works well for this. It is recommended that the lubricated packing rings be installed individually rather than pushed in as a set.

4. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the female packing adaptor as shown in figure 7 and install over the valve stem (key 16).
5. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the packing ring as shown in figure 7 and install over the valve stem.
6. Install the male packing adaptor, lower anti-extrusion washer (key 10), and lower packing spacer over the valve stem as shown in figure 6.
7. Firmly press all packing parts into the packing bore with a tube.

8. Install the Belleville springs (key 11). The Belleville springs (key 11) should be single stacked with the I.D. of the inner spring contacting the packing spacer (key 14) and the O.D. of the outer spring contacting the packing retainer (key 10). The final Belleville spring should be within the 1.26 inch diameter bore of the bonnet.
9. Adjust the packing retainer by hand until it makes contact with the Belleville springs. Do not tighten by hand, simply install the packing retainer until it makes contact with the Belleville springs. Tighten the packing retainer clockwise precisely 1.16 turns (7 flats on the retainer) to seat the packing. This should fully compress the Belleville springs as detected by an increase in torque between 6 and 7 flats.
10. Loosen the packing retainer completely. Adjust the packing retainer by hand until it makes contact with the Belleville springs. Do not tighten by hand, simply install the packing retainer until it makes contact with the Belleville springs. Tighten the packing retainer clockwise precisely 1/2 turn (3 flats on the retainer).
11. Lock the packing retainer (key 10) solidly in place by tightening the packing retainer locknut (key 22) using a spanner wrench or a hammer and punch or chisel.

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Fisher™ 667 Diaphragm Actuator Sizes 30/30i-76/76i and 87

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Figure 1. Fisher 667 Actuator Mounted on easy-e™ Valve



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Introduction

Scope of Manual

This instruction manual provides information on installation, adjustment, maintenance, and parts ordering for the Fisher 667 actuator in sizes 30/30i through 76/76i and size 87. The 667-4 actuator in sizes 70/70i and 87 is also covered. Refer to separate instruction manuals for information about the valve positioner and other accessories used with these actuators.

Do not install, operate, or maintain a 667 actuator (see figure 1) without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson Process Management sales office](#) before proceeding.



Table 1. Specifications

SPECIFICATION ⁽¹⁾		ACTUATOR SIZE									
		30/30i	34/34i	40/40i	45/45i	46/46i	50/50i	60/60i	70/70i ⁽¹⁾	76/76i	87 ⁽¹⁾
Nominal Effective Area	Sq cm	297	445	445	667	1006	677	1006	1419	1006	1419
	Sq Inch	46	69	69	105	156	105	156	220	156	220
Yoke Boss Diameter	mm	54	54	71	71	71	90	90	90	90	125
	Inch	2-1/8	2-1/8	2-13/16	2-13/16	2-13/16	3-9/16	3-9/16	3-9/16	3-9/16	5
Acceptable Valve Stem Diameter	mm	9.5	9.5	12.7	12.7	12.7	19.1	19.1	19.1	19.1	25.4
	Inch	3/8	3/8	1/2	1/2	1/2	3/4	3/4	3/4	3/4	1
Maximum Allowable Output Thrust ⁽⁴⁾	N	10230	10230	12010	25131	33582	25131	30246	39142	30246	39142
	LB	2300	2300	2700	5650	7550	5650	6800	8800	6800	8800
Maximum Travel ⁽²⁾	mm	19	29	38	51	51	51	51	76 ⁽³⁾	51	76 ⁽³⁾
	Inch	0.75	1.125	1.5	2	2	2	2	3 ⁽³⁾	2	3 ⁽³⁾
Maximum Casing Pressure for Actuator Sizing ^(4,6)	Bar	3.8	4.8	4.8	4.5	3.8	4.5	3.8	3.4	3.4	3.4
	Psig	55	70	70	65	55	65	55	50	50	50
Maximum Excess Diaphragm Pressure ^(4,5)	Bar	3.8	1.4	1.4	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Psig	55	20	20	10	10	10	10	10	10	10
Maximum Diaphragm Casing Pressure ^(4,6,7)	Bar	7.6	6.2	6.2	5.2	4.5	5.2	4.5	4.1	4.1	4.1
	Psig	110	90	90	75	65	75	65	60	60	60
Approximate Weight	Kg	15/17	22/26	23/26	41/44	55/59	43/48	55/60	115/118	86/89	118
	Pounds	34/37	48/58	50/56	90/98	121/129	94/105	122/133	254/260	190/196	260
Material Temperature Capabilities	Nitrile Elastomers	-40 to 82°C (-40 to 180°F)									
	Silicone Elastomers	-54 to 149°C (-65 to 300°F)									

1. These values also apply to the 667-4 actuator construction.
 2. Actuator travel may be less than the value listed after connected to the valve.
 3. Maximum actuator travel for 667-4 is 102 mm (4 inches).
 4. See also the Specifications portion of the introduction section.
 5. Additional pressure may be added when the actuator is at full travel. If the Maximum Excess Diaphragm Pressure is exceeded, damage to the diaphragm or diaphragm casing might result. See the Maximum Pressure Limitation section.
 6. Maximum diaphragm casing pressure must not be exceeded and must not produce a force on the actuator stem greater than the maximum allowable actuator output thrust or the maximum allowable stem load. See the Maximum Pressure Limitation section.
 7. This maximum casing pressure is not to be used for normal operating pressure. Its purpose is to allow for typical regulator supply settings and/or relief valve tolerances.

Description

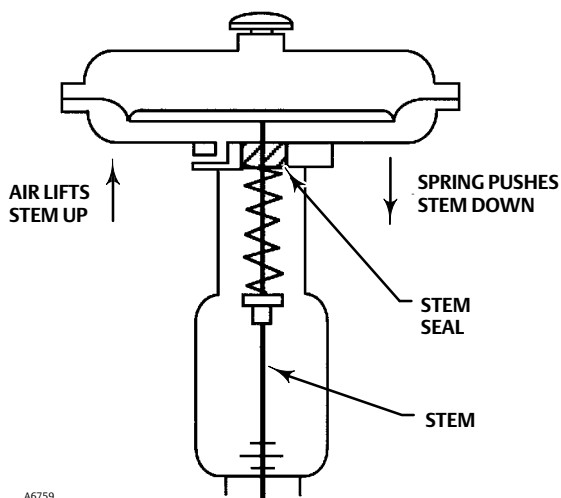
The 667 actuator (figure 1) and the 667-4 actuator are reverse-acting, spring-opposed diaphragm actuators. They provide automatic operation of control valves. The 667 actuator provides 76 mm (3 inches) maximum actuator travel. The 667-4 actuator provides 102 mm (4 inches) maximum actuator travel. Both actuators position the valve plug in response to varying pneumatic loading pressure on the diaphragm. Figure 2 shows the operation of these actuators.

A 667 or 667-4 actuator can be furnished with either a top-mounted or a side-mounted handwheel assembly. A top-mounted handwheel assembly is normally used as an adjustable down travel stop. (A down travel stop limits actuator travel in the down direction [when the stem is traveling out of the actuator]. Travel in the up direction is when the stem is traveling into the actuator.) A side-mounted handwheel assembly is normally used as an auxiliary manual actuator. The side-mounted handwheel can also be used as an adjustable up or down travel stop. Casing-Mounted adjustable up or down travel stops are also available on this actuator.

Note

If repeated or daily manual operation is expected, the actuator should be equipped with a side-mounted handwheel rather than a casing-mounted travel stop or top-mounted handwheel. The side-mounted handwheel is designed for more frequent use as a manual operator.

Figure 2. Schematic of Fisher 667 and 667-4 Actuators



A6759

Specifications

Refer to table 1 for Specifications of the 667 and 667-4 actuators. See the actuator nameplate for specific information for your actuator.

Educational Services

For information on available courses for Fisher 667 diaphragm actuators, as well as a variety of other products, contact:

Emerson Process Management
 Educational Services - Registration
 Phone: 1-641-754-3771 or 1-800-338-8158
 E-mail: education@emerson.com
<http://www.emersonprocess.com/education>



Instructional Videos

[Click here](#) or access the following QR code for a video on mounting a DVC6200 Digital Valve Controller on a 667 actuator.



[Click here](#) or access the following QR code for a video on installing a side-mounted handwheel on a 667 actuator.



⚠ WARNING

To avoid personal injury or damage to equipment that may result in the malfunction of the control valve or loss of control of the process caused by excessive pressure, do not exceed the Maximum Pressures listed in table 1. Refer to the Maximum Pressure Limitations section.

Maximum Pressure Limitations

The casing and diaphragm of 667 actuators are pressure operated. This air pressure provides energy to compress the spring, to stroke the actuator, and to seat the valve. The following explanations describe the maximum pressure limits for an actuator. Refer to the nameplate or table 1 for maximum values for your actuator.

- **Maximum Casing Pressure for Actuator Sizing:** This is the maximum pressure that can be applied at less than full travel of the actuator. If this stroking pressure is exceeded before the upper diaphragm plate contacts the travel stop, damage to the stem or other parts might result.
- **Maximum Excess Diaphragm Pressure:** Additional pressure may be added when the actuator is at full travel. If the Maximum Excess Diaphragm Pressure is exceeded, damage to the diaphragm or diaphragm casing might result.

Because the actuator has traveled its specified travel, and the diaphragm head is physically stopped from movement, the energy from any additional air pressure is transmitted to the diaphragm and diaphragm casings. The amount of air pressure that can be added once the actuator has traveled to the stops is limited by the resultant adverse effects that may occur. Exceeding this limiting factor could result in leakage or casing fatigue due to the deformation of the upper diaphragm casing.

- **Maximum Diaphragm Casing Pressure:** If the Maximum Diaphragm Casing Pressure is exceeded, damage to the diaphragm, diaphragm casing, or actuator might result.

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations.

Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Key number locations are shown in figures 6, 7, 8, 9, and 10, unless otherwise noted. Also, refer to figure 3 for location of parts.

CAUTION

To avoid parts damage, do not use an operating pressure that exceeds the Maximum Diaphragm Casing Pressure (table 1) or produces a force on the actuator stem greater than the Maximum Allowable Output Thrust (table 1) or the Maximum Allowable Valve Stem Load.

- **Valve/Actuator Assembly:** If the actuator and valve are shipped together as a control valve assembly, it has been adjusted at the factory, and may be installed in the pipeline. After installing the valve in the pipeline, refer to the Loading Connection procedures.
- **Actuator Mounting:** If the actuator is shipped separately or the actuator has been removed from the valve, it is necessary to mount the actuator on the valve before placing the valve in the pipeline. Refer to the following actuator mounting procedures before placing the valve in service. It is recommended that you perform the Bench Set Spring Adjustment procedures in this section to confirm that the actuator is adjusted correctly for the valve travel.
- **Positioner:** If a positioner is installed, or is to be installed on the actuator, refer to the positioner instruction manual for installation. During the adjustment procedures, it will be necessary to provide a temporary loading pressure to the actuator diaphragm.
- **Handwheel Cap:** If the handwheel cap (key 247, figures 11, 13, or 21) is not in place, install the cap by pushing it on by hand until it snaps into place.

Mounting the Actuator on the Valve

CAUTION

The 667 actuator spring load pushes the stem down out of the actuator yoke (see figure 2), and it can come in contact with the valve stem during actuator mounting.

If the valve stem is allowed to remain in the up position (towards the actuator) during actuator mounting, it can interfere with the actuator stem during mounting. It is possible to damage valve stem threads or bend the valve stem. Be sure the valve stem is pushed down (into the valve body), away from the actuator while mounting.

It may be necessary to apply a temporary loading pressure to the actuator to move the actuator stem away from the valve during installation.

If it is not possible to provide a temporary loading pressure, be very careful when lowering the actuator over the valve stem to prevent damage to valve stem and threads.

⚠ WARNING

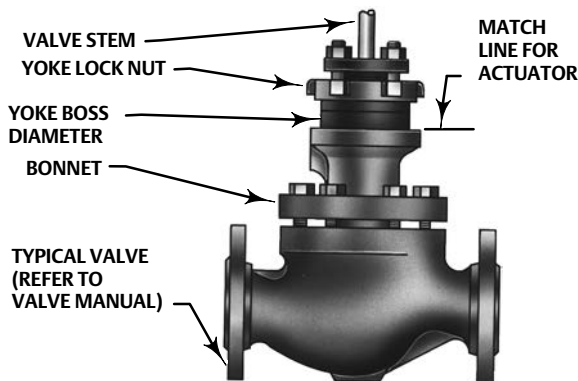
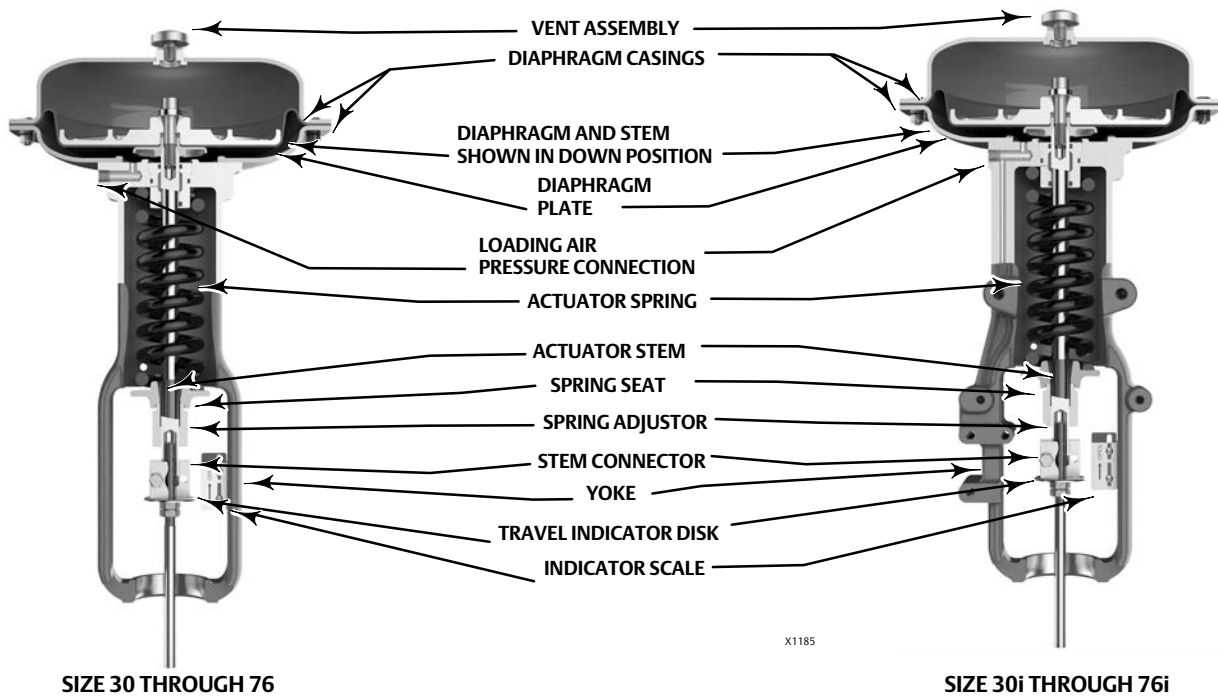
When moving the actuator stem with loading pressure applied, exercise caution to keep hands and tools out of the actuator stem travel path. If the loading pressure is accidentally disconnected, personal injury and property damage may result if something is caught between the actuator stem and other control valve parts.

1. Provide a vise or some other method of supporting the valve and the weight of the actuator during assembly. For direct or reverse acting valves, push the valve stem down away from the actuator while mounting the actuator.
2. Screw the stem locknuts all the way onto the valve stem. With the concave side of the travel indicator disk (key 34) facing the valve, install the travel indicator disk on the valve stem. (Note: The travel indicator disk is not used with size 87 actuators.)
3. Lift or hoist the actuator onto the valve bonnet:
 - a. For size 87 actuators: Slowly lower the actuator down onto the valve while guiding the valve stem into the opening in the end of the actuator stem (see figure 4). Once the actuator is in place, insert the cap screws and tighten the hex nuts, securing the actuator to the bonnet.

b. For all other size actuators:

- Slowly lower the actuator down onto the valve. As the yoke passes over the end of the valve stem, place the yoke locknut over the valve stem. (Note: On small size actuators, it may be necessary to remove the indicator disk and re-install it while lowering the actuator onto the valve because the disk will not go through the actuator yoke opening).
 - Continue to lower the actuator while guiding the valve stem into the opening in the end of the actuator stem until the actuator is in place (see figure 4).
 - Screw the yoke locknut onto the valve bonnet and tighten the locknut.
4. Do not connect the actuator stem to the valve stem at this time. Whenever the actuator is installed on the valve, it is recommended that you perform the Bench Set Spring Adjustment procedures below, to verify that the actuator is still adjusted correctly.

Figure 3. Actuator-Mounting Components for Size 30/30i through 70/70i Actuators



W6199-1

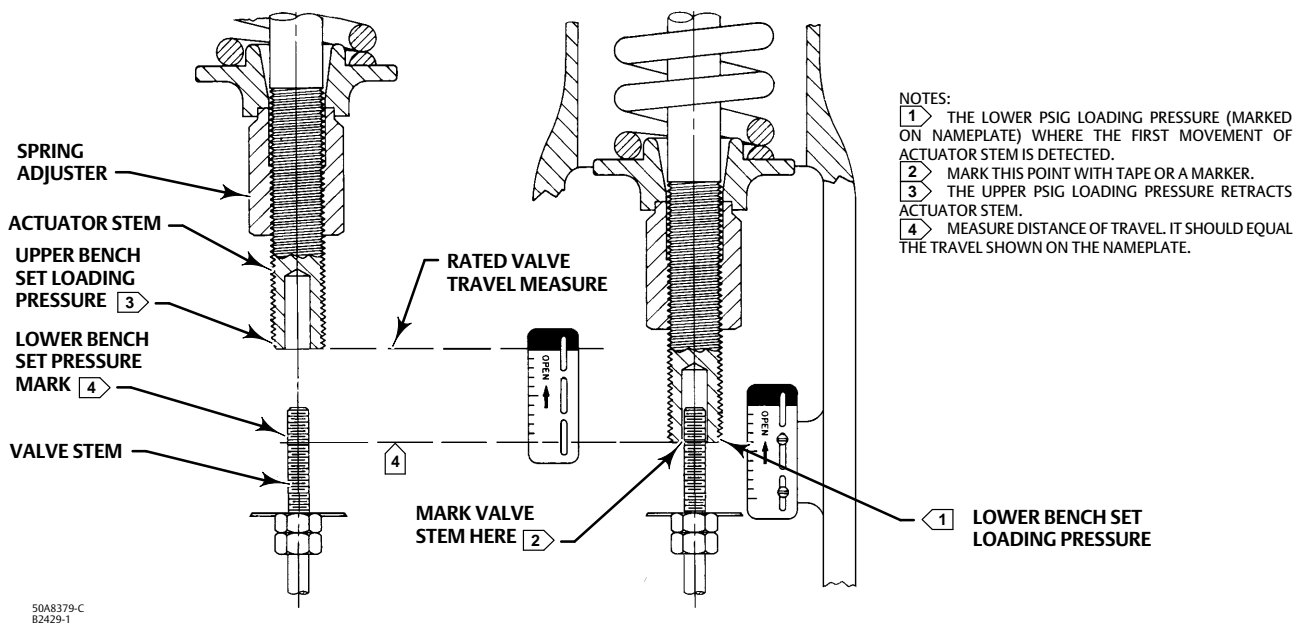
Discussion of Bench Set

The bench set pressure values are used to adjust the initial compression of the actuator spring with the valve-actuator assembly “on the bench.” The correct initial compression ensures that the valve-actuator assembly will function properly when it is put into service and the proper actuator diaphragm operating pressure is applied.

The bench set values are established with the assumption that there is no packing friction. When attempting to adjust the spring in the field, it is very difficult to ensure that there is no friction being applied by “loose” packing.

Accurate adjustment to the bench set range can be made during the actuator mounting process by making the adjustment before the actuator is connected to the valve (see the Spring Verification Procedure).

Figure 4. Bench Set Adjustment



Spring Verification

Ensure that the actuator diaphragm is at the bottom of its travel as shown in figure 4 and not connected to the valve. (Note: Some spring compression is required to move the diaphragm to the bottom of its travel.)

Also, provide a certified pressure gauge that will accurately read the diaphragm pressure from 0 through 0.3 bar (5 psig) above the upper operating range pressure marked on the nameplate. Apply loading pressure to the diaphragm.

Stroke the actuator a few times to ensure that the pressure gauge is working correctly, and that the actuator is functioning properly.

CAUTION

To prevent actuator damage, it is important to ensure that the actuator stem is stroking smoothly and not exhibiting binding or excessive friction between the actuator stem and the bushing (key 7). Binding or excessive friction could be an indicator of incorrect assembly or damaged parts.

Key numbers are shown in figures 6, 7, 8, 9, and 10.

Note

For 667 actuators installed on push-down-to-close (direct acting) valves with fail-close action, the valve plug seat is the limit for downward travel and the actuator is the limit for upward (away from the valve) movement.

For 667 actuators installed on push-down-to-open (reverse acting) valves with fail-open action, the actuator down stop is the limit for downward movement, and the valve seat is the limit for upward (away from the valve) movement.

Ensure the correct Spring Verification procedure is followed for the type of valve on which the 667 actuator is installed.

For Push Down to Close (Direct Acting) Valves

1. If not already accomplished, push the valve stem down away from the actuator to the closed position.
2. Set the diaphragm loading pressure to 0.3 bar (5 psig) over the upper operating range pressure. The travel stop cap screw (key 12) should be contacting the upper diaphragm casing.
3. Slowly decrease the pressure towards the upper bench set pressure, as indicated on the nameplate, while checking for the first linear movement of the actuator stem.

Note

Before turning the spring adjuster on size 70/70i, 76/76i, or 87 actuators, assemble the stem connector around the actuator stem and the anti-rotating lug on the yoke. Mark the actuator stem as a visual reference to verify that stem rotation does not occur. Remove the stem connector before rechecking the bench set.

4. If movement occurs before or after the upper bench set pressure is reached, adjust the spring adjuster (see figure 4). Thread the adjuster up or down on the actuator stem until the actuator stem movement is first detected at the upper bench set pressure. (Note: You may need to lower the loading pressure to reduce spring compression, allowing the spring adjuster to turn.)
5. Be sure the spring adjuster is adjusted to meet the requirements of step 4 above.
6. Slowly decrease diaphragm loading pressure to the lower bench set pressure, as indicated on the nameplate. This will extend the actuator stem toward the valve. Mark the end of the actuator stem on a nearby surface using tape or some other method.
7. Slowly increase the diaphragm loading pressure until the upper bench set pressure is reached. Again, the travel stop cap screw (key 12) should be against the upper diaphragm casing.
8. Measure the distance between the mark or tape to the end of the actuator stem. This distance should match the rated travel indicated on the nameplate.
9. If the measured travel matches the nameplate travel, bench set is complete. Proceed to the Installing the Stem Connector Assembly subsection.
10. If the measured travel is not exact, consider the spring free-length and spring rate tolerances may produce a slightly different bench set than specified. Contact your Emerson Process Management sales office for assistance.

For Push Down to Open (Reverse Acting) Valves

1. If not already accomplished, push the valve stem down away from the actuator to the open position. Later, when installing the connector, pull up the valve stem to the closed position.

2. Set the diaphragm loading pressure to a value less than the lower bench set pressure, as indicated on the nameplate, or near zero. The down travel stops (key 77) should be contacting the yoke.
3. Slowly increase the pressure towards the lower bench set pressure while checking for the first linear movement of the actuator stem.

Note

Before turning the spring adjuster on size 70/70i, 76/76i, or 87 actuators, assemble the stem connector around the actuator stem and the anti-rotating lug on the yoke. Mark the actuator stem as a visual reference to verify that stem rotation does not occur. Remove the stem connector before rechecking the bench set.

4. If movement occurs before or after the lower pressure is reached, adjust the spring adjuster (see figure 4). Thread the adjuster up or down on the actuator stem until the actuator stem movement is first detected at the lower bench set pressure.
5. Apply the upper bench set pressure indicated on the nameplate to the diaphragm. This will retract the actuator stem away from the valve. Mark the end of the actuator stem on a nearby surface using tape or some other method.
6. Slowly decrease the diaphragm pressure until the lower bench set pressure is applied. Again, the down travel stops (key 77) should be against the yoke.
7. Measure the distance between the mark or tape to the end of the actuator stem. This distance should match the rated travel indicated on the nameplate.
8. If the measured travel matches the nameplate travel, bench set is complete. Proceed to the Installing the Stem Connector Assembly subsection.
9. If the measured travel is not exact, consider the spring free-length and spring rate tolerances may produce a slightly different bench set than specified. Contact your Emerson Process Management sales office for assistance.

Installing the Stem Connector Assembly

When installing the stem connector assembly (key 31), the actuator and valve stem threads should engage the threads of the stem connector by a distance equal to the diameter of the stem.

▲ WARNING

Install the stem connector securely before a positioner is mounted to the actuator and pressurized, using only a regulator-controlled air supply, not the positioner, to move the actuator stem.

To avoid personal injury or property damage, keep hands and tools out of the actuator stem travel path while applying loading pressure to move the actuator stem in the following steps.

CAUTION

To avoid damaging the seating surfaces, do not rotate the valve plug while it is seated. Exercise care while installing the stem connector assembly to avoid damage to the valve plug stem and valve stem threads.

Note

Replacement stem connectors are an assembly of two stem connector halves, cap screws, and a spacer between the connector halves. Remove the spacer and discard it, if present, before clamping the actuator and valve stems together. Use only a mated pair of stem connectors.

1. If necessary, push the valve stem down so that the valve plug is touching the seat ring on direct-acting valves. For reverse-acting valves, pull the stem up to the closed position. Always start with the valve plug on the seat.
2. If necessary, screw the valve stem locknuts down, away from the connector location. For all actuators except size 87, ensure that the travel indicator disk (key 34) is on top of the locknuts.
3. Adjust the diaphragm pressure to the lower bench set pressure (or, the upper bench set pressure for reverse-acting valves.) This should be the same pressure used in the Spring Verification steps, and it is marked on the nameplate.
4. Place the stem connector half with the threaded holes approximately half way between the actuator and valve stems, and align the actuator stem and valve stem with threads from both stems mated root-to-crest with the stem connector. If the threads from one of the stems do not fully align with the stem connector, a slight change to loading pressure may be necessary to align the threads. Refer to figures 6, 7, 8, 9, and 10 to help locate the connector position.

CAUTION

Incomplete engagement of either the valve stem or actuator stem in the stem connector can result in stripped threads or improper operation. Be sure that the length of each stem clamped in the stem connector is equal to or greater than one diameter of that stem. Damage to threads on either stem or in the stem connector can cause the parts to be replaced prematurely. Do not loosen the cap screws when the stem connector has spring or loading pressure force applied.

5. Install the other half of the stem connector and insert the cap screws and tighten them while ensuring even spacing between the stem connector halves on all sides. If installing a positioner, also attach the feedback bracket at the same time.

CAUTION

Over-tightening the valve stem locknuts can make disassembly difficult.

6. Screw the valve stem locknuts up against the stem connector for the size 87 actuator. For all other actuator sizes, screw the valve stem locknuts up until the indicator disk contacts the bottom of the stem connector. Do not overtighten the locknuts.
7. Slowly stroke the valve from fully open to fully closed and verify full rated travel is achieved.

Be sure that the valve is in the closed position. Loosen the screws on the travel indicator scale (key 32), and align it with the travel indicator disk (key 34). Stroke the valve full travel to ensure that the travel matches the rated valve travel on the nameplate. If valve travel is not correct, repeat the stem connector procedure.

Friction Discussion

If you are attempting to adjust the bench set after the actuator is connected to the valve and the packing tightened, you must take friction into account. Make the spring adjustment so full actuator travel occurs at the bench set values (a) plus the friction force divided by the effective diaphragm area with increasing diaphragm pressure or (b) minus the friction force divided by the effective diaphragm area with decreasing diaphragm pressure.

If the stem connector assembly has been installed, the valve friction may be determined by the following procedure:

1. Install a pressure gauge in the actuator loading pressure line that connects to the actuator diaphragm casing.

Note

Steps 2 and 4 require that you read and record the pressure shown on the pressure gauge.

2. Increase the actuator diaphragm pressure and read the diaphragm pressure as the actuator reaches a travel position in the rated travel of the valve that does not contact a travel stop. Make a reference mark on the travel indicator scale using tape or some other method at this point.
3. Increase the actuator diaphragm pressure until the actuator is at a travel position greater than the position referenced in step 2 using the reference point to identify first movement.
4. Decrease the actuator diaphragm pressure and read the diaphragm pressure as the actuator returns to the position referenced in step 2.

The difference between the two diaphragm pressure readings is the change in the diaphragm pressure required to overcome the friction forces in the two directions of travel.

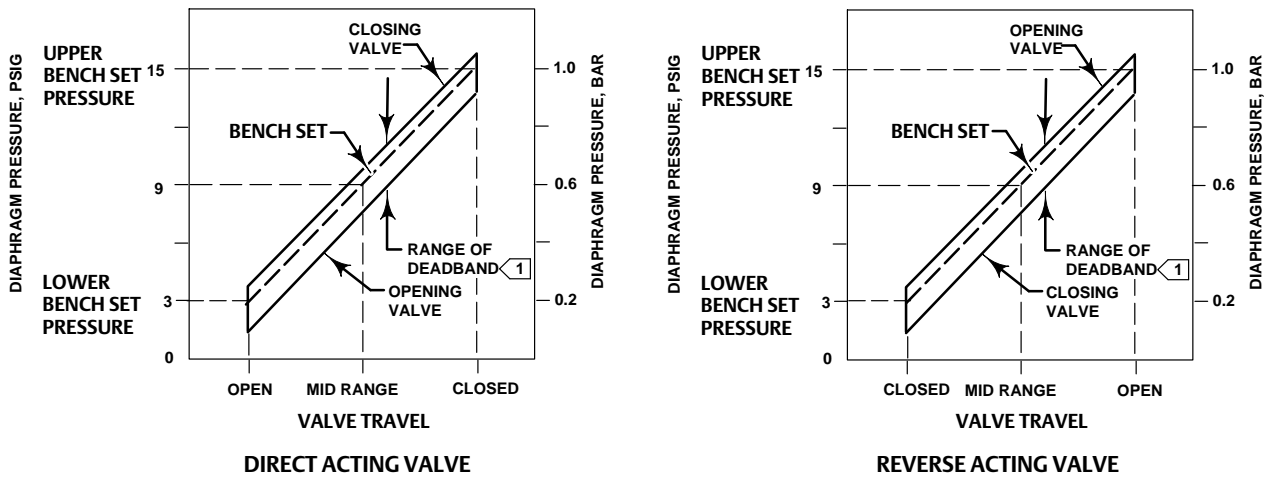
5. Calculate the actual friction force:

$$\text{Friction Force, = pounds} = 0.5 \left(\begin{array}{c} \text{Difference} \\ \text{in pressure} \\ \text{readings, psig} \end{array} \right) \times \left(\begin{array}{c} \text{Effective} \\ \text{diaphragm area,} \\ \text{inches}^2 \end{array} \right)$$

Refer to table 1 for the effective diaphragm area.

It is difficult to rotate the spring adjuster (key 74, figures 6, 7, 8, 9, and 10) when the full actuator loading pressure is applied to the actuator. Release the actuator loading pressure before adjusting. Then re-apply loading pressure to check the adjustment.

Figure 5. Typical Valve Response to Deadband



NOTE:
 1 DEADBAND IS CAUSED BY FRICTION.
 A6763-2

Deadband Measurement

Deadband is caused by packing friction, unbalanced forces, and other factors in the control valve assembly. Deadband is the range a measured signal can vary without initiating a response from the actuator (see figure 5). Each actuator spring has a fixed spring rate (force divided by compression). You have verified that the right spring was installed in the actuator by completing the Spring Verification steps.

Deadband is one factor that affects the control valve assembly operation during automatic loop control. The control loop tolerance for deadband varies widely depending on the loop response. Some common symptoms of the

deadband being too wide are no movement, a “jump” movement, or oscillating movements of the actuator during automatic loop control. The following steps are provided to determine the span of deadband. The percent of deadband is helpful in troubleshooting problems with the process control loop.

1. Start at a pressure near the lower bench set pressure, slowly increase pressure until the valve is approximately at mid-travel. Note this pressure reading.
2. Slowly decrease pressure until movement of the valve stem is detected, and note this pressure.
3. The difference between these two pressures is deadband, in psi.
4. Calculate the percent of deadband by:

Deadband, psi

$$\text{Deadband} = \frac{\text{Deadband, psi}}{\text{Bench Set Span, psi}} = \text{nn \%}$$

Loading Connection

Key number locations are shown in figures 6, 7, 8, 9, and 10, unless otherwise noted.

The loading pressure connections are made at the factory if the valve, actuator, and positioner come as a unit. Keep the length of tubing or piping as short as possible to avoid transmission lag in the control signal. If a volume booster, valve positioner, or other accessory is used, be sure that it is properly connected to the actuator. Refer to the positioner instruction manual or other manuals as necessary. For actuators shipped separately or whenever the actuator pressure connections are installed, use the following steps:

1. Connect the loading pressure piping to the NPT internal connection in the side of the yoke (key 73).
2. For size 70/70i and 87 actuators, if necessary, remove the 1/4 NPT bushing if a 1/2 NPT internal connection is needed to increase connection size. The connection can be made with either piping or tubing.
3. Cycle the actuator several times to be sure that the valve stem travel is correct when the correct pressure ranges are applied to the diaphragm.
4. If valve stem travel appears to be incorrect, refer to the Bench Set Spring Adjustment procedures at the beginning of this section. Do not place the valve in service if it is not reacting correctly to diaphragm loading pressure changes.

Maintenance

Actuator parts are subject to normal wear and must be inspected regularly and replaced when necessary. The frequency of inspection and replacement depends on the severity of service conditions.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.

- Vent the power actuator loading pressure and relieve any actuator spring pre-compression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

The maintenance instructions are divided into several sections: Actuator, Top-Mounted Handwheel Assembly (Adjustable Down Travel Stop), Side-Mounted Handwheel Assembly for Size 34/34i through 60/60i Actuators (Manual Actuator), Side-Mounted Handwheel Assembly for Size 70, 76 and 87 Actuators (Manual Actuator), and Casing-Mounted Travel Stops.

Actuator

This procedure describes how the actuator can be completely disassembled and assembled. When inspection or repairs are required, disassemble only those parts necessary to accomplish the job; then, start the assembly at the appropriate step.

Key numbers are shown in figures 6, 7, 8, 9, or 10, unless otherwise noted. Figure 6 shows the size 30 through 60 actuators, figure 7 shows the size 30i through 60i actuators, figure 8 shows the size 70 actuator, figure 9 shows the size 70i actuator, and figure 10 shows the size 87 actuator.

Actuator Disassembly

Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Also shut off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

1. If equipped, remove the tubing or piping from the connection in the top of the yoke (key 73).
2. Turn the spring adjuster (key 74) counterclockwise (**toward the valve body**) until all spring compression is relieved.

⚠ WARNING

To avoid personal injury due to the sudden uncontrolled movement of parts, do not loosen the stem connector cap screws when the stem connector has spring force applied to it.

3. If necessary, remove the actuator from the valve body by separating the stem connector (key 31). Loosen the stem locknuts for the size 87 actuator, and remove the stem connector nuts. For all other sizes, separate the stem connector by loosening the stem locknuts (keys 69 and 75) and unscrewing the two stem connector cap screws.
4. Unscrew the spring adjuster (key 74) from the actuator stem (key 144). Also lift the spring seat and spring (key 19 and 18) out of the yoke.
5. Remove the diaphragm casing cap screws and nuts (keys 13 and 14), and lift off the upper diaphragm casing (key 1).

CAUTION

Be careful during disassembly to avoid damaging the O-rings (key 8).

6. Remove the following connected parts: the diaphragm (key 3), upper diaphragm plate (key 4), spacer (key 2), cap screw (key 12), lower diaphragm plate (key 71), and actuator stem (key 144). Be careful when pulling the threads of the actuator stem through the seal bushing (key 7) to avoid damaging the O-rings (key 8).
7. Remove the cap screw (key 12) to separate the parts of this assembly.
8. To remove the seal bushing, remove the snap ring (key 72), and lift out the bushing. Inspect, and if necessary, replace O-rings (keys 8 and 9).
9. Remove cap screws (key 30), and take off the lower diaphragm casing (key 64) and the gasket (key 70, size 30/30i through 60/60i and 76/76i) or O-ring (key 70, size 70/70i or 87). If necessary, the down travel stops (key 77) can be removed.

Table 2. Actuator Assembly Recommended Torque Values

DESCRIPTION, KEY NUMBER	ACTUATOR SIZE	THREAD SIZE, INCH	TORQUE	
			N • m	Lbf • ft
Casing to yoke, key 30 ⁽¹⁾	30/30i to 60/60i and 76/76i	3/8-16	41	30
	70/70i and 87	1/2-13	95	70
Travel stop, key 12	30/30i	3/8-24	41	30
	34/34i and 40/40i	1/2-20	68	50
	45/45i to 76/76i and 87	3/4-16	183	135
MO U-bolt nut, key 170	34 and 40	1/2-13	81	60
	45 to 60	5/8-11	163	120
MO U-bolt nut, key 147	34 and 40	3/8-16	41	30
MO U-bolt nut, key 144	45 to 60	3/8-16	41	30
Diaphragm casing, key 14 ⁽¹⁾	30/30i to 76/76i and 87	3/8-24	27	20
Hex cap screw, key 256	34i to 40i	1/2-13	92	68
	45i to 60i	5/8-11	163	120
Hex cap screw, key 257	34i to 60i	3/8-16	39	29
Stem connector, key 26 ⁽²⁾	30/30i through 40/40i	5/16-18	23	17
	45/45i through 70/70i	3/8-16	39	29
	87	1/2-13	91	67

1. Observe tightening pattern and procedure described in the appropriate Actuator Assembly section.
2. Torque values when lithium grease is used on the threads.

Actuator Assembly

Refer to table 2 as appropriate.

1. Coat the O-rings (key 70/70i, sizes 70 and 87) with lithium grease (key 237), or, coat the gasket with lithium grease (key 237). Place a new gasket or O-ring (key 70) on the yoke (key 73). Position the lower diaphragm casing (key 64) on the yoke and align the holes. Insert the cap screws (key 30) and tighten evenly in a crisscross pattern to 41 N•m (30 lbf•ft) for size 30/30i-60/60i and 76/76i actuators or 95 N•m (70 lbf•ft) for size 70/70i and 87 actuators. If down travel stops (key 77) were removed, insert and tighten them.
2. Coat the O-rings (keys 8 and 9) with lithium grease (key 237) and place the O-rings in the seal bushing (key 7).
3. Fill the seal bushing with lithium grease (key 237), slide the bushing into the yoke (key 73), and install the snap ring (key 72).

CAUTION

Be careful during assembly to avoid damaging the O-rings (key 8).

4. Assemble the actuator stem (key 144), lower diaphragm plate (key 71), diaphragm (key 3), upper diaphragm plate (key 4), and the travel stop cap screw and spacer (keys 12 and 2). Coat the cap screw threads with lithium grease

(key 237). Tighten the cap screw (key 12) to the appropriate torque as shown in table 2. Place this assembly in the actuator. Take care when pushing the actuator stem through the seal bushing so that the threads do not damage the O-rings.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30/30i-76/76i and 87 actuators.

CAUTION

Over-tightening the diaphragm cap screws and nuts (keys 13 and 14) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

5. Install the upper diaphragm casing (key 1), and install the cap screws and nuts (keys 13 and 14). Tighten the diaphragm cap screws and nuts in the following manner.
6. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).
7. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
8. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
9. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
10. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
11. Once completed, no more tightening is recommended.
12. Install the actuator spring (key 18) and spring seat (key 19). Apply anti-seize lubricant (key 239) to the threads of the actuator stem and to the surface of the spring adjuster (key 74) that contacts the spring seat. Thread the spring adjuster onto the actuator stem.
13. Mount the actuator onto the valve in accordance with the procedures in the Installation section.

Top-Mounted Handwheel Assembly (Adjustable Down Travel Stop)

Actuator key numbers are shown in figures 6, 7, 8, 9, and 10. And, top-mounted handwheels are shown in figures 11, 12, 13, 14, and 15.

Note

If repeated or daily manual operation is expected, the actuator should be equipped with a side-mounted handwheel rather than a casing-mounted travel stop or top-mounted handwheel. The side-mounted handwheel is designed for more frequent use as a manual operator.

A top-mounted handwheel assembly (figures 11, 12, 13, 14, and 15) is usually used as an adjustable down travel stop to limit full extension of the actuator stem. Turning the handwheel counterclockwise pulls the extension rod (key 150, figures 11, 13, and 14) up, retracting the actuator stem.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

Note

For size 70/70i and 87 actuators with handjack bars (figure 15) it is recommended that the handjack bar (key 58) be removed when not in use and the handwheel cap (key 247) be installed for weather protection of the internal components.

Disassembly for Top-Mounted Handwheel

1. Bypass the control valve, reduce loading pressure to atmospheric, and if equipped, remove the tubing or piping from the connection in the top of the yoke (key 73, figures 6, 8, 9, and 10).
2. Turn the handwheel (key 58) clockwise so that the handwheel assembly is not causing any spring compression.
3. Turn the actuator spring adjuster (key 74) to relieve all the compression from the spring (key 18).
4. If servicing just the thrust bearing, races, and handwheel screw (keys 180, 181, and 160), use the following steps:
 - Remove the cap and take out the cotter pin. Remove the castle nut, bearing retainer, thrust bearing, and races (keys 247, 167, 166, 180, and 181).
 - Use the handwheel to remove the handwheel screw (key 160) from the handwheel body (key 148).
 - If necessary, remove the extension rod (key 150) at this time. Most maintenance procedures do not require the rod to be removed.
 - Clean and inspect all parts or replace parts as necessary. Upon re-assembly, lubricate handwheel threads, bearings, and races with anti-seize lubricant (key 239).
 - Lubricate and re-install the handwheel screw into handwheel body (key 148). Lubricate and replace the races, bearing, and retainer (keys 181, 180, and 182). Replace the castle nut (key 166), tighten it, and insert the cotter pin (key 167). Replace the handwheel cap (key 247).
5. For size 30/30i through 60/60i and 76/76i actuator handwheels (figures 11 and 13):
 - Remove the cap screws (key 161). Make sure that the guide plate can turn between the handwheel body and the mounting plate (keys 157, 148 and 158).
 - Remove the cap (key 247) and cotter pin (key 167). Remove the castle nut (key 166) and, if necessary, unscrew the extension rod (key 150). Remove the rod, the handwheel body (key 148), and the attached parts.
 - Remove the hex nuts and cap screws (keys 14 and 13, figures 6, 7, 8, 9, and 10) from the diaphragm casings. Lift off the upper diaphragm casing (key 1) and the mounting plate (key 158).
 - Turn the handwheel (key 58) to remove the handwheel screw (key 160) from the handwheel body (key 148). Remove the retaining ring (key 60) if the handwheel (key 58) must be separated from the handwheel screw.
 - If necessary, perform other actuator maintenance before returning to the following assembly steps.

6. For size 70/70i and 87 actuator handwheels (figures 14 and 15):

- Remove the cap (key 247). Take out the cotter pin (key 167) and remove the castle nut, the bearing retainer, and thrust bearing (keys 166, 182, 181, and 180). It is not necessary to remove the extension rod (key 150) at this time.
- Remove the hex nuts and cap screws (keys 14 and 13, figures 6, 7, 8, 9, and 10) from the diaphragm casings. Lift off the upper diaphragm casing (key 1), handwheel body (key 148) and attached parts.
- If travel stops (key 152) are used, note and record their position relative to the cap screws (key 154) for use in assembly. Remove the travel stops and cap screws, and remove either the mounting plate (key 158, figure 14) or the handwheel body (key 148, figure 14) and attached parts.
- Turn the handwheel (key 58) to remove the handwheel screw (key 160) from the handwheel body (key 148). Remove the retaining ring (key 60) if the handwheel (key 58) must be separated from the handwheel screw.
- If necessary, perform other actuator maintenance before returning to the following assembly steps.

Assembly for Top-Mounted Handwheel

For size 30/30i through 60/60i and 76/76i actuator handwheels:

Refer to figures 11, 12, and 13 for top-mounted handwheel assemblies.

1. If it was removed, slide the handwheel (key 58) onto the end of the handwheel screw (key 160), and snap the retaining ring (key 60) into place. Also, install the guide post (key 150) if it was removed.
2. Generously coat the threads of the handwheel screw (key 160) with anti-seize lubricant (key 239). Turn the screw into the handwheel body (key 148).
3. Install the mounting plate (key 158) to the diaphragm casing (key 1, figures 6, 8, 9, and 10) with the cap screws (key 154). Finger tighten the screws.
4. If travel stops were used, install the travel stops to their original positions as recorded in the preceding Disassembly steps. Tighten the screws and travel stops.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30/30i-76/76i and 87 actuators.

CAUTION

Over-tightening the diaphragm cap screws and nuts (keys 13 and 14) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

5. Position the diaphragm casing (key 1, figures 6, 7, 8, 9, and 10), mounting plate (key 158), travel stops (key 152), if used, and cap screws (key 154) on the diaphragm. Install the cap screws and hex nuts (keys 13 and 14, figures 6, 7, 8, 9, and 10) and tighten in the following manner.

6. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).
7. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
8. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
9. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
10. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
11. Once completed, no more tightening is recommended.
12. If necessary, screw the extension rod (key 150) into the connector (key 27). Slide the guide plate (key 157) onto the extension rod (key 150). For size 45/45i through 76/76i, place the spacer (key 253) on top of the guide plate (key 157). If necessary, replace the extension rod (key 150). Slide the handwheel body (key 148) over the extension rod, position the handwheel body on the spacer (key 253), align the holes, and insert and tighten the cap screws (key 161).
13. Lubricate and install the thrust bearings (keys 181 and 180), install the bearing retainer (key 182), install the castle nut (key 166) on the extension rod. Do not overtighten the castle nut on the bearing. Install the cotter pin (key 167). Replace the cap (key 247).
14. Refer to the Assembly portion of the Actuator maintenance section.

For size 70/70i and 87 actuators handwheels (figures 14 and 15):

Refer to figure 14 for top-mounted handwheel assemblies and figure 15 for handjack bar assemblies.

1. If removed, slide the handwheel (key 58) onto the end of the handwheel screw (key 160), and snap the retaining ring (key 60) into place.
2. Generously coat the threads of the handwheel screw (key 160) with anti-seize lubricant (key 239). Turn the screw into the handwheel body (key 148).
3. If necessary, install the extension rod (key 150) into the connector (key 27) and tighten it. Position the handwheel body (key 148) on the diaphragm casing (key 1, figures 6, 7, 8, 9, and 10), and align the holes. Insert the cap screws (key 154). Finger tighten the screws.
4. If travel stops were used, return the travel stops to their original positions as recorded in the preceding Disassembly steps. Tighten the screws and travel stops.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30/30i-76/76i and 87 actuators.

CAUTION

Over-tightening the diaphragm cap screws and nuts (keys 13 and 14) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

5. Slide the extension rod (key 150) into the handwheel screw (key 160), and position the diaphragm casing (key 1, figures 6, 7, 8, 9, and 10) with the attached parts on the diaphragm. Install the cap screws and hex nuts (keys 13 and 14, figures 6, 7, 8, 9, and 10) and tighten in the following manner.
6. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).
7. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
8. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
9. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
10. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
11. Once completed, no more tightening is recommended.
12. Lubricate and install the thrust bearings (keys 180 and 181), install the bearing retainer (key 182), install the castle nut (keys 166) on the extension rod. Do not overtighten the castle nut on the bearing. Install the cotter pin (key 167). Replace the cap (key 247).
13. Refer to the Assembly portion of the Actuator maintenance section.

Side-Mounted Handwheel for Sizes 34 through 60 and 34i through 60i Actuators

A side-mounted handwheel assembly is normally used as a manual actuator for sizes 34 through 60 (figures 16 and 18) and 34i through 60i actuators (figures 17 and 19). Turning the handwheel counter-clockwise past the neutral position opens the valve. Two levers (key 146, figures 16, 17, 18, and 19) on a handwheel assembly operate the valve by moving the valve stem.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then begin the assembly at the appropriate step.

Disassembly for Side-Mounted Handwheel (Sizes 34-60 and 34i-60i)

1. Use step a. for size 34 through size 60 actuators, and use step b. for sizes 34i through 60i.
 - a. **For Size 34 through 60:** If desired, the handwheel assembly can be removed from the actuator yoke. To do this, remove the hex nuts (keys 147 and 170) from the U-bolts (key 166 and 143) that hold the assembly to the yoke for the size 30 and size 40. Remove the hex nuts (key 144 and 170) from the U-bolts (key 166 and 143) that hold the assembly to the yoke for the size 45 through size 60.
 - b. **For Size 34i through 60i:** If desired, the handwheel assembly can be removed from the actuator yoke. To do this, remove the cap screws (key 256 and 257) and spacers (key 258) that hold the assembly to the yoke for the size 30i through size 60i.
2. Remove the retaining ring (key 154) and drive out the lever pivot pin (key 153).
3. Two screws (key 156) hold the right- and left-hand levers (key 146) together. Remove the screw from the top of the levers so that the levers will drop down out of the assembly. Disassemble further, if necessary, by removing the other screw.
4. Remove the screw (key 161) and pointer mounting bolt (key 159, not shown) located behind the pointer (key 160).
5. Remove the stop nut (key 54), lockwasher (key 150), and washer (key 149). Then remove the handwheel (key 51), being careful not to lose the small ball (key 55) and spring (key 56).
6. Loosen the locking set screw (key 168, figure 19). Then, using a suitable tool, unscrew the bearing retainer (key 136).

7. Pull the handwheel screw assembly (key 145) out of the handwheel body. The operating nut (key 132) will come out with the screw. Also remove the bushing (key 151, figure 16 or 17) on size 34 and 40.
8. If required, remove the two ball bearings (key 152), one from the bearing retainer and the other from the handwheel body.

Assembly for Side-Mounted Handwheel (Sizes 34-60 and 34i-60i)



[Click here or access the following QR code for a video on installing a side-mounted handwheel on a 667 actuator.](#)

1. Pack the ball bearings (key 152) with anti-seize lubricant (key 244). Insert one bearing and the bushing (key 151, figure 16 or 17) into the handwheel body (key 142). The bushing is not used in a handwheel assembly for sizes 45/45i through 60/60i actuators.
2. Coat the handwheel screw assembly (key 145) threads with anti-seize lubricant (key 244), and thread the operating nut (key 132) onto the screw. Slide the second ball bearing (key 152) onto the screw, and insert the end of the screw into either the bushing (key 151, figure 16 or 17) for sizes 34/34i and 40/40i, or into the bearing for sizes 45/45i through 60/60i.
3. Thread the bearing retainer (key 136) into the body (key 142). Completely tighten the bearing retainer, and then loosen it one-quarter turn. Tighten the set screw (key 168, figure 16 or 17) to hold the bearing retainer in place.
4. Coat the groove in the handwheel body (key 142) with lithium grease (key 241). Insert the spring (key 56) and ball (key 55) into the handwheel (key 51). Holding the ball and spring in the handwheel, put the handwheel, the washer (key 149), the lockwasher (key 150), and the stop nut (key 54) onto the end of the end of the handwheel screw (key 145). Tighten the stop nut.
5. Position the pointer mounting bolt (key 159, not shown) and pointer (key 160). Insert and tighten the screw (key 161).
6. Assemble the two levers (key 146) with the cap screws (key 156) for handwheel assemblies for sizes 45/45i, 50/50i, and 60/60i actuators, or with the machine screws (key 156) for handwheel assemblies on sizes 34/34i and 40/40i actuators.
7. Use **step a.** for size 34 through size 60 actuators, and use **step b.** for sizes 34i through 60i.
 - a. **For Size 34 through 60:** If the handwheel assembly was removed from the yoke (key 9, figures 6, 8, or 10), remount the handjack assembly to the yoke using the dowel pins for alignment. For the size 34 and size 40, position the U-bolts and J-bolts (keys 166 and 143) on the yoke, and hand-tighten the hex nuts (keys 170 and 147) to hold the handwheel assembly in position. For the size 45 through size 60, position the U-bolts (keys 166 and 143) on the yoke, and hand-tighten the hex nuts (keys 170 and 144) to hold the handwheel assembly in position. Cap screws (key 163) should be tight against the yoke legs to provide stability. Tighten the nuts (key 144 for size 30 and size 40, key 158 for the size 45 through size 60). For the size 34 and size 40 finish tightening the U-bolt nuts to 81 N•m [60lbf•ft] (key 170) and 41 N•m [30 lbf•ft] (key 147). For the sizes 45 through 60 finish tightening the U-bolt nuts to 163 N•m [120lbf•ft] (key 170) and 41 N•m [30 lbf•ft] (key 144). Be sure the handwheel assembly remains flat against the mounting pad and perpendicular to the yoke.
 - b. **For Size 34i through 60i:** If the handwheel assembly was removed from the yoke (key 9, figures 7, 9, or 10), remount the handjack assembly to the yoke using the dowel pins for alignment. Position the upper cap screws (key 256) on the assembly and hand-tighten to hold the handwheel assembly in position. Place the spacers (key 258) between the yoke and handjack assembly, position cap screws (key 257), and hand-tighten. For the size 34i and size 40i finish tightening the cap screws (key 256) to 92 N•m [68 lbf•ft] and (key 257) to 39 N•m [29 lbf•ft]. For the sizes 45i through 60i finish tightening the cap screws (key 256) to 163 N•m [120 lbf•ft] and (key 257) to 39 N•m [29 lbf•ft].
8. Position the levers (key 146) as shown in figures 11 or 12. Insert the lever pivot pin (key 153), and snap the retaining ring (key 154) onto the lever pivot pin.

Side-Mounted Handwheel Assembly for Size 70, 76, and 87 Actuators

A side-mounted handwheel assembly (figure 20) is usually used as a manual actuator. Turning the handwheel clockwise past the neutral position always closes the valve body. A sleeve (key 123, figure 20) on a handwheel assembly for a size 70, 76 or 87 actuator opens the valve body by moving the valve stem.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; and then begin the assembly at the appropriate step.

Disassembly for Side-Mounted Handwheel (Sizes 70, 76, and 87)

1. Bypass the control valve. Reduce the loading pressure to atmospheric. Disconnect the loading pressure tubing or piping at the yoke.
2. Remove the cover band (key 87), and relieve spring compression by turning the spring adjuster (key 74) counterclockwise.
3. Remove the cap screws and nuts (keys 13 and 14) and lift off the upper diaphragm casing (key 1).
4. Remove the travel stop screw (key 12) and spacer (key 2), and take off the diaphragm plate (key 4), the diaphragm (key 3), and the lower diaphragm plate (key 71).
5. Unscrew the cap screws (key 90) and remove the following connected parts: the lower diaphragm casing (key 64), the O-ring (key 70), spring case adaptor (key 89), the seal bushing, O-rings, and snap ring (keys 7, 8, 9, and 72).
6. Remove the snap ring (key 72), and slide the seal bushing and O-rings (keys 7, 8, and 9) out of the spring case adaptor (key 89).
7. Take out the actuator spring (key 18).
8. Remove the stem connector (key 31) and stem connector cap screws.
9. Pull the actuator stem (key 144) up and out of the yoke. The spring seat (key 19), spring adjuster (key 74), thrust bearing (key 128), and the pinned adjusting screw (key 131) will come out with the actuator stem.
10. Turn the handwheel so that the lower sleeve (key 123) extends out of the bottom of the yoke. DO NOT move the neutral indicator scale (key 125).
11. Loosen two set screws (key 121), and unscrew the bearing retainer flange (key 45). Take out the worm gear and two thrust bearings (key 132), one on each side of the gear.
12. The worm shaft (key 51) and associated parts can be disassembled, if desired, by first removing the handwheel nut (key 127) and the handwheel (key 58). Do not lose the small ball (key 141) and spring (key 142).
13. Loosen the set screw (key 52) for each worm shaft retainer (keys 48 and 49). Unscrew the two worm retainers (keys 48 and 49). The ball bearings (key 50) will come out with the retainers.

Assembly for Side-Mounted Handwheel (Sizes 70, 76, and 87)

1. The front and back worm retainers (keys 48 and 49) each have a slot in their threads for a set screw (key 52). Pack the ball bearings (key 50) with anti-seize lubricant (key 239), and insert one ball bearing in the back worm retainer (key 49) as shown in figure 20.
2. Thread the back bearing retainer and ball bearing (keys 49 and 50) into the yoke. Align the slot in the bearing retainer with the set screw hole in the yoke, insert the set screw (key 52), and tighten it.
3. Coat the worm shaft (key 51) threads with anti-seize lubricant (key 239), and slide the shaft into the yoke so that the end of the shaft fits snugly into the back bearing retainer.
4. Insert the bearing in the front bearing retainer (key 49), and thread the retainer and ball bearing into the yoke. Align the slot in the retainer with the hole in the yoke, insert the set screw (key 52), and tighten it.
5. Put the spring and ball (keys 141 and 142) in the handwheel (key 58). Slide the handwheel onto the worm shaft (key 51). Thread the hex nut (key 127) onto the worm shaft.

6. Pack the two needle bearings (key 132) and coat the worm gear (key 44) threads with anti-seize lubricant (key 239). Insert the key (key 122), the bearings, and the worm gear in the yoke (key 73) as shown in figure 20.
7. Slots are cut in the threads of the bearing retainer flange (key 45). Thread the flange into the yoke so that the slots and the holes for the set screws (key 121) align. Insert the screws, and tighten them.
8. The lower sleeve (key 123) has a milled groove in one end. Coat the sleeve threads with anti-seize lubricant (key 239), slide the end of the lower sleeve with the groove into the bearing retainer flange, turn the handwheel, and feed the sleeve through the worm gear so that the slot in the lower sleeve engages the key (key 122) in the yoke. Continue turning the handwheel until the lower sleeve protrudes 81 mm (3.19 inches) below the surface of the yoke. The bottom of the lower sleeve should be even with the bottom of the extension on the neutral indicator.
9. Pack the thrust bearing (key 128) with anti-seize lubricant (key 239). Slide the actuator stem (key 144) and the attached adjusting screw (key 131), pin (key 130), thrust bearing (key 128), spring seat (key 19), and spring adjuster (key 74) into the yoke. The lower end of the stem slides through the lower sleeve (key 123) and the lower sleeve slides into the adjusting screw (key 131), as shown in figure 20.
10. Position the actuator stem (key 144) against the valve stem. Clamp both stems between the two halves of the stem connector (key 31), and be sure the threads are engaged properly on both stems. The stem connector should not be closer than 3.2 mm (1/8 inches) to the lower sleeve when the actuator stem is in the retracted position. This adjustment will provide approximately 3.2 mm (1/8 inches) of free travel of the lower sleeve in either direction for manual operation. Fasten the halves together with the cap screws.
11. Put the actuator spring (key 18) in the yoke on the spring seat (key 19).
12. Coat the O-rings (keys 8 and 9) with lithium grease (key 237), and insert them in the seal bushing (key 7). Slide the seal bushing and O-rings into the spring case adaptor (key 89).
13. Install the snap ring (key 72).
14. Slide the seal bushing and O-rings (keys 7, 8, and 9) over the actuator stem (key 144), and position the spring case adaptor (key 89), lower diaphragm casing (key 64), and O-ring (key 70) on the yoke.
15. Insert and tighten the cap screws (key 90).
16. Slide the lower diaphragm plate (key 71), the diaphragm (key 3) with the patterned side up, the diaphragm plate (key 4), the spacer (key 2), and the cap screw (key 12) on the actuator stem (key 144). Tighten the cap screw.
17. Put the diaphragm casing (key 1) on the diaphragm. Align the holes in the diaphragm (key 3) and the diaphragm casings (keys 1 and 64).

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30/30i-76/76i and 87 actuators.

CAUTION

Over-tightening the diaphragm cap screws and nuts (keys 13 and 14) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

18. Install the cap screws and hex nuts (keys 13 and 14) and tighten in the following manner.

19. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).
20. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
21. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
22. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
23. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
24. Once completed, no more tightening is recommended.
25. Return the actuator to service after completing the Loading Connection procedure in the Installation section and the procedures in the Adjustments section.

Casing-Mounted Travel Stops

Note

If repeated or daily manual operation is expected, the actuator should be equipped with a side-mounted handwheel rather than a casing-mounted travel stop or top-mounted handwheel. The side-mounted handwheel is designed for more frequent use as manual operator.

Casing-mounted adjustable travel stops (shown in figures 21 through 25) are available to limit travel in the down direction (extending the actuator stem) or in the up direction (retracting the actuator stem). The travel stop in figure 21 is a down travel stop, the travel stop in figure 22 is an up and down travel stop, and the travel stops in figures 23, 24, and 25 are up travel stops.

Use the locknuts (key 151, figures 21 and 22), stem (key 150, figure 23), handwheel (key 58, figure 24) or cap screw (key 177, figure 25) to set the point at which the travel stop limits travel. Be sure to tighten the locknuts and replace the cap (key 149, figures 21 and 23; key 247, figure 22) after setting the travel stop.

Instructions are given below for disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

Key numbers are shown in figures 21 through 25.

1. Remove the cap (key 149 or 247) if the travel stop uses one. For down travel stops, loosen the locknuts (key 151, figures 21 and 22) so that the stop is not causing any spring compression.
2. Bypass the control valve, reduce loading pressure to atmospheric, and remove the tubing or piping from the connection on top of the yoke (key 73, figures 6, 8, and 10).
3. For down travel stops, turn the spring adjuster (key 74, figures 6, 8, and 10) out of the yoke toward the stem connector (key 31) to relieve all the compression in the spring (key 18).
4. For style 11 travel stops (figure 22), unscrew the cap screws (key 161), and make sure that the guide plate (key 157) can turn between the handwheel body (key 148) and the mounting plate (key 158).
5. Use a wrench on the nuts (key 151) to unscrew the extension rod (key 150). Remove the rod, the handwheel body (key 148), and the attached parts.
6. Unscrew the hex nuts and cap screws (keys 14 and 13, figures 6, 8, and 10) from the diaphragm casings. Lift off the upper diaphragm casing (key 1, figures 6, 8, and 10) and, for the style 11 travel stop, the mounting plate (key 158). For styles 10, 12 and 13, the travel stop assembly will be removed with the casing.
7. Note and record the position of travel stops (key 152) relative to the cap screws (key 154) for use in assembly. Unscrew the travel stops and cap screws, and remove either the mounting plate (key 158) or the handwheel body (key 148) and attached parts.

8. Separate the stem (key 150) and screw (key 160, figure 22) from the handwheel body.
9. Before reassembling, lubricate parts indicated by key 239 in figures 21 through 25. Use anti-seize lubricant (key 239).
10. Reassemble parts in the reverse order of removal.
11. When replacing the cap screws (key 154) and, if used, the travel stops (key 152), be sure to return them to their original position as recorded in step 7.

CAUTION

Over-tightening the diaphragm cap screws and nuts (keys 13 and 14), figures 6, 7, 8, 9, and 10 can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

12. Install the cap screws and nuts (keys 13 and 14, figures 6, 7, 8, 9, and 10) and finger tighten. Tighten the diaphragm cap screws and nuts to 27 N•m (20 lbf•ft) torque in a crisscross pattern.
13. Return the spring adjuster (key 74, figure 6, 7, 8, 9, and 10) to its original position. Re-adjust the travel stop.

Parts Ordering

Each actuator has a serial number stamped on the nameplate. Always mention this number when corresponding with your Emerson Process Management sales office regarding technical information or replacement parts. Also, reference the complete 11-character part number of each needed part as found in the following Parts Kits and Parts List sections.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Process Management should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Actuator Repair Kits

Parts kit includes keys 8, 9, and 70. O-ring material is nitrile, and gasket material is composition.

Key	Description	Part Number
	Size 30/30i	R667X000302
	Sizes 34/34i & 40/40i	R667X000402
	Sizes 45/45i through 60/60i	R667X000502
	Sizes 70/70i & 87	R667X000702
	Size 76/76i	R667X000762

Side-Mounted Handwheels Retrofit Kits

Key	Description	Part Number
Retrofit Kit includes parts to add a Side-Mounted Handwheel.		
	Size 34 Push-Down-To-Close	30A8778X0E2
	Size 34 Push-Down-To-Open	30A8778X0F2
	Size 40 Push-Down-To-Close	30A8778X0G2
	Size 40 Push-Down-To-Open	30A8778X0H2
	Size 45 & 46 Push-Down-To-Close	40A8779X0A2
	Size 45 & 46 Push-Down-To-Open	40A8779X0B2
	Size 50 & 60 Push-Down-To-Close	40A8779X0C2
	Size 50 & 60 Push-Down-To-Open	40A8779X0D2
	Size 34i push down to close	GE71635X0E2
	Size 34i push down to open	GE71635X0F2
	Size 40i push down to close	GE71635X0G2
	Size 40i push down to open	GE71635X0H2
	Size 45i & 46i push down to close	GE71636X0A2
	Size 40i & 60i push down to open	GE71636X0B2
	Size 50i & 60i push down to close	GE71636X0C2
	Size 50i & 60i push down to open	GE71636X0D2

Transition Kits for Side-Mounted Handwheels

Transition kits include fasteners necessary to remount an existing side-mounted handwheel to an actuator where the yoke has been changed to a size i yoke.

Contains key numbers 256, 257, and 258.

Description	Part Number
Size 34i/40i push-down-to-close or push-down-to-open	GE71635X0J2
Size 45i - 60i push-down-to-close or push-down-to-open	GE71636X0E2

Top-Mounted Handwheels Retrofit Kits

Retrofit Kit includes parts to add a Top-Mounted Handwheel. Kit number 1 includes the handwheel assembly only. Kit number 2 includes Kit number 1 and a new diaphragm case that is required to mount the handwheel assembly.

Key	Description	Part Number
Kit 1		
	Size 30/30i	30B3940X102
	Sizes 34/34i	30B3940X022
	Size 40/40i	30B3940X042
	Sizes 45/45i & 50/50i	33B9224X012
	Sizes 46/46i, 60/60i, & 76/76i	33B9224X012
	Sizes 70/70i & 87	CV8060X0012
Kit 2		
	Size 30/30i	30B3940X052
	Size 34/34i	30B3940X062
	Size 40/40i	30B3940X092
	Sizes 45/45i & 50/50i	33B9224X022
	Sizes 46/46i, 60/60i, & 76/76i	33B9224X032
	Sizes 70/70i & 87	CV8060X0022

Parts List

Note

Contact your [Emerson Process Management sales office](#) for Part Ordering information.

Actuator Assembly

Key	Description
1	Upper Diaphragm Casing
2	Travel Stop Spacer

Key	Description
3*	Diaphragm Molded Nitrile/Nylon Molded Silicone/Polyester
4	Upper Diaphragm Plate
7*	Bushing, Seal Brass S41600 [416 stainless steel (SST)] PTFE w/25% Glass
8*	O-Ring Nitrile Fluorocarbon
9*	O-Ring Nitrile Fluorocarbon
12	Screw, Cap, hex hd
13	Hex hd Cap Screw
14	Hex Nut
17	Vent Assembly
18	Spring
19	Seat, Lower Spring
27	Extension Rod Conn
30	Hex hd Cap Screw
31	Stem Connector Assembly
32	Travel Indicator Scale
33	Screw, Self Tapping
33	Screw, Mach, Fill hd
34	Disk, Travel Indicator
39	Nameplate
40	Screw, Drive
64	Lower Diaphragm Casing
69	Nut, Hex, Jam
70*	Gasket Composition [up to 232°C (450°F)]
70*	O-Ring Nitrile
71	Lower Diaphragm Plate
72	Ring, Snap
73	Yoke
74	Spring Adjuster
75	Nut, Hex
76	Nut, Speed, Twin
77	Stop, Travel
78	Bushing, Pipe, Hex
79	Screw, Mach, Flat Hd
81	Screw, Mach, Rd Hd
82	Indicator, Travel, Adaptor
83	Washer, Plain
89	Spring Case Adaptor
90	Screw, Cap
102	Plug, Pipe, Hex Hd
144	Actuator Stem
227	Washer, Plain
228	Stem Disk Spacer
237	Lubricant, lithium grease not furnished with actuator
239	Lubricant, anti-seize not furnished with actuator
254	Caution Nameplate

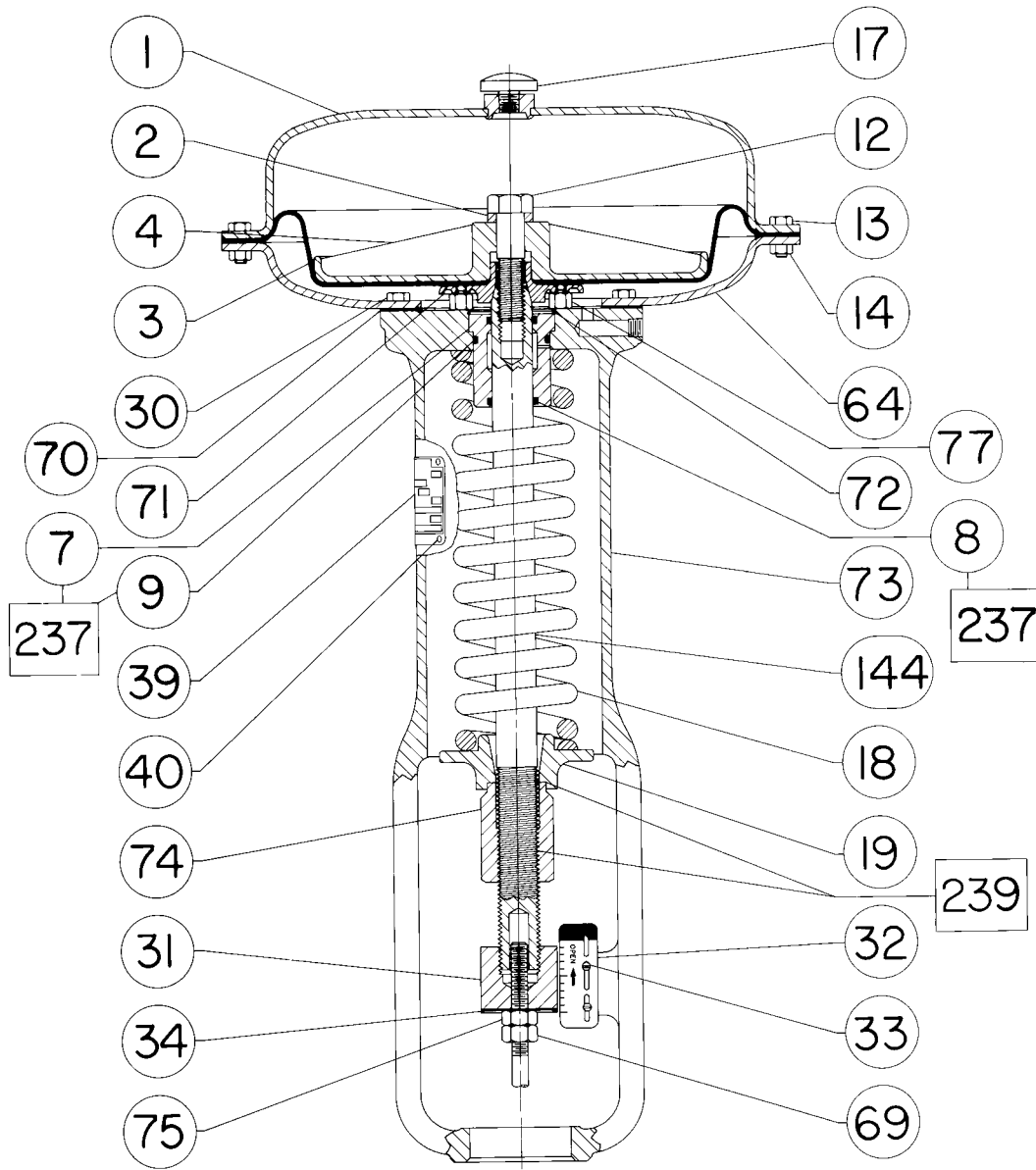
Top-Mounted Handwheel (figures 11, 12, 13, 14, and 15)

Key Description

58	Handwheel / Handjack Bar
60	Retainer Ring
148	Handwheel Body
150	Extension Rod
152	Up Travel Stop
154	Cap Screw
156	Vent Assembly
157	Guide Plate
158	Mounting Plate

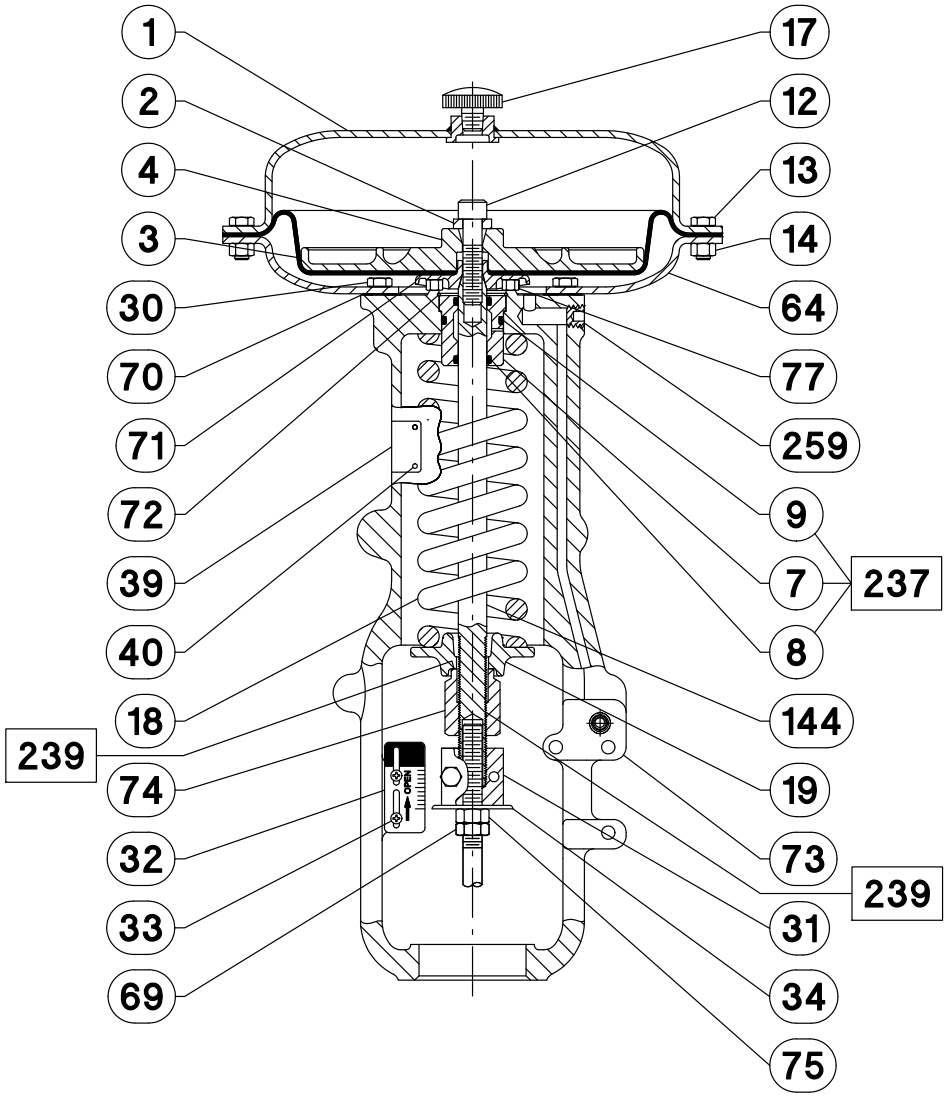
159	Lock Nut
160	Handwheel Screw
161	Cap Screw
166	Castle Nut
167	Cotter Pin
178	Machine Screw
179	Lockwasher
180	Thrust Bearing
181	Thrust Race
182	Bearing Retainer
183	Pipe Nipple
239	Lubricant, anti-seize not furnished with handwheel
247	Handwheel Cap
253	Spacer, Handjack

Figure 6. Fisher 667 Actuator Sizes 30 through 60



50A8379-C

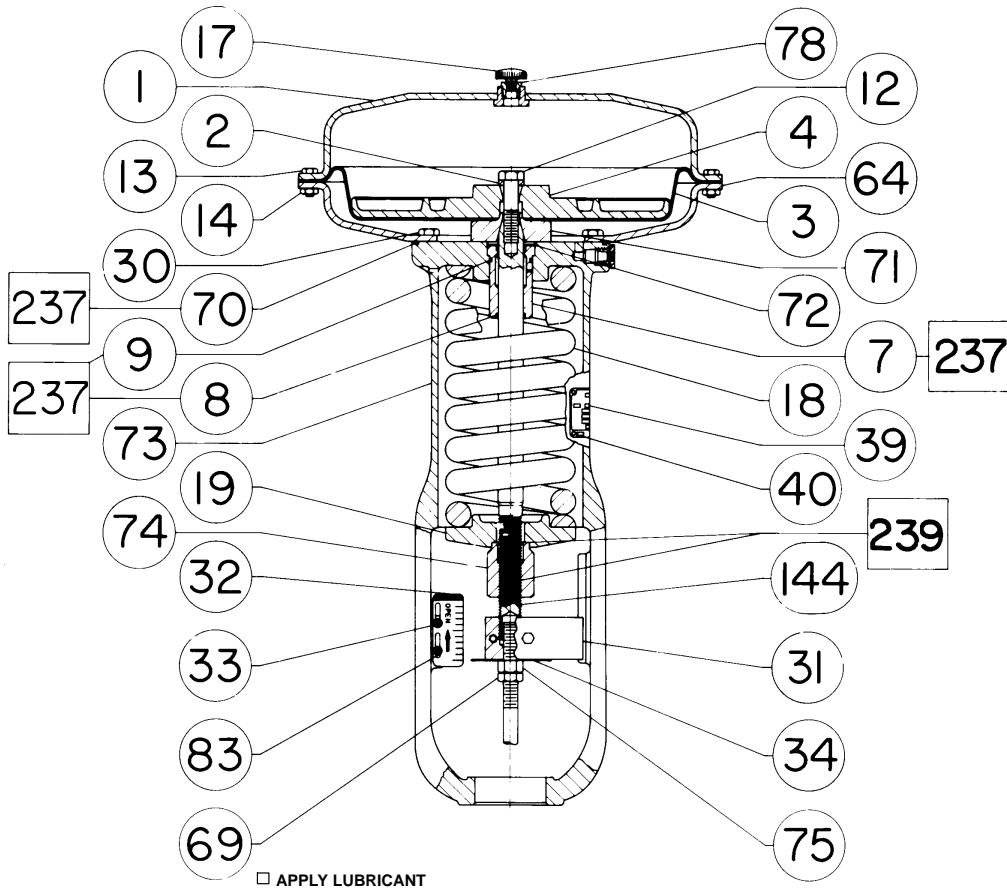
Figure 7. Fisher 667 Actuator Sizes 30i through 60i



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PARTS NOT SHOWN: KEY 76 AND 254

Figure 8. Fisher 667 Size 70 and 76 Actuator



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Figure 9. Fisher 667 Size 70i and 76i Actuator

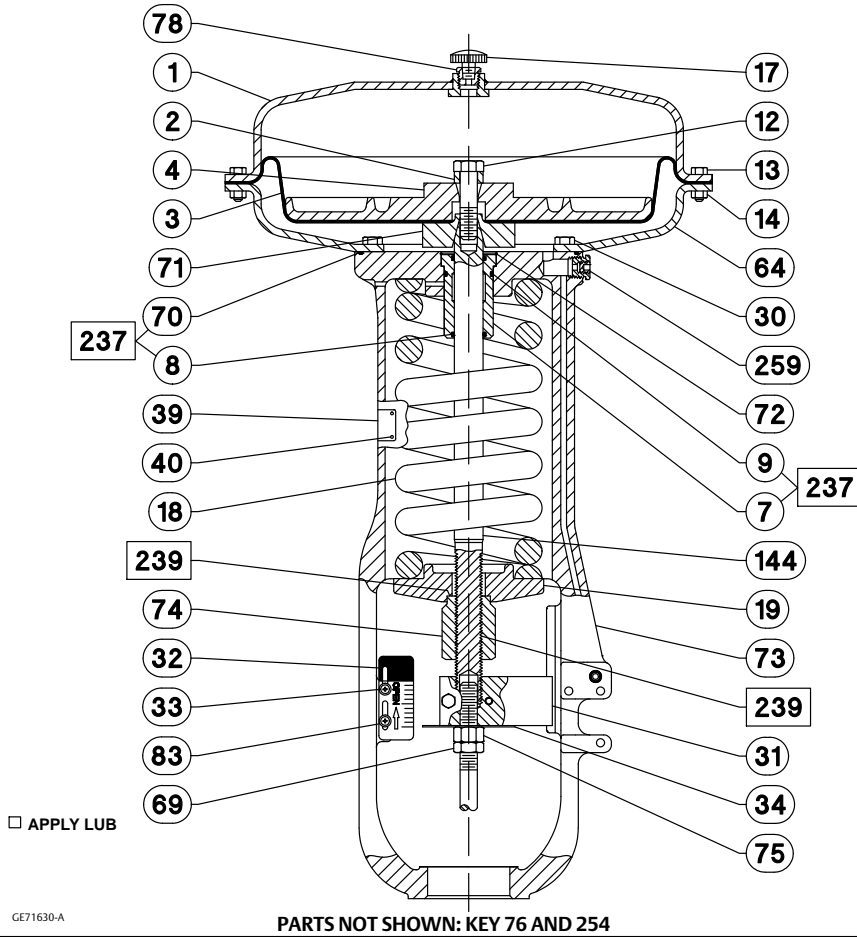
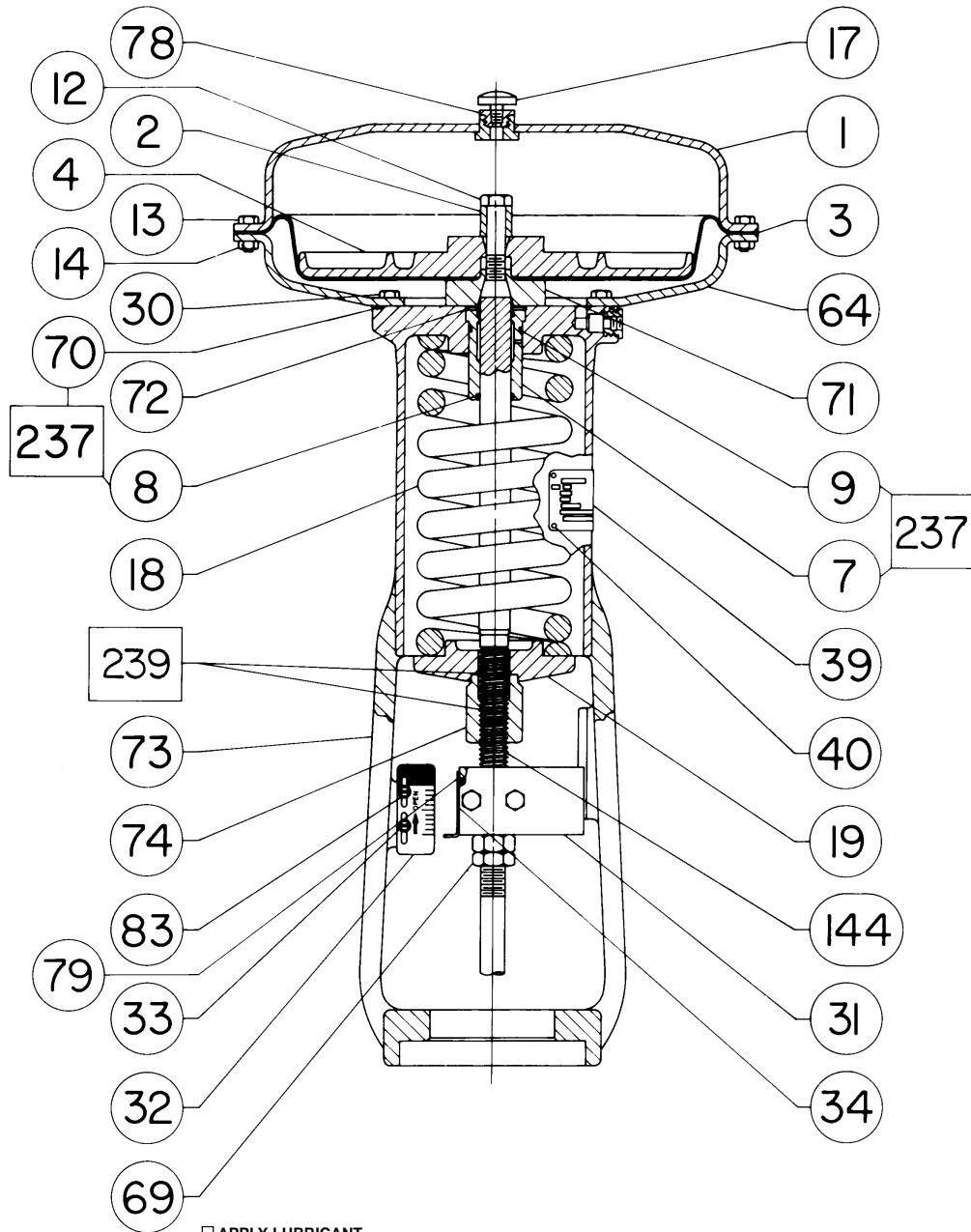
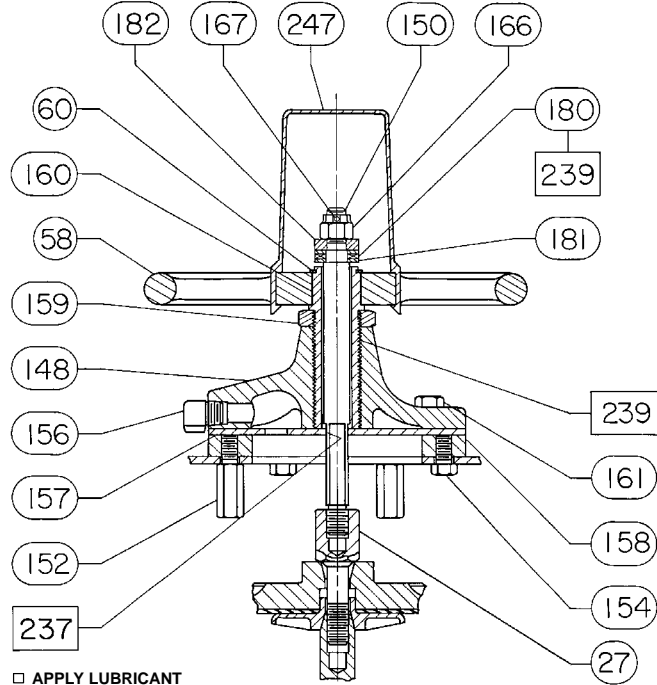


Figure 10. Fisher 667 Size 87 Actuator



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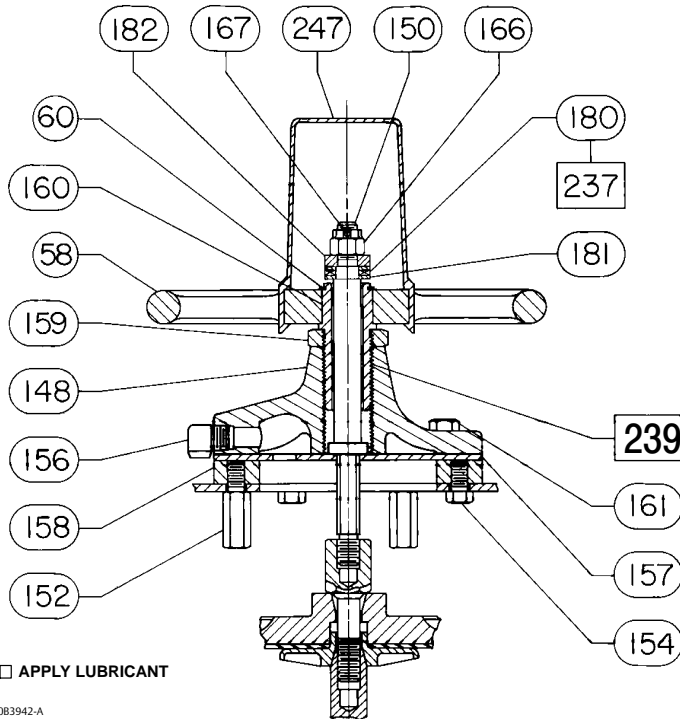
Figure 11. Top-Mounted Handwheel Assembly for Size 30/30i through 40/40i Actuators



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NOTE:
THE TOP MOUNTED HANDWHEEL IS NOT DESIGNED FOR USE UNDER HEAVY LOAD OR FREQUENT USE.
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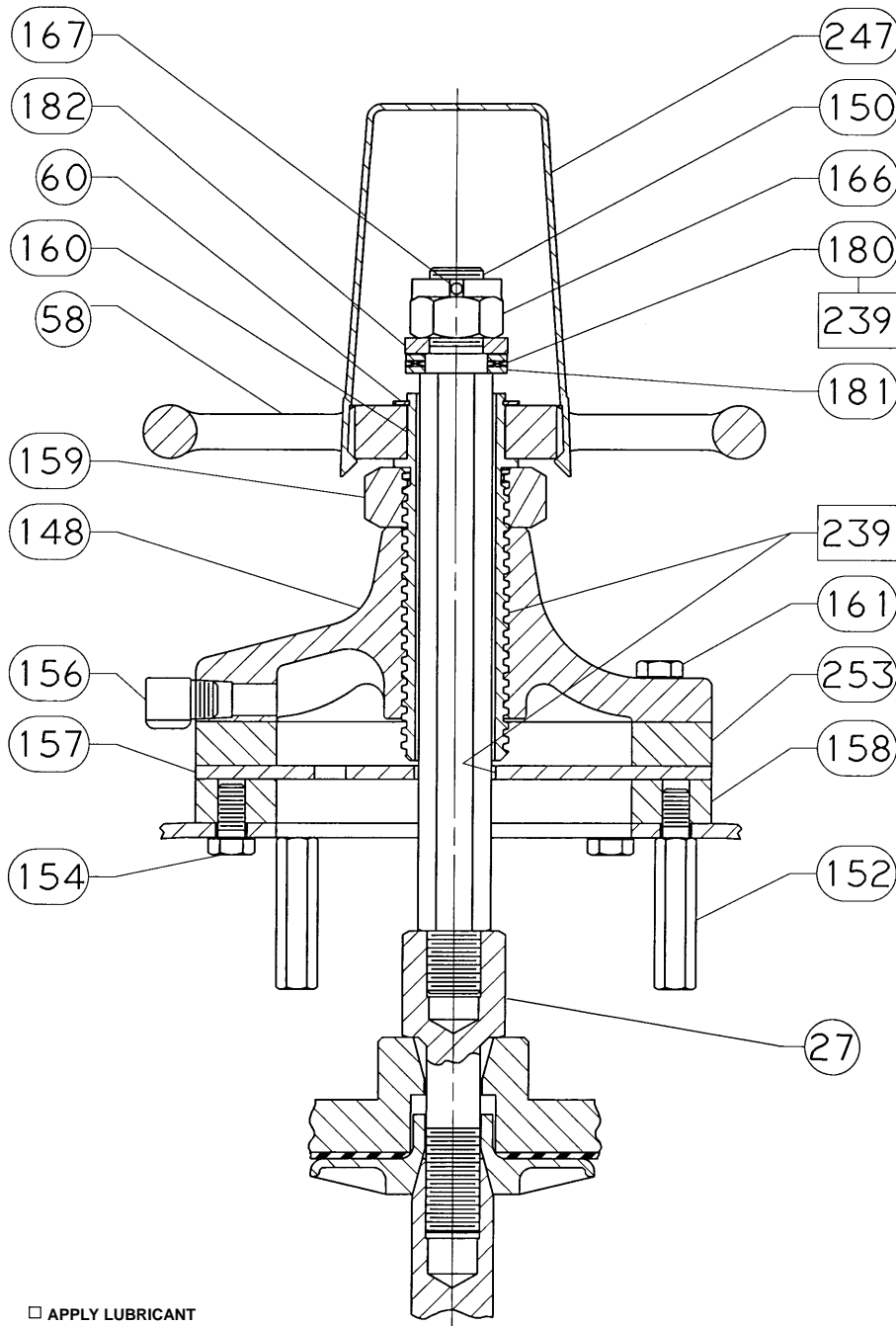
Figure 12. Top-Mounted Handwheel Assembly, Style P2 for Size 45/45i, 50/50i, 60/60i, and 76/76i Actuators



□ APPLY LUBRICANT

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Figure 13. Top-Mounted Handwheel Assembly for Size 45/45i-76/76i Actuators



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Figure 14. Top-Mounted Handwheel Assembly for Size 70/70i and 87 Actuators

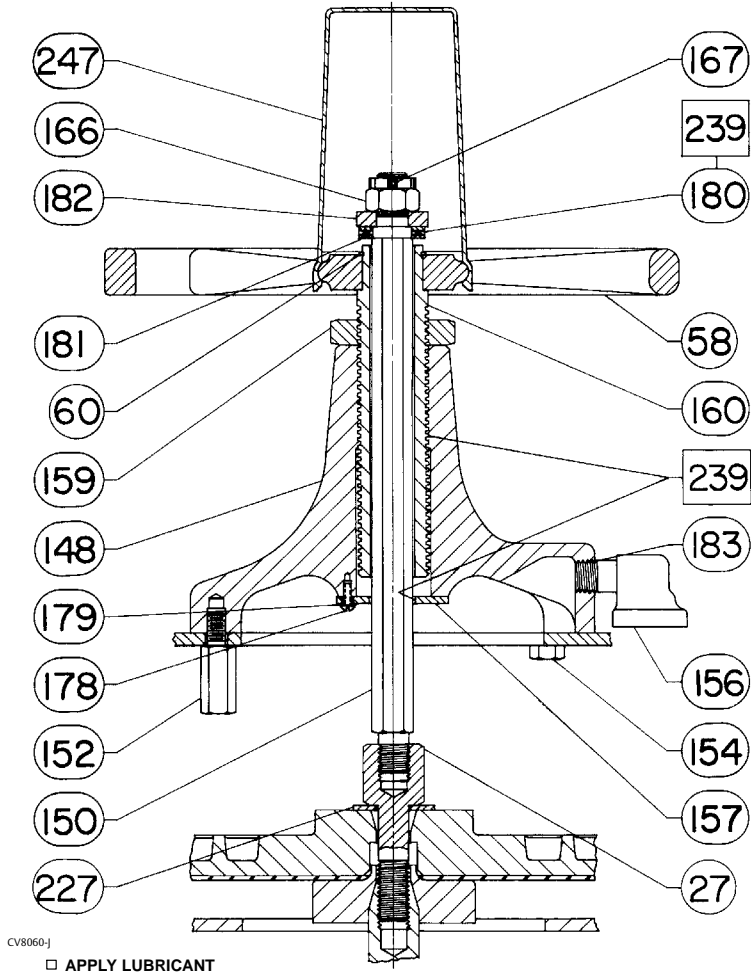
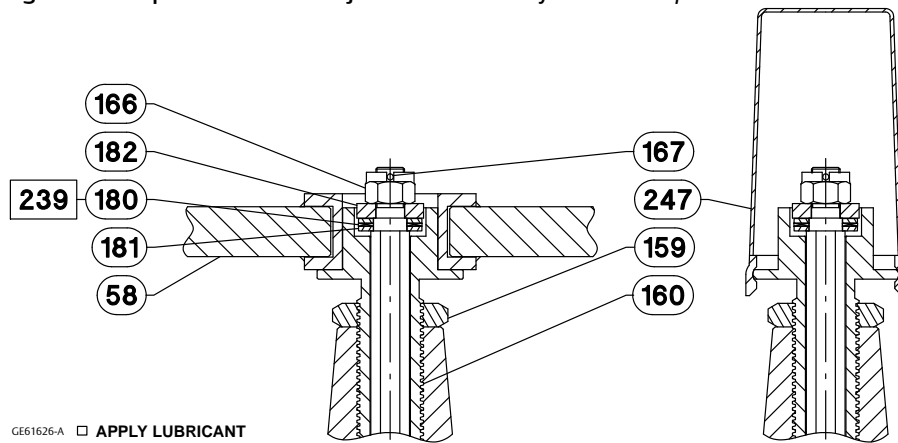


Figure 15. Top-Mounted Handjack Bar Assembly for Size 70/70i and 87 Actuators



NOTE:
THE TOP MOUNTED HANDJACK BAR SHOULD BE REMOVED WHEN NOT IN USE AND THE HANDWHEEL CAP INSTALLED FOR WEATHER PROTECTION OF INTERNAL COMPONENTS.

Figure 16. Side Mounted Handwheel Assembly for Size 34 and 40 Actuators

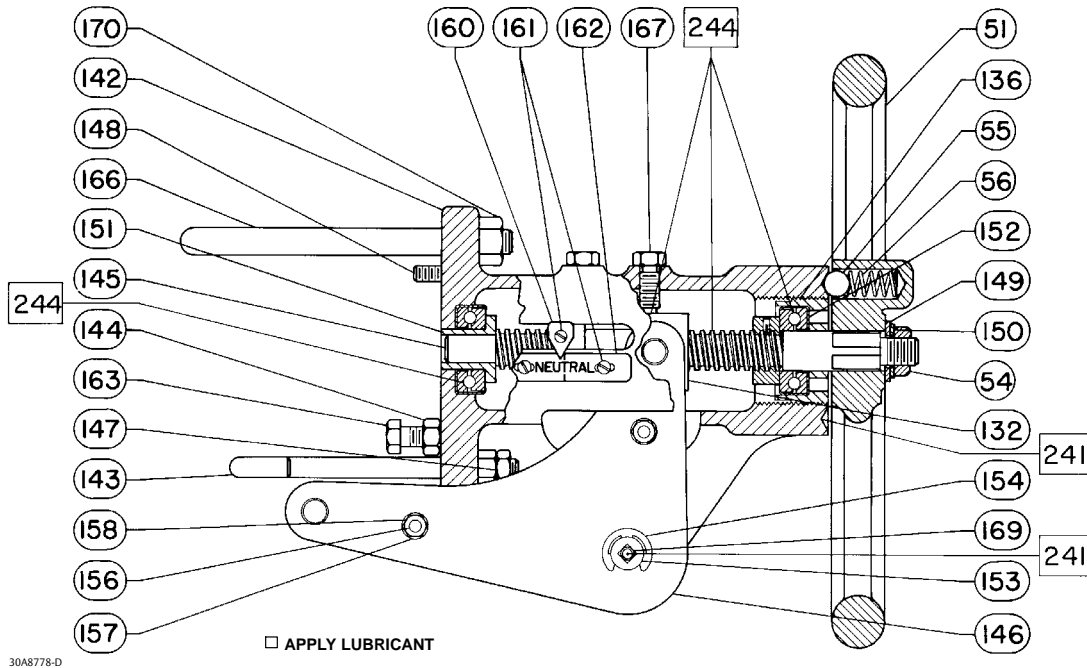


Figure 17. Side Mounted Handwheel Assembly for Size 34i and 40i Actuators

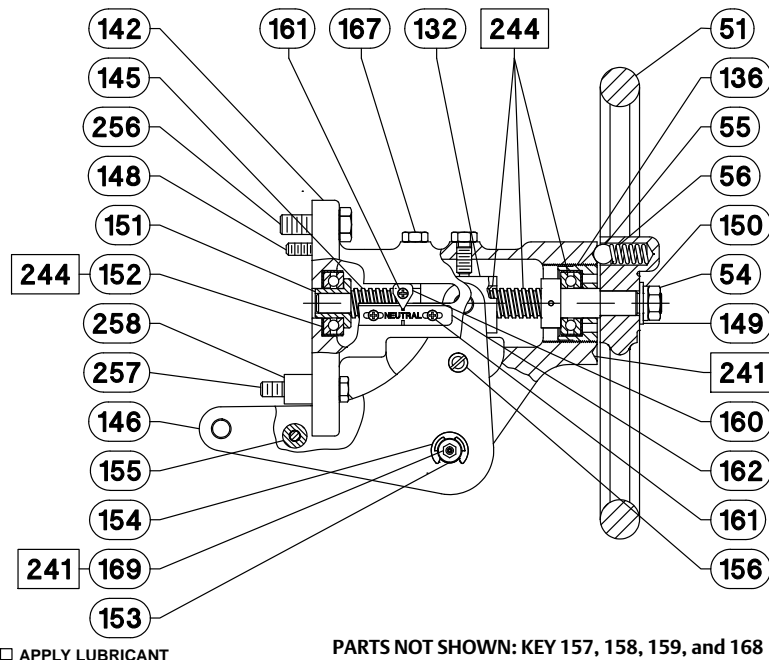


Figure 18. Side-Mounted Handwheel Assembly for Size 45 through 60 Actuators

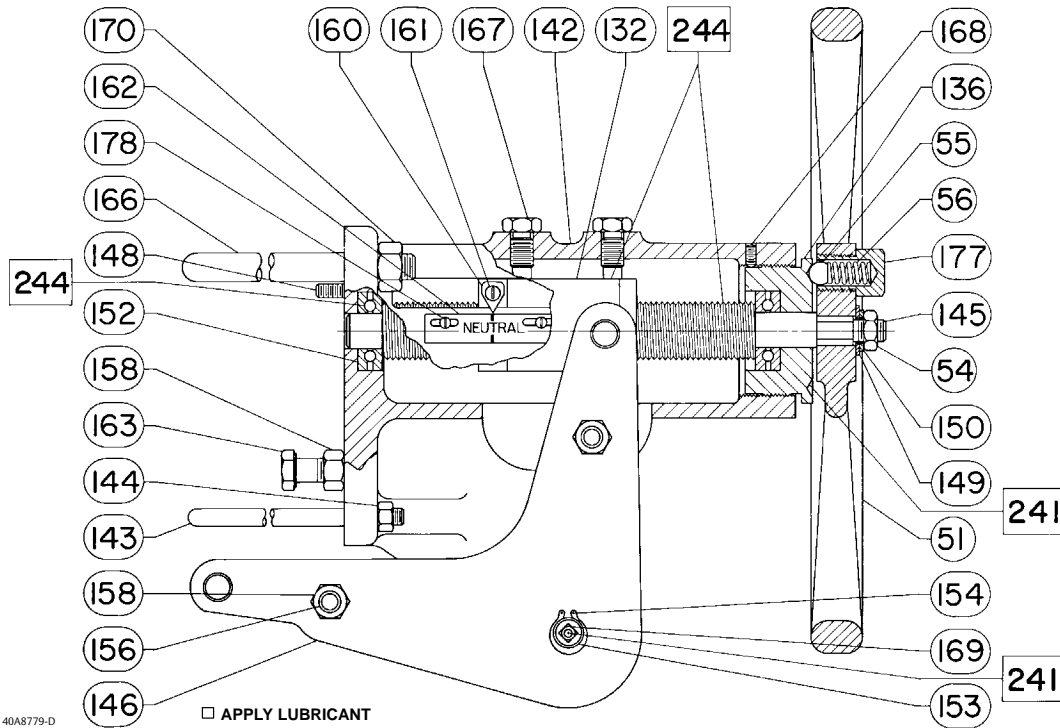
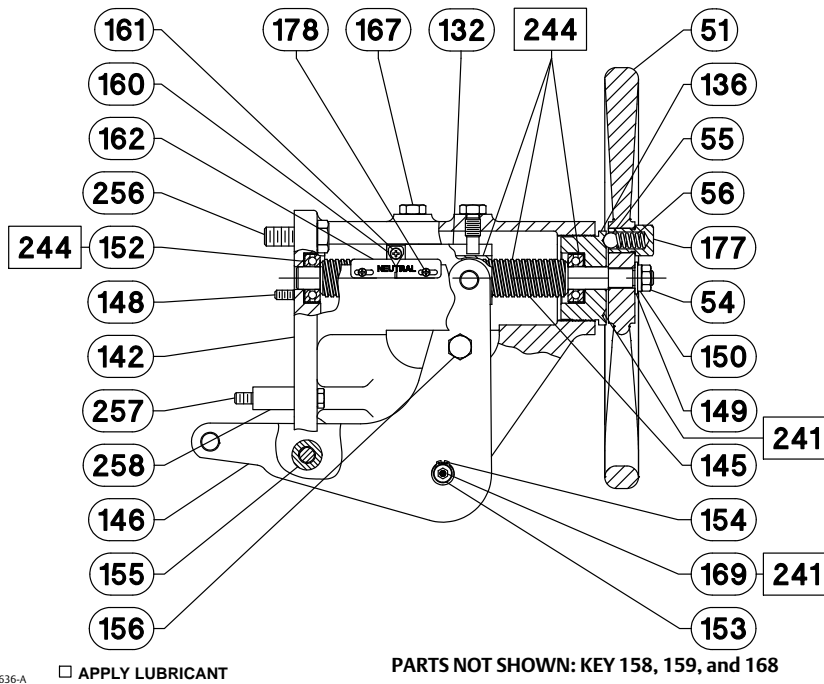


Figure 19. Side Mounted Handwheel Assembly for Size 45i through 60i Actuators



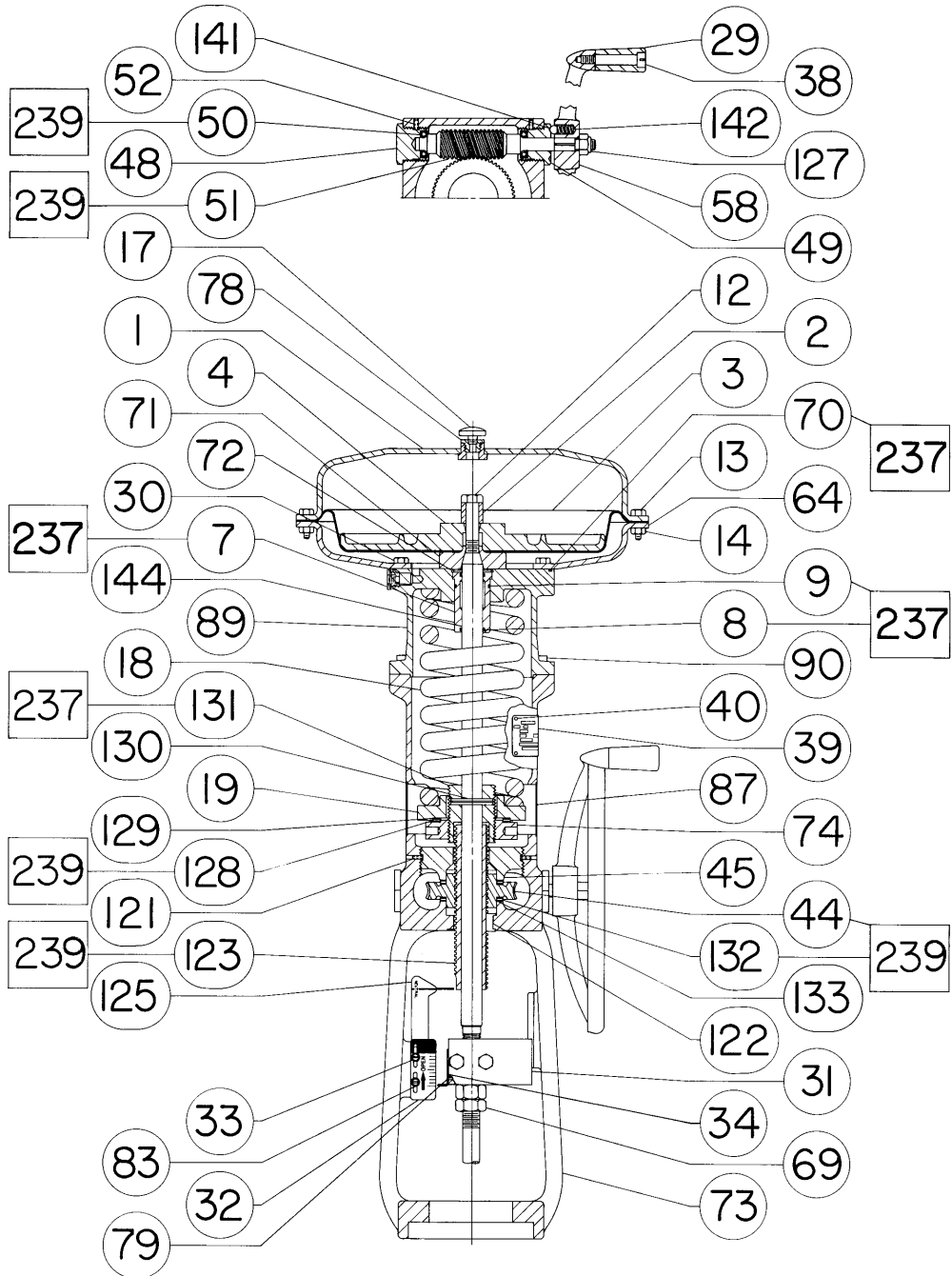
Side-Mounted Handwheel, Size 34-60 and 34i-60i (figures 16 and 18)

Key	Description
51	Handwheel
54	Hex Jam Nut
55	Ball
56	Spring
132	Operating Nut
136	Bearing Retainer
142	Handwheel Body
143	Mounting Bolts
144	Hex Nut
145	Handwheel Screw
146	Lever & Pin Assembly
147	Hex Jam Nut
148	Dowel Pin
149	Washer
150	Lockwasher
151	Bushing
152	Ball Bearing
153	Lever Pivot Pin
154	Retaining Ring
155	Spacer
156	Screw
157	Lockwasher
158	Hex Nut
159	Pointer Mounting Bolt
160	Pointer
161	Machine Screw
162	Indicator Plate (Aluminum)
163	Cap Screw
166	U-Bolt
167	Guide Bolt
168	Set Screw
169	Grease Fitting
170	Hex Nut
177	Spring Cap
178	Machine Screw
241	Lubricant, lithium grease Not furnished with handwheel
244	Lubricant, anti-seize Not furnished with handwheel
256	Cap Screw
257	Cap Screw
258	Spacer

Side-Mounted Handwheel, Size 70, 76 and 87 (figure 20)

Key	Description
29	Handgrip
38	Handgrip Bolt
44	Worm Gear
45	Bearing Retainer Flange
48	Back Worm Retainer
49	Front Worm Retainer
50	Ball Bearing
51	Worm Shaft
52	Set Screw
57	Grease Fitting
58	Handwheel
87	Cover Band Ass'y
89	Spring Case Adaptor
90	Cap Screw
121	Set Screw
122	Key
123	Lower Sleeve
125	Handwheel Indicator
127	Handwheel Cap
128	Needle Bearing
129	Needle Bearing Race
130	Roll Pin
131	Spring Adjusting Screw
132	Needle Bearing
133	Needle Bearing Race
141	Ball
142	Spring
237	Lubricant, lithium grease Not Furnished with Handwheel
239	Lubricant, anti-seize Not Furnished with Handwheel
245	Yoke Extension

Figure 20. Size 70, 76, and 87 Actuator with Side Mounted Handwheel Assembly

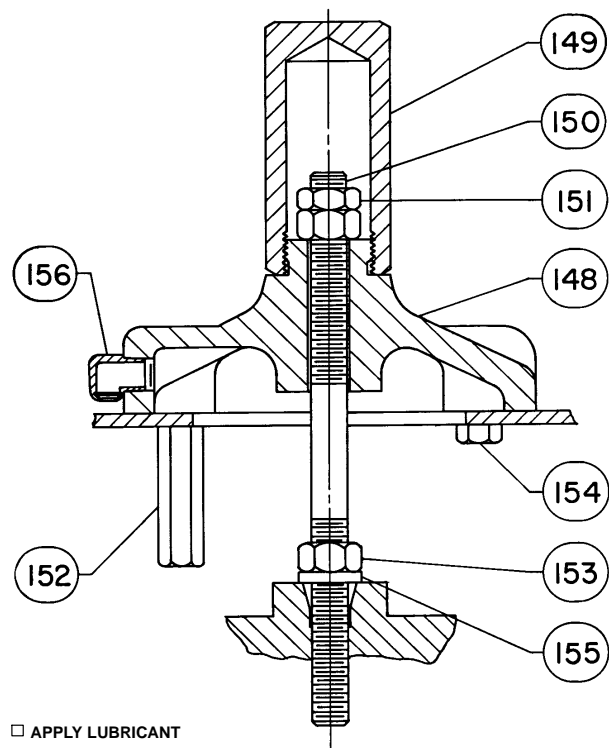


PART NOT SHOWN: 57
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Casing-Mounted Travel Stops (figures 21 through 25)

Key	Description
58	Handwheel
102	Plug, Pipe
127	Hex Nut
148	Travel Stop Body
149	Travel Stop Cap
150	Extension Rod
150	Travel Stop Stem
151	Hex Jam Nut
152	Up Travel Stop
153	Nut, Hex

Figure 21. Style 10 Down Travel Stop - For All Sizes
(Casing Mounted)



Key	Description
154	Screw, Cap, Hex Hd
155	Washer
156	Vent
157	Guide Plate
158	Mounting Plate
159	Nut, Travel Stop
160	Screw, Handwheel
161	Screw, Cap, Hex Hd
162	Washer
177	Travel Stop Screw
184	Nipple, Pipe, NPT
237	Lubricant, lithium grease
239	Lubricant, anti-seize
247	Travel Stop Cap
248	Mounting Plate

Figure 22. Style 11 Up Or Down Travel Stop - For
Sizes 30/30i to 60/60i and 76/76i (Casing Mounted)

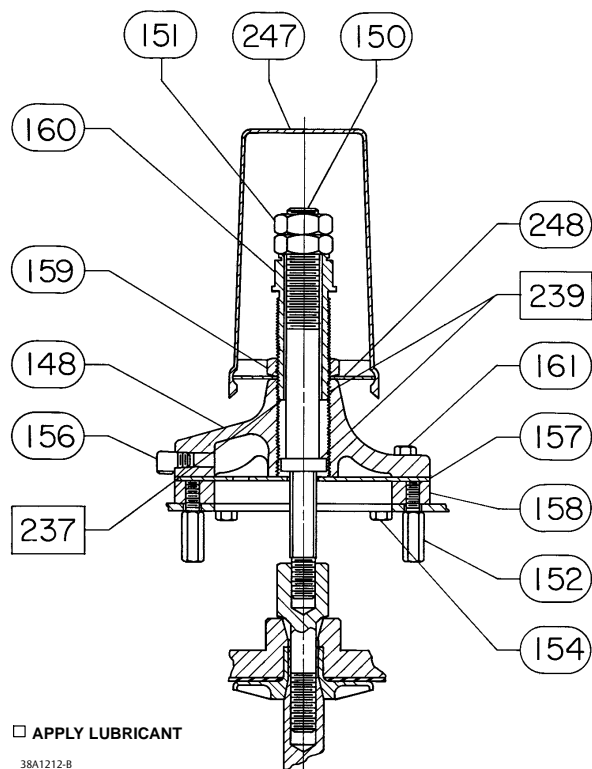


Figure 23. Style 12 Up Travel Stop (Casing Mounted)

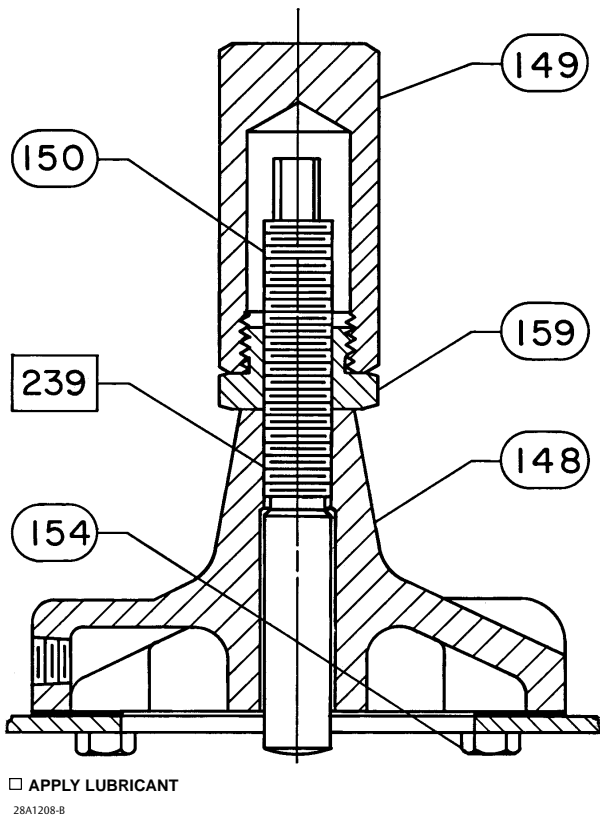


Figure 24. Style 13 Up Travel Stop - For Sizes 30/30i to 60/60i and 76/76i, Size 30/30i Shown (Casing Mounted)

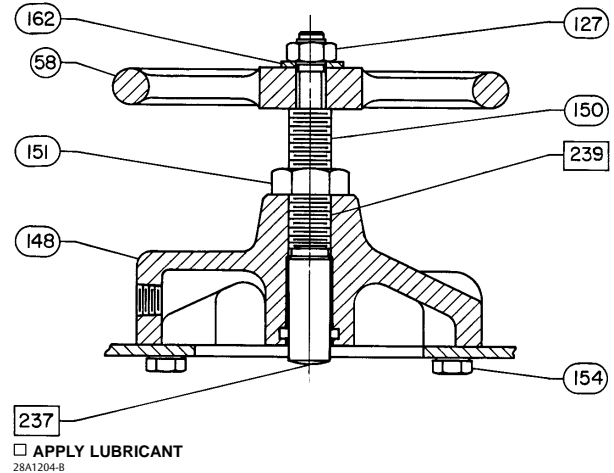
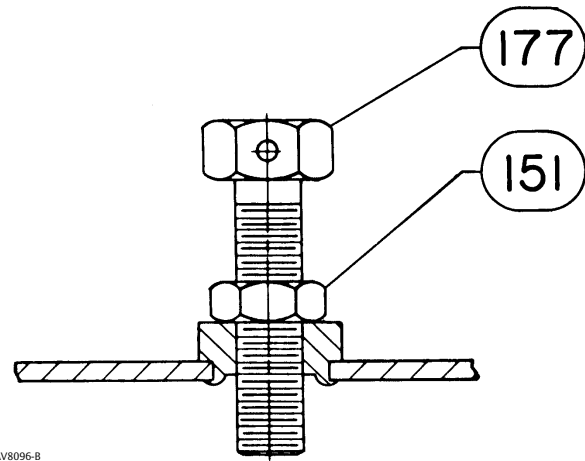


Figure 25. Style 14 Up Travel Stop (Casing Mounted)



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Fisher® ET and EAT easy-e™ Valves CL125 through CL600

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Figure 1. Fisher ET Control Valve with 667 Actuator



Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for NPS 1 through 8 Fisher ET valves, and NPS 1 through 6 EAT valves, through CL600 ratings. Refer to separate manuals for instructions covering the actuator and accessories.

Do not install, operate, or maintain ET valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your Emerson Process Management sales office before proceeding.



Table 1. Specifications

<p>End Connection Styles</p> <p>Cast Iron Valves <i>Flanged:</i> CL125 flat-face or 250 raised-face flanges per ASME B16.1</p> <p>Steel and Stainless Steel Valves <i>Flanged:</i> CL150, 300, and 600 raised-face or ring-type joint flanges per ASME B16.5 <i>Screwed or Socket Welding:</i> All available ASME B16.11 schedules that are consistent with CL600 per ASME B16.34 <i>Buttwelding:</i> Consistent with ASME B16.25</p> <p>Maximum Inlet Pressure⁽¹⁾</p> <p>Cast Iron Valves <i>Flanged:</i> Consistent with CL125B or 250B pressure-temperature ratings per ASME B16.1</p> <p>Steel and Stainless Steel Valves <i>Flanged:</i> Consistent with CL150, 300, and 600⁽²⁾ pressure-temperature ratings per ASME B16.34 <i>Screwed or Welding:</i> Consistent with CL600 pressure-temperature ratings per ASME B16.34</p> <p>Shutoff Classifications See table 2</p>	<p>Flow Characteristics</p> <p>Linear (all cages), quick-opening (all except Whisper Trim™, WhisperFlo™, and Cavitrol™ cages), or equal percentage (all except Whisper Trim, WhisperFlo, and Cavitrol cages)</p> <p>Flow Directions</p> <p>Linear, Quick Opening, or Equal Percentage Cage: Normally down Whisper Trim and WhisperFlo Cages: Always up Cavitrol Cage: Always down</p> <p>Approximate Weights</p> <table border="1"> <thead> <tr> <th rowspan="2">VALVE SIZE, NPS</th> <th colspan="2">WEIGHT</th> </tr> <tr> <th>kg</th> <th>Pounds</th> </tr> </thead> <tbody> <tr> <td>1 and 1-1/4</td> <td>14</td> <td>30</td> </tr> <tr> <td>1-1/2</td> <td>20</td> <td>45</td> </tr> <tr> <td>2</td> <td>39</td> <td>67</td> </tr> <tr> <td>2-1/2</td> <td>45</td> <td>100</td> </tr> <tr> <td>3</td> <td>54</td> <td>125</td> </tr> <tr> <td>4</td> <td>77</td> <td>170</td> </tr> <tr> <td>6</td> <td>159</td> <td>350</td> </tr> <tr> <td>8</td> <td>408</td> <td>900</td> </tr> </tbody> </table>	VALVE SIZE, NPS	WEIGHT		kg	Pounds	1 and 1-1/4	14	30	1-1/2	20	45	2	39	67	2-1/2	45	100	3	54	125	4	77	170	6	159	350	8	408	900
VALVE SIZE, NPS	WEIGHT																													
	kg	Pounds																												
1 and 1-1/4	14	30																												
1-1/2	20	45																												
2	39	67																												
2-1/2	45	100																												
3	54	125																												
4	77	170																												
6	159	350																												
8	408	900																												

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.
2. Certain bonnet bolting material selections may require a CL600 easy-e valve assembly to be derated. Contact your Emerson Process Management sales office.

Table 2. Available Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4

Valve	Seating	Shutoff Class
All except those with Cavitrol III cages	PTFE (standard)	V - air test
		V - water test (optional)
	Metal	IV
ET with Cavitrol III one-stage cage	Metal	V (optional) ⁽²⁾
ET with Cavitrol III two-stage cages	Metal	IV (standard)
ET w/ PEEK Anti-Extrusion Rings	Metal	V (optional)
ET w/ 3.4375 to 7-inch port	Soft or Metal	V
ET and EAT w/ TSO (Tight Shutoff Trim)	Replaceable, protected soft seat	V to 316°C (600°F)
		VI
		TSO ⁽¹⁾

1. This is a special non-ANSI/FCI leakage class.
2. Class V shutoff requires spring-loaded seal ring, radiused-seat plug, and wide-bevel seat ring (not available with 8-inch port, quick-opening cage). Not available with trims 4, 29, and 85.

Description

These single-port valves have cage guiding, quick-change trim, and balanced push-down-to-close valve plug action. Valve configurations are as follows:

ET--Globe-style valve (figure 1) with metal-to-PTFE seating (standard for all except Cavitrol III cages) for stringent shutoff requirements, or metal-to-metal seating (standard for Cavitrol III cages, optional for all others) for higher temperatures.

EAT--Angle version of ET, used to facilitate piping or in applications which require a self-draining valve.

Specifications

Typical specifications for these valves are shown in table 1.

Educational Services

For information on available courses for Fisher ET and ETA valves, as well as a variety of other products, contact:

Emerson Process Management
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
<http://www.emersonprocess.com/education>

Installation

▲ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some valve body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your Emerson Process Management sales office.

Before installing the valve, inspect the valve and pipelines for any damage and any foreign material which may cause product damage.

1. Before installing the valve, inspect the valve and associated equipment for any damage and any foreign material.
2. Make certain the valve body interior is clean, that pipelines are free of foreign material, and that the valve is oriented so that pipeline flow is in the same direction as the arrow on the side of the valve.

3. The control valve assembly may be installed in any orientation unless limited by seismic criteria. However, the normal method is with the actuator vertical above the valve. Other positions may result in uneven valve plug and cage wear, and improper operation. With some valves, the actuator may also need to be supported when it is not vertical. For more information, consult your Emerson Process Management sales office.
4. Use accepted piping and welding practices when installing the valve in the line. For flanged valves, use a suitable gasket between the valve and pipeline flanges.

CAUTION

Depending on valve body materials used, post weld heat treating may be required. If so, damage to internal elastomeric and plastic parts, as well as internal metal parts is possible. Shrink-fit pieces and threaded connections may also loosen. In general, if post weld heat treating is to be performed, all trim parts should be removed. Contact your Emerson Process Management sales office for additional information.

5. With a leak-off bonnet construction, remove the pipe plugs (keys 14 and 16, figure 14) to hook up the leak-off piping. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the control valve assembly.
6. If the actuator and valve are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Valves with ENVIRO-SEAL live-loaded packing or HIGH-SEAL live-loaded packing will not require this initial readjustment. See the Fisher instruction manuals, ENVIRO-SEAL Packing System for Sliding-Stem Valves or HIGH-SEAL Live-Loaded Packing System (as appropriate), for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the Parts Kits section.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing lubrication, packing maintenance, trim maintenance, and ENVIRO-SEAL bellows seal bonnet replacement. All maintenance operations may be performed with the valve in the line.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.

- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
 - Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.
 - Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
 - The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
 - Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
-

CAUTION

Follow instructions carefully to avoid damaging the product surfaces, which could result in damage to the product.

Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This ensures a good gasket seal because the used gasket may not seal properly.

Packing Lubrication

Note

ENVIRO-SEAL and HIGH-SEAL packing do not require lubrication.

⚠ WARNING

To avoid personal injury or property damage resulting from fire or explosion, do not lubricate packing used in oxygen service or in processes with temperatures over 260°C (500°F).

If a lubricator or lubricator/isolating valve (figure 2) is provided for PTFE/composition or other packings that require lubrication, it will be installed in place of the pipe plug (key 14, figure 14). Use a good quality silicon-base lubricant. Do not lubricate packing used in oxygen service or in processes with temperatures over 260°C (500°F). To operate the lubricator, simply turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve operates the same way except open the isolating valve before turning the cap screw and then close the isolating valve after lubrication is completed.

Packing Maintenance

Note

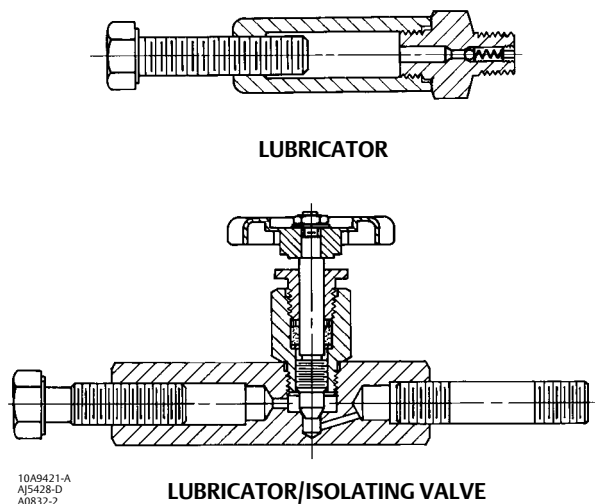
For valves with ENVIRO-SEAL packing, see the Fisher instruction manual, ENVIRO-SEAL Packing System for Sliding-Stem Valves, D101642X012, for packing instructions.

For valves with HIGH-SEAL packing, see the Fisher instruction manual, HIGH-SEAL Live-Loaded Packing System, D101453X012, for packing instructions.

Key numbers refer to figure 3 for PTFE V-ring packing and to figure 4 for PTFE/composition packing, unless otherwise indicated.

For spring-loaded single PTFE V-ring packing, the spring (key 8) maintains a sealing force on the packing. If leakage is noted around the packing follower (key 13), check to be sure the shoulder on the packing follower is touching the bonnet. If the shoulder is not touching the bonnet, tighten the packing flange nuts (key 5, figure 14) until the shoulder is against the bonnet. If leakage cannot be stopped in this manner, proceed to the Replacing Packing procedure.

Figure 2. Lubricator and Lubricator/Isolating Valve (Optional)



If there is undesirable packing leakage with other than spring-loaded packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts.

If the packing is relatively new and tight on the stem, and if tightening the packing flange nuts does not stop the leakage, the valve stem may be worn or nicked so that a seal cannot be made. The surface finish of a new valve stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, the leakage may be caused by nicks or scratches around the packing box wall. If performing any of the following procedures, inspect the valve stem and packing box wall for nicks and scratches.

Replacing Packing

▲ WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, and release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Disconnect the operating lines from the actuator and any leak-off piping from the bonnet. Disconnect the stem connector, then remove the actuator from the valve by unscrewing the yoke locknut (key 15, figure 14) or the hex nuts (key 26, figure 14).

- Loosen the packing flange nuts (key 5, figure 14) so that the packing is not tight on the valve stem. Remove any travel indicator parts and stem locknuts from the valve stem threads.

⚠ WARNING

To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet.

Figure 3. PTFE V-Ring Packing Arrangements for Plain and Extension Bonnets

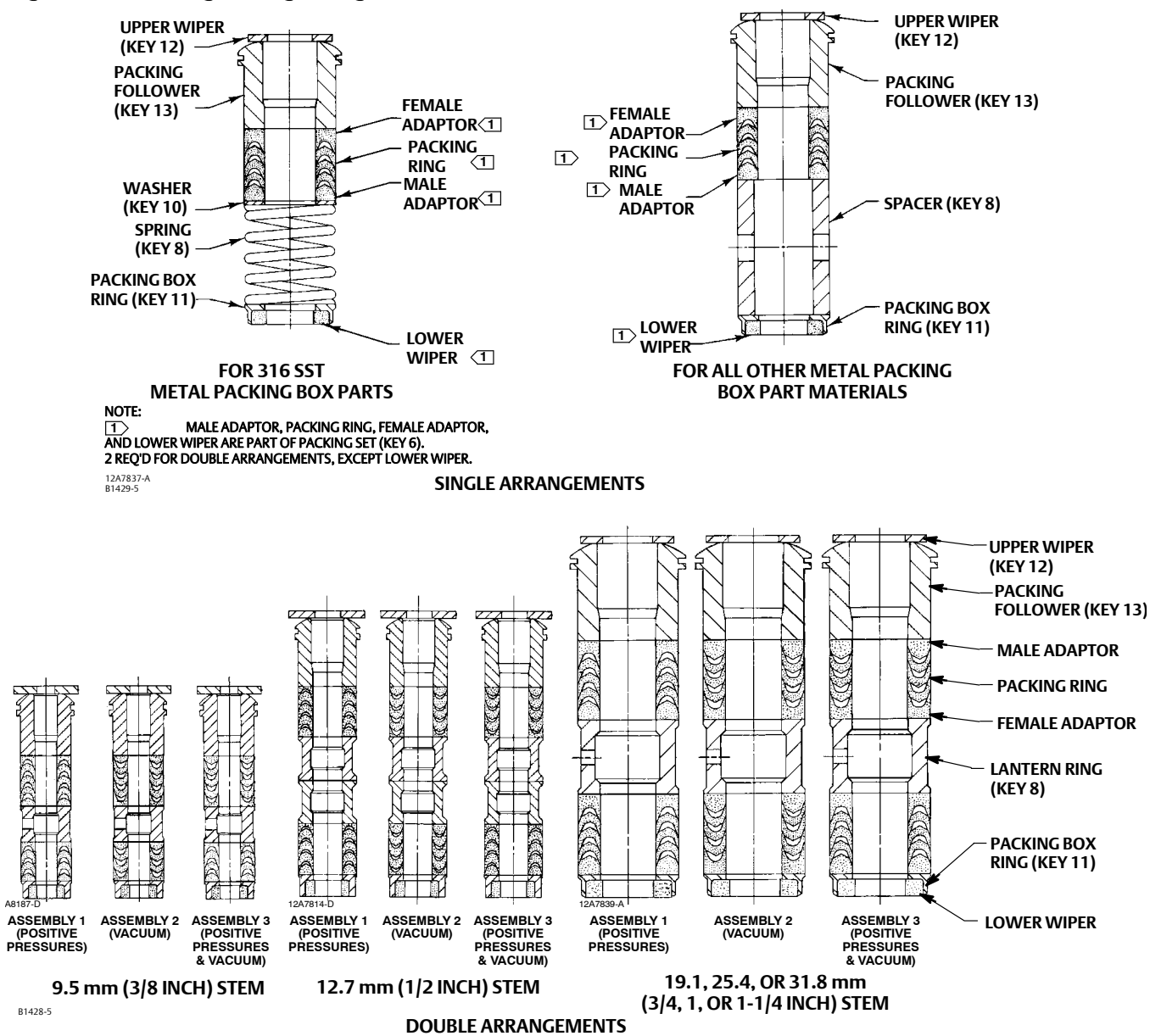


Figure 4. Detail of PTFE/Composition Packing Arrangements for Plain and Extension Bonnets

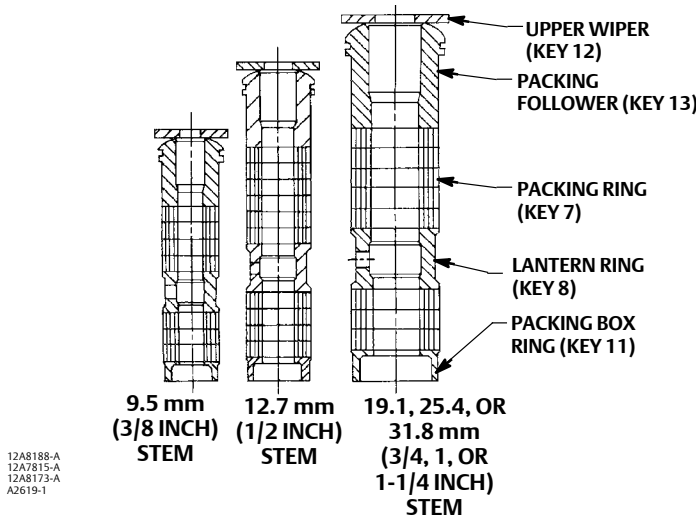


Table 3. Body-to-Bonnet Bolt Torque Guidelines

VALVE SIZE, NPS		BOLT TORQUES ⁽¹⁾			
ET	EAT	SA193-B7, SA193-B8M ^(3, 4)		SA193-B8M ^(2, 4)	
		N•m	Lbf•ft	N•m	Lbf•ft
1-1/4 or less	1	129	95	64	47
1-1/2, 1-1/2 x 1, 2, or 2 x 1	2 or 2 x 1	96	71	45	33
2-1/2 or 2-1/2 x 1-1/2	3 or 3 x 1-1/2	129	95	64	47
3, 3 x 2, or 3 x 2-1/2	4 or 4 x 2	169	125	88	65
4, 4 x 2-1/2, or 4 x 3	6 or 6 x 2-1/2	271	200	156	115
6	---	549	405	366	270
8	---	746	550	529	390

1. Determined from laboratory tests.
2. SA193-B8M annealed.
3. SA193-B8M strain hardened.
4. For other materials, contact your Emerson Process Management sales office.

Note

The following step also helps to provide additional assurance that the valve body fluid pressure has been relieved.

CAUTION

Avoid damaging the seating surface caused by the valve plug and stem assembly dropping from the bonnet (key 1, figure 14) after being lifted part way out. When lifting the bonnet, temporarily install a valve stem locknut on the valve stem. The locknut will prevent the valve plug and stem assembly from dropping out of the bonnet.

- Hex nuts (key 16, figure 16, 17, or 20) or cap screws (not shown) attach the bonnet (key 1, figure 14) to the valve body (key 1, figure 16, 17, or 20). Loosen these nuts or cap screws approximately 3 mm (1/8 inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve. Work the

prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, remove the nuts or cap screws completely and carefully lift the bonnet off the valve.

Table 4. Recommended Torque for Packing Flange Nuts

VALVE STEM DIAMETER		PRESSURE RATING	GRAPHITE TYPE PACKING				PTFE TYPE PACKING			
			Minimum Torque		Maximum Torque		Minimum Torque		Maximum Torque	
			N•m	Lbf•in	N•m	Lbf•in	N•m	Lbf•in	N•m	Lbf•in
9.5	3/8	CL125, 150	3	27	5	40	1	13	2	19
		CL250, 300	4	36	6	53	2	17	3	26
		CL600	6	49	8	73	3	23	4	35
12.7	1/2	CL125, 150	5	44	8	66	2	21	4	31
		CL250, 300	7	59	10	88	3	28	5	42
		CL600	9	81	14	122	4	39	7	58
19.1	3/4	CL125, 150	11	99	17	149	5	47	8	70
		CL250, 300	15	133	23	199	7	64	11	95
		CL600	21	182	31	274	10	87	15	131
25.4	1	CL300	26	226	38	339	12	108	18	162
		CL600	35	310	53	466	17	149	25	223
31.8	1-1/4	CL300	36	318	54	477	17	152	26	228
		CL600	49	437	74	655	24	209	36	314

- Remove the locknut and separate the valve plug and stem from the bonnet. Set the parts on a protective surface to prevent damage to gasket or seating surfaces.

CAUTION

To prevent possible product damage, cover the opening in the valve in the following procedure to prevent foreign material from getting into the valve body cavity.

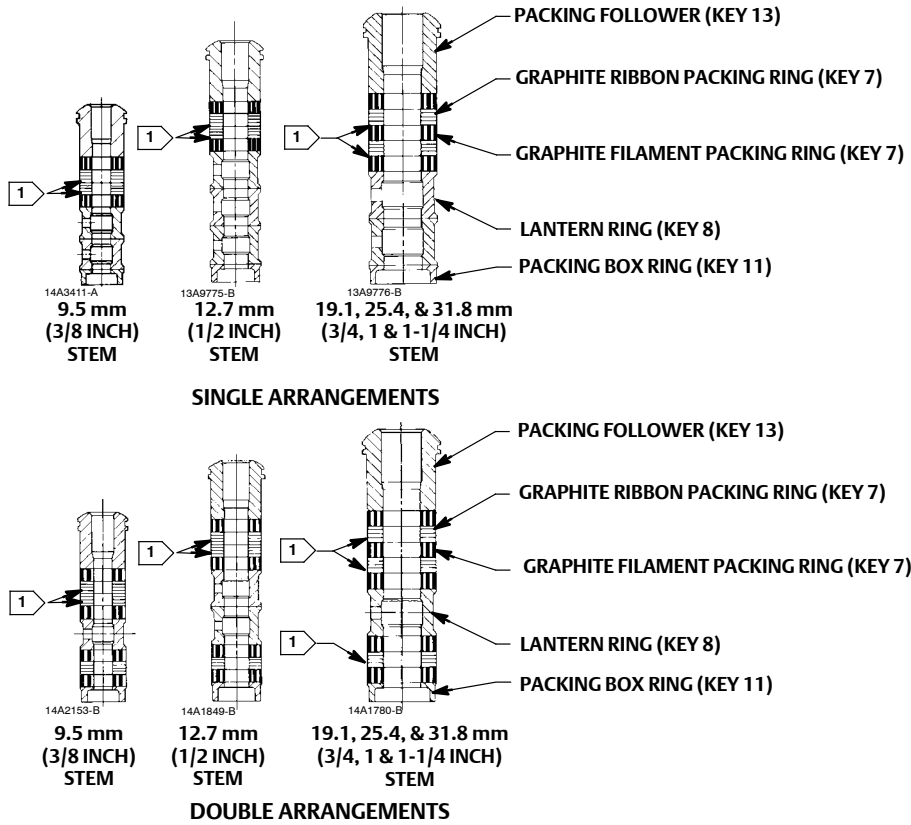
- Remove the bonnet gasket (key 10, figure 16, 17, or 20) and cover the opening in the valve to protect the gasket surface and prevent foreign material from getting into the valve body cavity.
- Remove the packing flange nuts, packing flange, upper wiper, and packing follower (keys 5, 3, 12, and 13, figure 14). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and the metal packing parts.
- Inspect the valve stem threads and packing box surfaces for any sharp edges which might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts by following the appropriate steps in the Trim Maintenance procedure.
- Remove the covering protecting the valve body cavity and install a new bonnet gasket (key 10, figure 16, 17, or 20), making sure the gasket seating surfaces are clean and smooth. Then slide the bonnet over the stem and onto the stud bolts (key 15, figure 16, 17, or 20) or onto the valve body cavity if cap screws (not shown) will be used instead.

Note

Proper performance of the bolting procedures in step 10 compresses the spiral wound gasket (key 12, figure 16 or 17) or load ring (key 26, figure 20) enough to both load and seal the seat ring gasket (key 13, figure 16, 17 or 20). It also compresses the outer edge of the bonnet gasket (key 10, figure 16 through 20) enough to seal the body-to-bonnet joint.

The proper bolting procedures in step 10 include--but are not limited to--ensuring that bolting threads are clean, and evenly tightening the cap screws, or the nuts onto the studs, in a crisscross pattern. Tightening one cap screw or nut may loosen an adjacent cap screw or nut. Repeat the crisscross tightening pattern several times until each cap screw or nut is tight and the body-to-bonnet seal is made. When the operating temperature has been reached, perform this torquing procedure once again.

Figure 5. Detail of Graphite Ribbon/Filament Packing for Plain and Extension Bonnets



AS864 NOTE: 0.102 mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS; USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson Process Management representative immediately if a discrepancy between actual parts and approved parts is suspected.

10. Lubricate the bolting (not necessary if factory pre-lubricated stud bolt nuts are used) and install it, using accepted bolting procedures during tightening, so that the body-to-bonnet joint will withstand test pressures and application service conditions. Use the bolt torques in table 3 as guidelines.
11. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 3, 4, or 5. Place a smooth-edged pipe over the valve stem and gently tap each soft packing part into the packing box.

12. Slide the packing follower, upper wiper, and packing flange (keys 13, 12, and 3, figure 14) into position. Lubricate the packing flange studs (key 4, figure 14) and the faces of the packing flange nuts (key 5, figure 14). Install the packing flange nuts.

13. For **spring-loaded PTFE V-ring packing**, tighten the packing flange nuts until the shoulder on the packing follower (key 13, figure 14) contacts the bonnet.

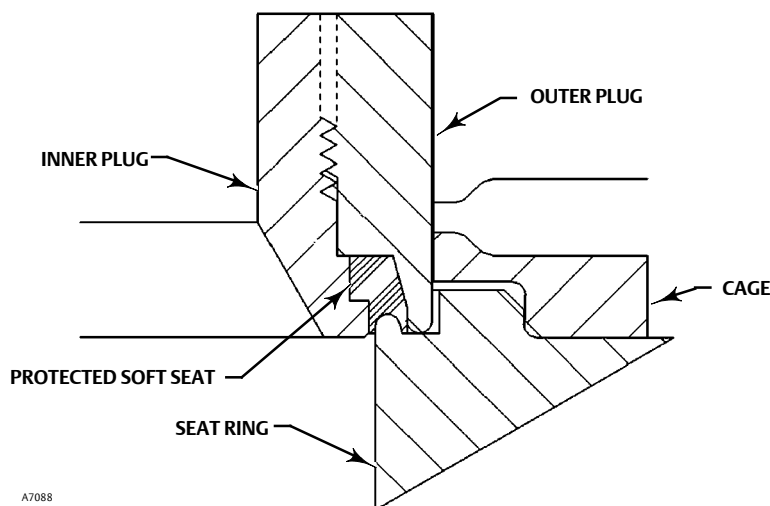
For **graphite packing**, tighten the packing flange nuts to the maximum recommended torque shown in table 4. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 4.

For **other packing types**, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 4. Then, tighten the remaining flange nut until the packing flange is level and at a 90-degree angle to the valve stem.

For **ENVIRO-SEAL or HIGH-SEAL live-loaded packing**, refer to the note at the beginning of Packing Maintenance.

14. Mount the actuator on the valve assembly and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual.

Figure 6. TSO (Tight Shutoff Trim), Detail of Protected Soft Seat



Trim Maintenance

⚠ WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

Except where indicated, key numbers in this section are referenced in figure 16 for standard NPS 1 through 6 constructions, figure 17 for Whisper Trim III detail, figures 18 and 19 for WhisperFlo trim, and figure 20 for Cavitrol III detail and the NPS 8 ET valve.

Disassembly

1. Remove the actuator and the bonnet according to steps 1 through 6 of the Replacing Packing procedure in the Maintenance section.

⚠ WARNING

To avoid personal injury due to leaking fluid, avoid damaging gasket sealing surfaces. The surface finish of the valve stem (key 7) is critical for making a good packing seal. The inside surface of the cage or cage/baffle assembly (key 3), or cage retainer (key 31), is critical for smooth operation of the valve plug. The seating surfaces of the valve plug (key 2) and seat ring (key 9) are critical for proper shutoff. Unless inspection reveals otherwise, assume all these parts are in good condition and protect them accordingly.

2. Remove the packing flange nuts, packing flange, upper wiper, and packing follower (keys 5, 3, 12, and 13 in figure 14). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and the metal packing parts.
3. Inspect the valve stem threads and packing box surfaces for any sharp edges which might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts.
4. Remove the load ring (key 26) from an NPS 8 ET valve, or the cage adaptor (key 4) from any restricted-trim valve through NPS 4, and wrap it for protection.
5. On an NPS 6 ET valve with Whisper Trim III or WhisperFlo cage, also remove the bonnet spacer (key 32) and bonnet gasket (key 10) on top of the spacer. Then on any construction with a cage retainer (key 31), remove the cage retainer and its associated gaskets. A Whisper Trim III and WhisperFlo cage retainer has two 3/8-inch-16 UNC tappings in which screws or bolts can be installed for lifting.
6. Remove the cage or cage/baffle assembly (key 3), the associated gaskets (keys 10, 11, and 12), and shim (key 51). If the cage is stuck in the valve, use a rubber mallet to strike the exposed portion of the cage at several points around its circumference.
7. **For constructions other than TSO (tight shutoff) trim**, remove the seat ring or liner (key 9) or disk seat (key 22), seat ring gasket (key 13), and the seat ring adaptor (key 5) and adaptor gasket (key 14) where used in a restricted-trim seat ring construction. PTFE-seat constructions use a disk (key 23) sandwiched between the disk seat and disk retainer (key 21).
8. **For TSO (tight shutoff) trim constructions**, perform the following steps (refer to figures 6 and 7):
 - Remove the retainer, backup ring, anti-extrusion rings, and piston ring.
 - Remove the set screws that lock the outer plug to the inner plug.
 - Using a strap wrench or similar tool, unscrew the outer plug from the inner plug. Do not damage the outer plug guide surfaces.
 - Remove the protected soft seat seal.
 - Inspect the parts for damage and replace if needed.
9. **For all constructions**, inspect parts for wear or damage which would prevent proper operation of the valve. Replace or repair trim parts according to the following procedure for Lapping Metal Seats or other valve plug maintenance procedures as appropriate.

Lapping Metal Seats

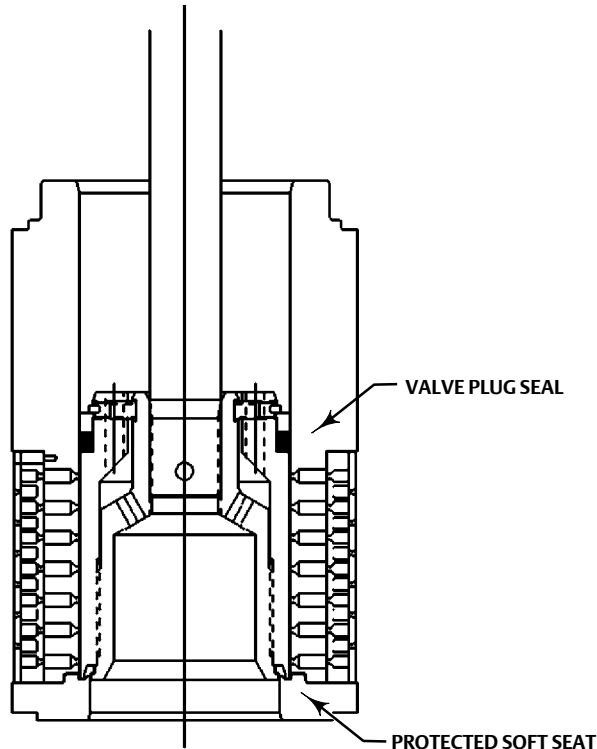
CAUTION

To avoid damaging the ENVIRO-SEAL Bellows Seal Bonnet assembly, do not attempt to lap the metal seating surfaces. The design of the assembly prevents rotation of the stem and any forced lapping rotation will damage internal components of the ENVIRO-SEAL Bellows Seal bonnet.

Except with respect to the ENVIRO-SEAL Bellows Seal Bonnet assembly, with metal-seat constructions, lapping seating surfaces of the valve plug and seat ring or liner (keys 2 and 9, figure 16, 17, or 20) can improve shutoff. (Deep nicks should be machined out rather than ground out.) Use a good quality lapping compound of a mixture of 280 to 600-grit. Apply the compound to the bottom of the valve plug.

Assemble the valve to the extent that the cage and the cage retainer and bonnet spacer (if used) are in place and the bonnet is bolted to the valve body. A simple handle can be made from a piece of strap iron locked to the valve plug stem with nuts. Rotate the handle alternately in each direction to lap the seats. After lapping, remove the bonnet and clean the seat surfaces. Completely assemble as described in the Assembly portion of the Trim Maintenance procedure and test the valve for shutoff. Repeat the lapping procedure if leakage is still excessive.

Figure 7. Typical Balanced TSO Trim



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Valve Plug Maintenance

Except where indicated, key numbers in this section are referenced in figure 16 for standard NPS 1 through 6 constructions, figure 17 for Whisper Trim III, figures 18 and 19 for WhisperFlo trim, and figure 20 for Cavitrol III detail and the NPS 8 ET valve.

CAUTION

To avoid the valve plug seal ring (key 28) not sealing properly, be careful not to scratch the surfaces of the ring groove in the valve plug or any of the surfaces of the replacement ring.

1. With the valve plug (key 2) removed according to the Disassembly portion of the Trim Maintenance procedure, proceed as appropriate:

For the two-piece seal ring, The ring cannot be reused because it is a closed ring which must be pried and/or cut from the groove. Once the seal ring is removed, the elastomeric backup ring (key 29), which is also a closed ring, can be pried from the groove.

CAUTION

To avoid damaging the seal ring, slowly and gently stretch it for the following procedure. Avoid jerking sharply on the ring.

To install a new two-piece seal ring, apply a general purpose silicone-base lubricant to both the backup ring and seal ring (keys 29 and 28). Place the backup ring over the stem (key 7) and into the groove. Place the seal ring over the top edge of the valve plug (key 2) so that it enters the groove on one side of the valve plug. Slowly and gently stretch the seal ring and work it over the top edge of the valve plug. The PTFE material in the seal ring must be permitted time to cold-flow during the stretching procedure, so avoid jerking sharply on this ring. Stretching the seal ring over the valve plug may make it seem unduly loose when in the groove, but it will contract to its original size after insertion into the cage.

For the spring-loaded seal ring, the ring used on a valve plug having a 136.5 mm (5.375 inch) or less port diameter may be removed undamaged by first working the retaining ring (key 27) off with a screwdriver. Then carefully slide the metal backup ring (key 29) and seal ring (key 28) off the valve plug (key 2). The spring-loaded seal ring used on a valve plug having a 178 mm (7-inch) or greater port diameter must be carefully pried and/or cut from its groove. Therefore, it cannot be reused.

A spring-loaded seal ring must be installed so that its open side faces toward the valve stem, or toward the seat of the plug depending on flow direction, as shown in view A of figure 16 or 20. To install a spring-loaded seal ring on a valve plug with a 136.5 mm (5.375 inch) or less port diameter, slide the seal ring (key 28) onto the valve plug followed by the metal backup ring (key 29). Then install the retaining ring (key 27) by inserting one end in the groove and, while turning the plug, press the ring into the groove. Again, be careful not to scratch any surfaces of the ring or plug.

CAUTION

To avoid damaging the seal ring, slowly and gently stretch it for the following procedure. Avoid jerking sharply on the ring.

To install the seal ring on a valve plug with 178 mm (7-inch) or greater port diameter, lubricate it with a general purpose silicone-base lubricant. Then gently stretch the seal ring and work it over the top edge of the valve plug. The PTFE material in the seal ring must be permitted time to cold-flow during the stretching procedure, so avoid jerking sharply on the ring. Stretching the seal ring over the valve plug may make it seem unduly loose when in the groove, but it will contract to its original size after insertion into the cage.

CAUTION

Never reuse an old stem or adaptor with a new valve plug. Using an old stem or adaptor with a new plug requires drilling a new pin hole in the stem (or adaptor, in case an ENVIRO-SEAL bellows seal bonnet is being used). This drilling weakens the stem or adaptor and may cause failure in service. However, a used valve plug may be reused with a new stem or adaptor, except with Cavitrol III trim.

Note

The valve plug and valve plug stem for 2-stage Cavitrol III trim are a matched set and must be ordered together. If the 2-stage Cavitrol III valve plug or valve plug stem is damaged, replace the entire assembly (key 2, figure 20).

Note

For plain bonnets and style 1 extension bonnets, the valve plug (key 2), valve stem (key 7), and pin (key 8) are available completely assembled. Refer to the Key 2, 7, and 8 Valve Plug and Stem Assembly tables in the Parts List.

2. To replace the valve stem (key 7), drive out the pin (key 8). Unscrew the valve plug from the stem or adaptor.
3. To replace the adaptor (key 24, figure 14) on ENVIRO-SEAL bellows seal bonnets, place the plug stem assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out the pin (key 36, figure 14). Reverse the plug stem assembly in the soft-jaw chuck or vise. Grip the flat areas on the valve stem just below the threads for the actuator/stem connection. Unscrew the valve plug/adaptor assembly (key 24, figure 14) from the valve stem assembly (key 20, figure 14).
4. Screw the new stem or adaptor into the valve plug. Tighten to the torque value given in table 5. Refer to table 5 to select the proper hole size. Drill through the stem or adaptor, using the hole in the valve plug as a guide. Remove any chips or burrs and drive in a new pin to lock the assembly.

Table 5. Valve Stem Connection Assembly Torque and Pin Replacement

VALVE STEM DIAMETER		TORQUE, MINIMUM TO MAXIMUM		HOLE SIZE	
mm	Inches	N•m	Lbf•ft	mm	Inch
9.5	3/8	40-47	25-35	2.41 - 2.46	0.095 - 0.097
12.7	1/2	81-115	60-85	3.20 - 3.25	0.126 - 0.128
19.1	3/4	237-339	175-250	4.80 - 4.88	0.189 - 0.192
25.4	1	420-481	310-355	6.38 - 6.45	0.251 - 0.254
31.8	1-1/4	827-908	610-670	6.38 - 6.45	0.251 - 0.254

5. For ENVIRO-SEAL bellows seal bonnets, grip the flats of the stem extending out of the top of the bellows shroud with a soft-jaw chuck or other type of vise. Screw the valve plug/adaptor assembly onto the valve stem. Tighten as necessary to align the pin hole in the stem with one of the holes in the adaptor. Secure the adaptor to the stem with a new pin.

Assembly

Except where indicated, key numbers are referenced in figure 16 for standard NPS 1 through 6 constructions, figure 17 for Whisper Trim III detail, figures 18 and 19 for WhisperFlo detail, and figure 20 for Cavitrol III detail and the NPS 8 ET valve.

1. With a restricted-trim seat ring construction, install the adaptor gasket (key 14) and seat ring adaptor (key 5).
2. Install the seat ring gasket (key 13), seat ring or liner (key 9), or disk seat (key 22). With a PTFE-seat construction, install the disk and disk retainer (keys 21 and 23).
3. Install the cage or cage/baffle assembly (key 3). Any rotational orientation of the cage or assembly with respect to the valve body is acceptable. A Whisper Trim III cage designated by level A3, B3, or C3 may be installed with either end up. The level D3 cage/baffle assembly or Cavitrol III cage assembly, however, must be installed with the hole pattern end next to the seat ring. If a cage retainer (key 31) is to be used, place it on top of the cage.
4. **For constructions other than TSO (tight shutoff) trim**, slide the valve plug (key 2) and stem assembly, or valve plug and ENVIRO-SEAL bellows seal assembly, into the cage. Make sure the seal ring (key 28) is evenly engaged in the entrance chamfer at the top of the cage (key 3) or cage retainer (key 31) to avoid damaging the ring.
5. **For TSO (tight shutoff) trim constructions**, perform the following steps (refer to figures 6 and 7).
 - Thread the outer plug onto the inner plug until the parts seat metal to metal, using a strap wrench or similar tool that will not damage the outer plug guide surfaces.
 - Mark the top of the inner plug and outer plug with alignment marks in the assembled position.

- Disassemble the outer plug from the inner plug and install the seal over the inner plug, so that the seal rests below the threaded area.
 - Thread the outer plug onto the inner plug and tighten with a strap wrench or similar tool until the alignment marks line up. This will ensure that the plug parts are metal to metal and the seal is compressed properly. Do not damage the outer plug guide surfaces.
 - Install set screws centering the inner plug in the outer plug and torque to 11 N•m (8 lbf•ft).
 - Assemble the piston ring, anti-extrusion rings, backup ring, and retainer.
6. **For all constructions**, place the gaskets (keys 12, 11 or 14 if used, and 10) and the shim (key 51) on top of the cage or cage retainer. If there is a cage adaptor (key 4) or a bonnet spacer (key 32), set it on the cage or cage retainer gaskets and place another flat sheet gasket (key 10) on top of the adaptor or spacer. If there is only a cage retainer, place another flat sheet gasket on the retainer.
 7. With an NPS 8 ET valve, install the load ring (key 26).
 8. Mount the bonnet on the valve body and complete assembly according to steps 10 through 14 of the Replacing Packing procedure. Be sure to observe the note prior to step 10.

ENVIRO-SEAL Bellows Seal Bonnet

Replacing a Plain or Extension Bonnet with an ENVIRO-SEAL Bellows Seal Bonnet (Stem/Bellows Assembly)

1. Remove the actuator and bonnet according to steps 1 through 5 of the Replacing Packing procedure in the Maintenance section.
2. With care, remove the valve plug and stem assembly from the valve body. If necessary, also lift out the cage.

CAUTION

To prevent possible product damage, cover the opening in the valve in the following procedure to protect the sealing surfaces and to prevent foreign material from getting into the valve body cavity.

3. Remove and discard the existing bonnet gasket. Cover the valve body opening to protect sealing surfaces and to prevent foreign material from entering the valve body cavity.

Note

The ENVIRO-SEAL stem/bellows assembly for easy-e valves is available only with a threaded and drilled plug/adaptor/stem connection. The existing valve plug can be reused with the new stem/bellows assembly or a new plug can be installed.

4. Inspect the existing valve plug. If the plug is in good condition, it can be reused with the new ENVIRO-SEAL stem/bellows assembly. To remove the existing valve plug from the stem, first, place the existing plug stem assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out or drill out the pin (key 8).
5. Reverse the plug stem assembly in the soft-jaw chuck or vise. Grip the valve stem in an appropriate place and unscrew the existing plug from the valve stem.

Table 6. Recommended Torque for ENVIRO-SEAL Bellows Seal Packing Flange Nuts

VALVE SIZE, NPS	VALVE STEM DIAMETER THROUGH PACKING	MINIMUM TORQUE		MAXIMUM TORQUE	
		N•m	Lbf•in	N•m	Lbf•in
1 - 2	1/2	2	22	4	33
3 - 8	1	5	44	8	67

CAUTION

When installing a valve plug on the ENVIRO-SEAL stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.

To avoid product damage, do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

Note

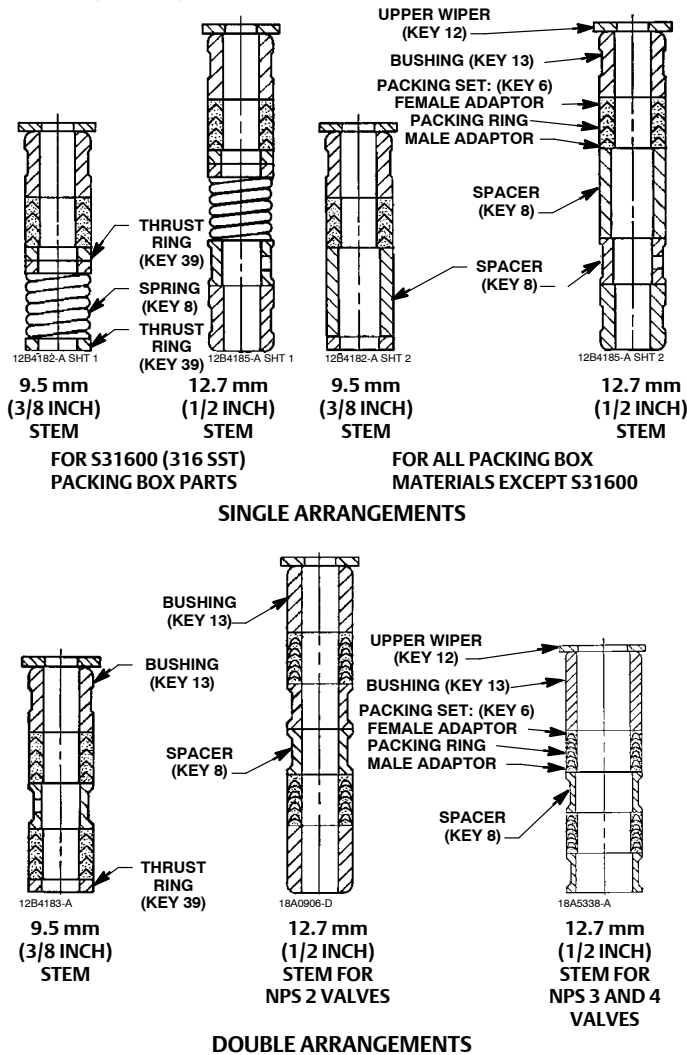
The ENVIRO-SEAL stem/bellows assembly has a one-piece stem.

CAUTION

To avoid damaging parts, do not grip the valve plug on any seating surface in the following procedure.

6. To attach the valve plug to the stem of the new ENVIRO-SEAL stem/bellows assembly, first attach the plug to the adaptor (key 24). Locate the adaptor. Notice that a hole has not been drilled in the threads where the plug screws onto the adaptor. Secure the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the adaptor. Thread the adaptor into the valve plug and tighten to the appropriate torque value.
7. Select the proper size of drill bit and drill through the adaptor using the hole in the valve plug as a guide. Remove any metal chips or burrs and drive in a new pin to lock the plug/adaptor assembly together.
8. Attach the plug/adaptor assembly to the ENVIRO-SEAL stem/bellows assembly by first securing the stem/bellows assembly in a soft-jaw chuck or other type of vise so that the jaws of the chuck or vise grip the flats of the stem extending out of the top of the bellows shroud. Screw the valve plug/adaptor assembly onto the valve stem. Tighten as necessary to align the pin hole in the stem with one of the holes in the adaptor. Secure the adaptor to the stem with a new pin.
9. Inspect the seat ring (key 9) and soft seat parts (keys 21, 22, and 23); replace, if necessary.
10. Place a new gasket (key 10) into the valve body in place of the bonnet gasket. Install the new stem/bellows assembly with valve plug/adaptor by placing it into the valve body on top of the new bellows gasket.
11. Place a new gasket (key 22) over the stem/bellows assembly. Place the new ENVIRO-SEAL bonnet over the stem/bellows assembly.

Figure 8. PTFE Packing Arrangements for Use in ENVIRO-SEAL Bellows Seal Bonnets



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Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson Process Management representative immediately if a discrepancy between actual parts and approved parts is suspected.

12. Properly lubricate the bonnet stud bolts. Install and tighten the bonnet hex nuts to the proper torque.
13. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 8 or 9.
14. Install the packing flange. Properly lubricate the packing flange stud bolts and the faces of the packing flange nuts.

For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in table 6. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 6.

For other packing types, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 6. Then, tighten the remaining flange nut until the packing flange is level and at a 90-degree angle to the valve stem.

15. Install travel indicator parts and stem locknuts; mount the actuator on the valve body according to the procedure in the appropriate actuator instruction manual.

Replacement of an Installed ENVIRO-SEAL Bellows Seal Bonnet (Stem/Bellows Assembly)

1. Remove the actuator and bonnet according to steps 1 through 5 of the Replacing Packing procedure in the Maintenance section.

CAUTION

To prevent possible product damage, cover the opening in the valve in the following procedure to protect the sealing surfaces and to prevent foreign material from getting into the valve body cavity.

2. Carefully remove the ENVIRO-SEAL stem/bellows assembly. If necessary, also lift out the cage. Remove and discard the existing bonnet gasket and bellows gasket. Cover the valve body opening to protect sealing surfaces and to prevent foreign material from entering the valve body cavity.

CAUTION

The ENVIRO-SEAL stem/bellows assembly for easy-e valves is available only with a threaded and drilled plug/adaptor/stem connection. The existing valve plug can be reused with the new stem/bellows assembly or a new plug can be installed. If the existing valve plug is reused, and the adaptor is in good condition, it may be also reused. However, never reuse an old adaptor with a new valve plug. Using an old adaptor with a new valve plug requires drilling a new pin hole in the adaptor. This drilling weakens the adaptor and may cause failure in service. However, a used valve plug may be reused with a new adaptor, except with Cavtrol III trim.

3. Inspect the existing valve plug and adaptor. If they are in good condition, they can be reused with the new stem/bellows assembly and they do not need to be separated.

CAUTION

When removing/installing a valve plug on the ENVIRO-SEAL stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.

To avoid product damage, do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

Note

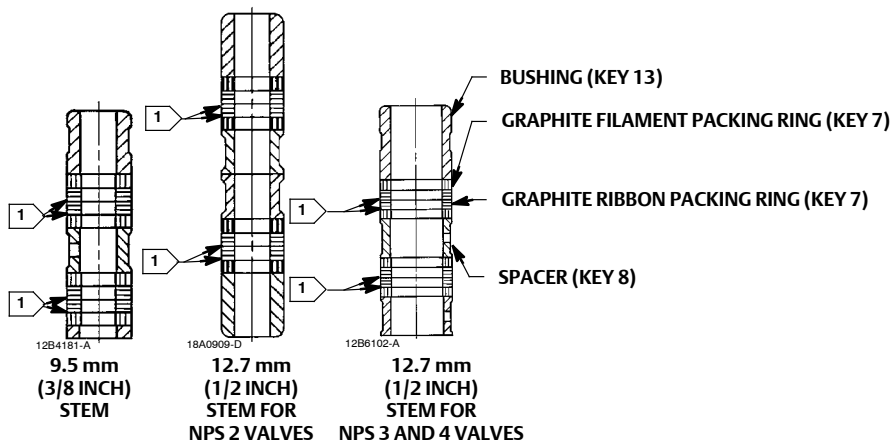
The ENVIRO-SEAL stem/bellows assembly has a one-piece stem.

4. If the valve plug and adaptor are not in good condition and must be replaced, first remove the valve plug/adaptor assembly from the stem/bellows assembly; then remove the valve plug from the adaptor. First, place the stem/bellows assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out or drill out the pin (key 8, figure 16, 17, or 20). Drive out the pin (key 36, figure 14).
5. Reverse the stem/bellows and plug/adaptor assembly in the soft-jaw chuck or vise. Grip the flat areas on the valve stem just below the threads for the actuator/stem connection. Unscrew the plug/adaptor assembly from the stem/bellows assembly. Unscrew the valve plug from the adaptor.
6. To attach either the existing valve plug or a new one to the stem of the new ENVIRO-SEAL stem/bellows assembly, first attach the plug to the adaptor (if the valve plug was removed from the adaptor) as follows:
 - Locate the adaptor. Notice that a hole has not been drilled in the threads where the plug screws onto the adaptor.

CAUTION

To avoid damaging parts, do not grip the valve plug on any seating surface in the following procedure.

Figure 9. Double Graphite Ribbon/Filament Arrangements for Use in ENVIRO-SEAL Bellows Seal Bonnets



NOTE:
 1 0.102 mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS; USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.

- Secure the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the adaptor.
 - Thread the adaptor into the valve plug and tighten to the appropriate torque value.
7. Complete the installation by following steps 7 through 9 and steps 12 through 15 of the ENVIRO-SEAL Bellows Seal Bonnet installation instructions found on pages 14 and 15.

Purging the ENVIRO-SEAL Bellows Seal Bonnet

The ENVIRO-SEAL bellows seal bonnet can be purged or leak tested. Refer to figure 14 for an illustration of an ENVIRO-SEAL bellows seal bonnet, and perform the following steps for purging or leak testing.

1. Remove the two diametrically opposed pipe plugs (key 16).
2. Connect a purging fluid to one of the pipe plug connections.
3. Install appropriate piping or tubing in the other pipe plug connection to pipe away the purging fluid or to make a connection to an analyzer for leak testing.

- When purging or leak testing has been completed, remove the piping or tubing and reinstall the pipe plugs (key 16).

Table 7. Standard Material Designations

Standard Designation	Common Name or Tradename
CoCr-A Hardfacing Alloy R30006 S17400 SST S31600 SST	CoCr-A Alloy 6 Casting 17-4PH Stainless Steel 316 Stainless Steel
S41000 SST S41600 SST WCC Carbon Steel Casting	410 Stainless Steel 416 Stainless Steel WCC

Parts Ordering

Each body-bonnet assembly is assigned a serial number which can be found on the valve. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your Emerson Process Management sales office for technical assistance. When ordering replacement parts, refer to the serial number and to the eleven-character part number for each part required from the following parts kit or parts list information.

Refer to table 7 for standard and common material designations.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Process Management should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Gasket Kits

Gasket Kits (includes keys 10, 11, 12, 13, and 51; plus 14 and 20 on some restricted capacity valves)

DESCRIPTION	Standard Trim Cage Whisper Trim I Cage Cavitrol III - 1 Stage Cage	Cavitrol III - 2 Stage Cage Whisper Trim III Cage WhisperFlo Cage
	-198 to 593°C (-325 to 1100°F)	-198 to 593°C (-325 to 1100°F)
Full Capacity Valves	Part Number	Part Number
NPS 1 & 1-1/4	RGASKETX162	RGASKETX422
NPS 1-1/2 (NPS 2 EAT)	RGASKETX172	RGASKETX432
NPS 2	RGASKETX182	RGASKETX442
NPS 2-1/2 (NPS 3 EAT)	RGASKETX192	RGASKETX452
NPS 3 (NPS 4 EAT)	RGASKETX202	RGASKETX462
NPS 4 (NPS 6 EAT)	RGASKETX212	RGASKETX472
NPS 6	RGASKETX222	RGASKETX482
NPS 8	RGASKETX232	10A3265X152
Restricted Capacity Valves w/ Metal Seating		
NPS 1-1/2 x 1 (NPS 2 x 1 EAT)	RGASKETX242	---
NPS 2 x 1	RGASKETX252	---
NPS 2-1/2 x 1-1/2 (NPS 3 x 1-1/2 EAT)	RGASKETX262	---
NPS 3 x 2 (NPS 4 x 2 EAT)	RGASKETX272	---
NPS 4 x 2-1/2 (NPS 6 x 2-1/2 EAT)	RGASKETX282	---

Packing Kits

Standard Packing Repair Kits (Non Live-Loaded)

Standard Packing Repair Kits (Non Live-Loaded)

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)
PTFE (Contains keys 6, 8, 10, 11, and 12)	RPACKX00012	RPACKX00022	RPACKX00032	RPACKX00342	RPACKX00352
Double PTFE (Contains keys 6, 8, 11, and 12)	RPACKX00042	RPACKX00052	RPACKX00062	RPACKX00362	RPACKX00372
PTFE/Composition (Contains keys 7, 8, 11, and 12)	RPACKX00072	RPACKX00082	RPACKX00092	---	---
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8, and 11)	RPACKX00102	RPACKX00112	RPACKX00122	---	---
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], and 11)	---	---	---	RPACKX00532	RPACKX00542
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring])	RPACKX00132	RPACKX00142	RPACKX00152	---	---
Double Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8, and 11)	RPACKX00162	RPACKX00172	RPACKX00182	---	---

ENVIRO-SEAL Packing Retrofit Kits

Retrofit kits include parts to convert valves with existing standard bonnets to the ENVIRO-SEAL packing box construction. Refer to figure 11 for key numbers for PTFE packing, to figure 12 for key numbers for Graphite ULF packing, and to figure 13 for key numbers for duplex packing. PTFE kits include keys 200, 201, 211, 212, 214, 215, 216, 217, 218, tag, and cable tie. Graphite ULF kits include keys 200, 201, 207, 208, 209, 210, 211, 212, 214, 217, tag, and cable tie. Duplex kits include keys 200, 201, 207, 209, 211, 212, 214, 215, 216, 217, tag, and cable tie.

Stems and packing box constructions that do not meet Emerson Process Management stem finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of this packing kit.

For part numbers of individual components in the ENVIRO-SEAL packing kits, refer to instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves, D101642X012.

ENVIRO-SEAL Packing Retrofit Kits

PACKING MATERIAL	STEM DIAMETER AND YOKE BOSS DIAMETER, mm (INCH)				
	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)
Double PTFE	RPACKXRT012	RPACKXRT022	RPACKXRT032	RPACKXRT042	RPACKXRT052
Graphite ULF	RPACKXRT262	RPACKXRT272	RPACKXRT282	RPACKXRT292	RPACKXRT302
Duplex	RPACKXRT212	RPACKXRT222	RPACKXRT232	RPACKXRT242	RPACKXRT252

ENVIRO-SEAL Packing Repair Kits

Repair kits include parts to replace the “soft” packing materials in valves that already have ENVIRO-SEAL packing arrangements installed or in valves that have been upgraded with ENVIRO-SEAL retrofit kits. Refer to figure 11 for key numbers for PTFE packing, to figure 12 for key numbers for Graphite ULF packing, and to figure 13 for key numbers for duplex packing. PTFE repair kits include keys 214, 215, and 218. Graphite ULF repair kits include keys 207, 208, 209, 210, and 214. Duplex repair kits include keys 207, 209, 214, and 215.

Stems and packing box constructions that do not meet Emerson Process Management stem finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of this packing kit.

For part numbers of individual components in the ENVIRO-SEAL packing kits, refer to instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves, D101642X012.

ENVIRO-SEAL Packing Repair Kits

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)
Double PTFE (contains keys 214, 215, & 218)	RPACKX00192	RPACKX00202	RPACKX00212	RPACKX00222	RPACKX00232
Graphite ULF (contains keys 207, 208, 209, 210, and 214)	RPACKX00592	RPACKX00602	RPACKX00612	RPACKX00622	RPACKX00632
Duplex (contains keys 207, 209, 214, and 215)	RPACKX00292	RPACKX00302	RPACKX00312	RPACKX00322	RPACKX00332

Figure 10. Typical HIGH-SEAL Graphite ULF Packing System

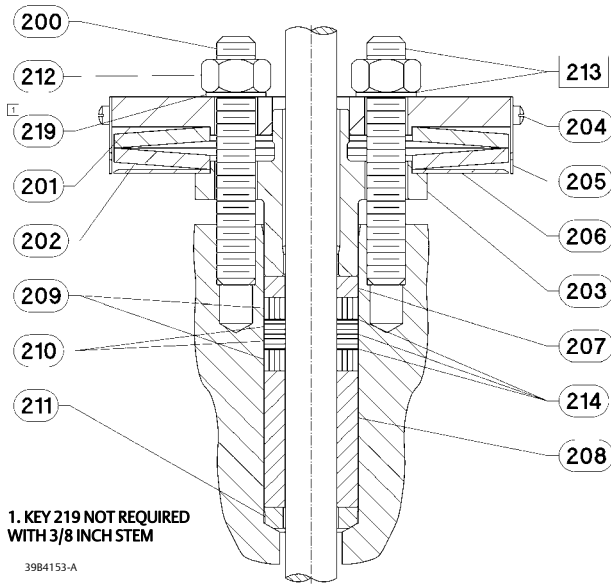


Figure 12. Typical ENVIRO-SEAL Packing System with Graphite ULF Packing

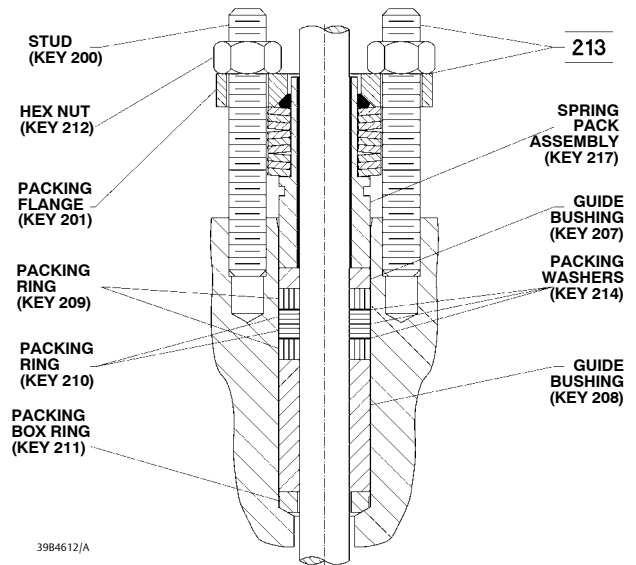


Figure 11. Typical ENVIRO-SEAL Packing System with PTFE Packing

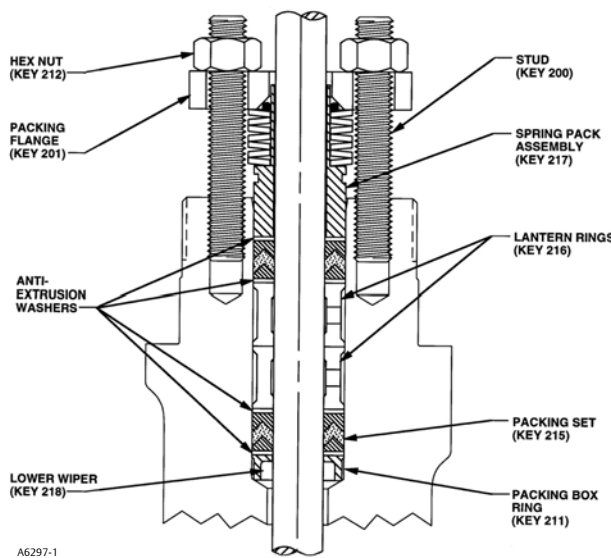
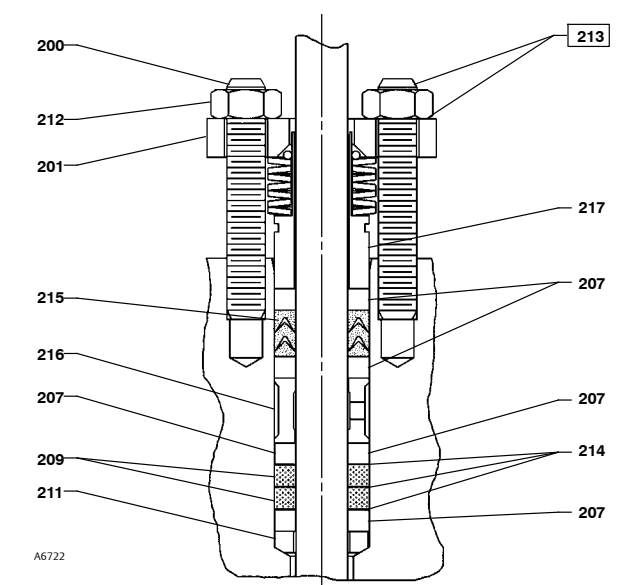


Figure 13. Typical ENVIRO-SEAL Packing System with Duplex Packing



Parts List

Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your Emerson Process Management sales office.

Bonnet (figures 3 through 9 and figure 14)

Key	Description	Part Number
1	Bonnet/ENVIRO-SEAL bellows seal bonnet If you need a bonnet or an ENVIRO-SEAL bellows seal bonnet as a replacement part, order by valve size and stem diameter, serial number, and desired material.	
2	Extension Bonnet Baffle	
3	Packing Flange	
3	ENVIRO-SEAL bellows seal packing flange	
4	Packing Flange Stud	
4	ENVIRO-SEAL bellows seal stud bolt	
5	Packing Flange Nut	
5	ENVIRO-SEAL bellows seal hex nut	
6*	Packing set, PTFE	see following table
6*	ENVIRO-SEAL bellows seal packing set PTFE for 9.5 mm (3/8 inch) stem (1 req'd for single packing, 2 req'd for double packing)	12A9016X012
	PTFE for NPS 2 with 12.7 mm (1/2 inch) stem (2 req'd for double packing)	12A9016X012
	PTFE for NPS 3 and 4 with 12.7 mm (1/2 inch) stem (2 req'd for double packing)	12A8832X012
7*	Packing ring, PTFE composition	see following table
7*	ENVIRO-SEAL bellows seal packing ring for low chloride graphite ribbon/filament packing arrangement Ribbon packing ring for 9.5 mm (3/8 inch) and NPS 2 with 12.7 mm (1/2 inch) stem (4 req'd)	18A0908X012
	Filament packing ring for 9.5 mm (3/8 inch) and NPS 2 with 12.7 mm (1/2 inch) stem (4 req'd)	1P3905X0172
	Ribbon packing ring for NPS 3 and 4 with 12.7 mm (1/2 inch) stem (4 req'd)	18A0918X012
	Filament packing ring for NPS 3 and 4 with 12.7 mm (1/2 inch) stem (4 req'd)	14A0915X042
8	Spring	
8	Lantern ring	
8	ENVIRO-SEAL bellows seal spring	
8	ENVIRO-SEAL bellows seal spacer	
10	Special washer	
11*	Packing Box Ring, S31600 9.5 mm (3/8 inch) stem, 12.7 mm (1/2 inch) stem, 19.1 mm (3/4 inch) stem, 25.4 mm (1-inch) stem, 31.8 mm (1-1/4 inch) stem,	1J873135072 1J873235072 1J873335072 1J873435072 1J873535072

Key	Description	Part Number
12*	Upper Wiper, felt 9.5 mm (3/8 inch) stem 12.7 mm (1/2 inch) stem 19.1 mm (3/4 inch) stem 25.4 mm (1-inch) stem 31.8 mm (1-1/4 inch) stem	1J872606332 1J872706332 1J872806332 1J872906332 1J873006332
12*	ENVIRO-SEAL bellows seal upper wiper For 9.5 mm (3/8 inch) and NPS 2 with 12.7 mm (1/2 inch) stem For NPS 3 and 4 with 12.7 mm (1/2 inch) stem	18A0868X012 18A0870X012
13	Packing Follower	
13*	ENVIRO-SEAL bellows seal bushing For 9.5 mm (3/8 inch) stem (1 req'd), for NPS 2 with 12.7 mm (1/2 inch) stem (2 req'd) S31600/PTFE R30006 S31600/Cr Coated For NPS 3 and 4 with 12.7 mm (1/2 inch) stem (1 req'd) S31600/PTFE R30006 S31600/Cr Coated	18A0820X012 18A0819X012 11B1155X012 18A0824X012 18A0823X012 11B1157X012
13*	ENVIRO-SEAL bellows seal bushing/liner For 9.5 mm (3/8 inch) stem (1 req'd), for NPS 2 with 12.7 mm (1/2 inch) stem (2 req'd) N10276 bushing, PTFE/glass liner N10276 bushing, PTFE/carbon liner For NPS 3 and 4 with 12.7 mm (1/2 inch) stem (1 req'd) N10276 bushing, PTFE/glass liner N10276 bushing, PTFE/carbon liner	12B2713X012 12B2713X042 12B2715X012 12B2715X042
14	Pipe Plug	
14	Lubricator	
14	Lubricator/Isolating Valve	
15	Yoke Locknut	
15	ENVIRO-SEAL bellows seal Locknut	
16	Pipe Plug	
16	ENVIRO-SEAL bellows seal pipe plug	
20*	ENVIRO-SEAL bellows seal stem/bellows assembly 1 Ply Bellows S31600 trim mat'l, N06625 bellows mat'l NPS 1 w/ 9.5 mm (3/8 inch) stem NPS 1-1/2 w/ 9.5 mm (3/8 inch) stem NPS 2 w/ 12.7 mm (1/2 inch) stem NPS 3 w/ 12.7 mm (1/2 inch) stem NPS 4 w/ 12.7 mm (1/2 inch) stem N06022 trim mat'l, N06022 bellows mat'l NPS 1 w/ 9.5 mm (3/8 inch) stem NPS 1-1/2 w/ 9.5 mm (3/8 inch) stem NPS 2 w/ 12.7 mm (1/2 inch) stem NPS 3 w/ 12.7 mm (1/2 inch) stem NPS 4 w/ 12.7 mm (1/2 inch) stem 2 Ply Bellows S31600 trim mat'l, N06625 bellows mat'l NPS 1 w/ 9.5 mm (3/8 inch) stem NPS 1-1/2 w/ 9.5 mm (3/8 inch) stem NPS 2 w/ 12.7 mm (1/2 inch) stem NPS 3 w/ 12.7 mm (1/2 inch) stem NPS 4 w/ 12.7 mm (1/2 inch) stem	32B4224X012 32B4225X012 32B4226X012 32B4227X012 32B4228X012 32B4224X022 32B4225X022 32B4226X022 32B4227X022 32B4228X022 32B4224X032 32B4225X032 32B4226X032 32B4227X032

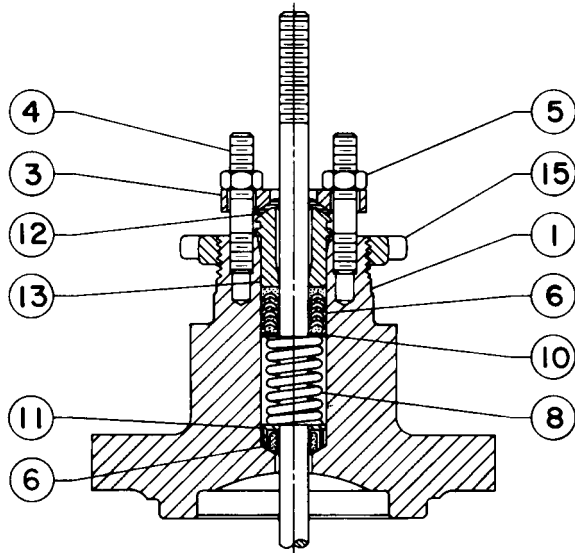
Keys 6*, 7*, 8, and 10 Packing Box Parts⁽¹⁾

DESCRIPTION		KEY NO.	STEM DIAMETER, mm (INCHES)					
			9.5 (3/8)	12.7 (1/2)	19.1 (3/4)	25.4 (1)	31.8 (1-1/4)	
PTFE V-Ring Packing	Packing Set, PTFE (1 req'd for single, 2 req'd for double) ⁽²⁾	6	1R290001012	1R290201012	1R290401012	1R290601012	1R290801012	
	Spring, Stainless Steel (for single only)	8	1F125437012	1F125537012	1F125637012	1D582937012	1D387437012	
	Lantern Ring, Stainless Steel (for double only)	8	1F364135072	1J962335072	0N028435072	0U099735072	0W087135072	
	Quantity required	Double	---	1	2	1	1	1
	Special Washer, Stainless Steel (for single only)	10	1F125236042	1F125136042	1F125036042	1H982236042	1H995936042	
PTFE/Composition Packing	Packing Ring, PTFE composition	7	1F3370X0012	1E319001042	1E319101012	1D7518X0012	1D7520X0012	
	Quantity required	Double	---	7	10	8	8	8
	Lantern Ring, Stainless Steel (1 required)	8	1F364135072	1J962335072	0N028435072	0U099735072	0W087135072	
Graphite Ribbon/Filament	Graphite Ribbon Ring	7	1V3160X0022	1V3802X0022	1V2396X0022	1U6768X0022	1V5666X0022	
	Quantity required	Single	---	2	2	2	2	2
		Double	---	3	3	3	3	3
	Graphite Filament Ring	7	1F3370X0322	1E3190X0222	1E3191X0282	1D7518X0132	1D7520X0162	
	Quantity required	Single	---	2	2	3	3	3
		Double	---	4	4	5	5	5
	Lantern Ring	8	1F364135072	1J962335072	0N028435072	0U099735072	0W087135072	
	Quantity required	Single	---	2	3	2	2	2
Double		---	1	2	1	1	1	
Warning Tag			11B9513X012	11B9513X012	11B9513X012	11B9513X012	11B9513X012	

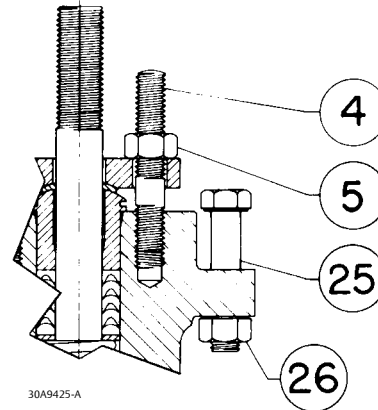
1. For ENVIRO-SEAL or HIGH-SEAL packing box parts, see instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves, D101642X012 or HIGH-SEAL Live-Loaded Packing System, D101453X012.
 2. Key 6 for double construction contains one extra packing ring for the 9.5 mm (3/8 inch) stem and one extra lower wiper for all sizes. Discard upon assembly.

Key	Description	Part Number	Key	Description	Part Number
	NPS 4 w/ 12.7 mm (1/2 inch) stem	32B4228X032		NPS 3	12B6319X022
	N06022 trim mat'l, N06022 bellows mat'l			NPS 4	12B6320X022
	NPS 1 w/ 9.5 mm (3/8 inch) stem	32B4224X042	24	ENVIRO-SEAL bellows seal adaptor	
	NPS 1-1/2 w/ 9.5 mm (3/8 inch) stem	32B4225X042	25	Cap Screw	
	NPS 2 w/ 12.7 mm (1/2 inch) stem	32B4226X042	26	Hex Nut	
	NPS 3 w/ 12.7 mm (1/2 inch) stem	32B4227X042	27	Pipe Nipple for lubricator/isolating valve	
	NPS 4 w/ 12.7 mm (1/2 inch) stem	32B4228X042	28	ENVIRO-SEAL bellows seal nameplate, warning	
22*	ENVIRO-SEAL bellows seal bonnet gasket (graphite/S31600)		29	ENVIRO-SEAL bellows seal drive screw	
	NPS 1/2 through 1-1/4	12B6316X022	34	Lubricant, Anti-Seize (not included with valve)	
	NPS 1-1/2	12B6317X022	36*	ENVIRO-SEAL bellows seal pin	12B3951X012
	NPS 2	12B6318X022	37	ENVIRO-SEAL bellows seal warning tag	
			38	ENVIRO-SEAL bellows seal tie	
			39	ENVIRO-SEAL bellows seal thrust ring	

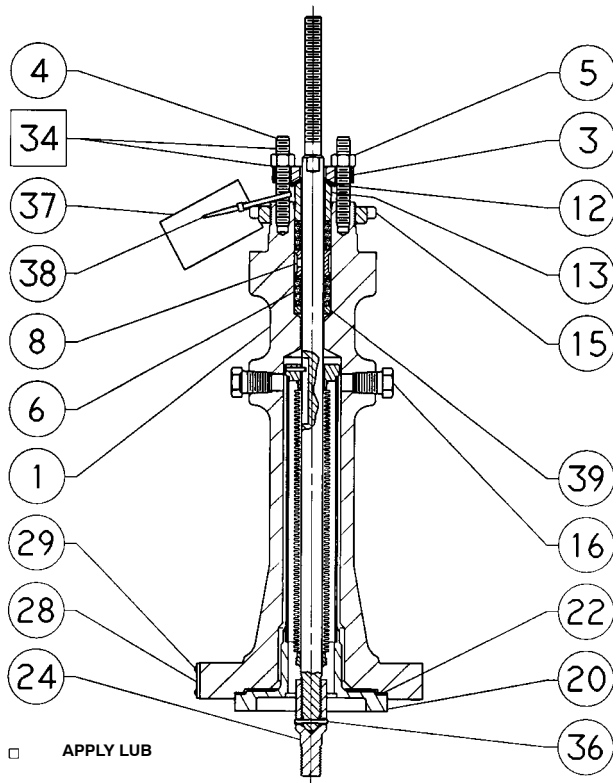
Figure 14. Typical Bonnets



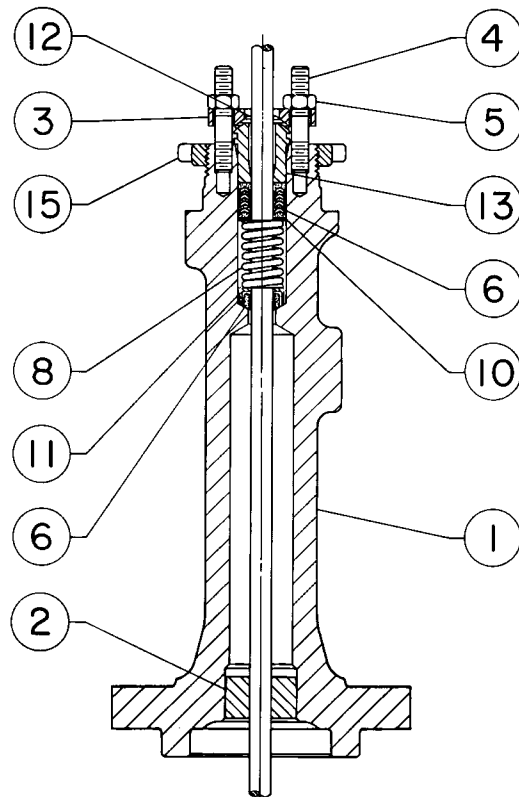
PLAIN BONNET



DETAIL OF 127 mm (5-INCH) YOKE BOSS ACTUATOR BOLTING

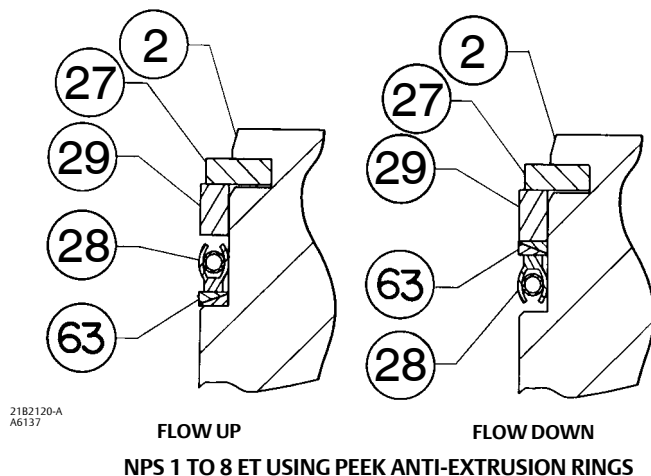


ENVIRO-SEAL BELLOWS SEAL BONNET



STYLE 1 OR 2 EXTENSION BONNET

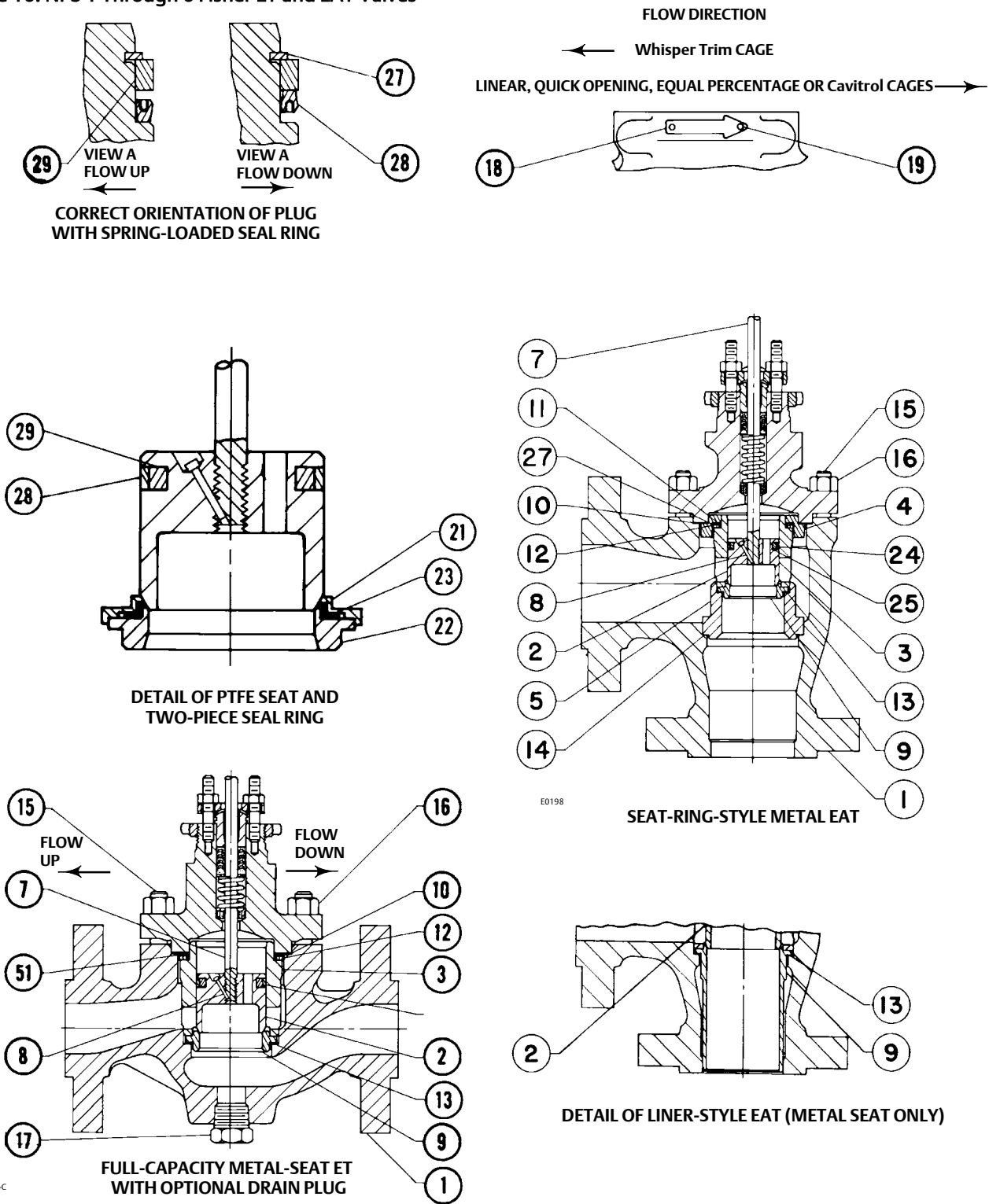
Figure 15. Alternate Configurations



Key	Description	Part Number	Key	Description	Part Number
1	Valve Body If you need a valve body as a replacement part, order by valve size, serial number, and desired material.		23*	Disk	see following table
2*	Valve plug	see following table	24*	Seal Ring (EAT)	see following table
3*	Cage	see following table	25*	Backup Ring (EAT)	see following table
4	Trim adaptor		26	Load Ring (for NPS 8 ET only)	
5	Trim adaptor		27*	Retaining Ring	see following table
7*	Valve plug stem	see following table	27*	Shim (EAT)	see following table
8*	Pin, 316 Stainless Steel		28*	Seal Ring (ET)	see following table
	9.5 mm (3/8 inch) stem	1V322635072	29*	Backup Ring (ET)	see following table
	12.7 mm (1/2 inch) stem	1V322735072	31*	Whisper Trim III Cage Retainer for Levels A3, B3 & C3 (NPS 6 ET only)	
	19.1 mm (3/4 inch) stem	1V326035072		410 Stainless steel	22A3255X012
	25.4 mm (1 inch) or 31.8 mm (1-1/4 inch) stem	1V334035072		WCC steel (ENC)	22A3256X012
9*	Liner	see following table		316 Stainless Steel (ENC)	22A3256X022
9*	Seat Ring	see following table		316 Stainless Steel w/CoCr-A bore	22A3257X012
10*	Bonnet Gasket	see following table		316 Stainless Steel (Cr Cr)	31A9792X012
11*	Cage Gasket	see following table	31*	Whisper Trim III Cage Retainer & Baffle Ass'y for Level D3 (NPS 6 ET only)	
12*	Spiral-Wound Gasket	see following table		410 Stainless Steel retainer & steel baffle	22A3258X012
13*	Seat Ring or Liner Gasket	see following table		WCC steel (ENC) retainer & steel baffle	22A3258X022
14*	Adaptor Gasket	see following table		316 Stainless Steel (ENC) retainer & steel baffle	22A3258X052
15	Cap Screw			316 Stainless Steel w/CoCr-A retainer & steel baffle	22A3258X032
15	Stud			316 Stainless steel (ENC) retainer & 316 stainless steel baffle	22A3258X042
16	Nut			316 Stainless Steel (Cr Cr) retainer & 316 Stainless Steel baffle	22A3258X062
17	Pipe Plug, for use in valves with drain tapping only		32	Cavitrol III Bonnet Spacer	
18	Flow Direction Arrow		32	Whisper Trim III Bonnet Spacer (NPS 6 ET only)	
19	Drive Screw, Stainless Steel		51*	Shim	see following table
20*	Adaptor Gasket	see following table	54	Wire	
21*	Seat Disk Retainer	see following table	63*	Anti-Extrusion Ring	see following table
22*	Disk Seat	see following table			

* Recommended spare parts

Figure 16. NPS 1 Through 6 Fisher ET and EAT Valves



44A7928-C

Figure 17. Fisher ET Valve Assembly with Whisper Trim III Cage and Optional Drain Plug

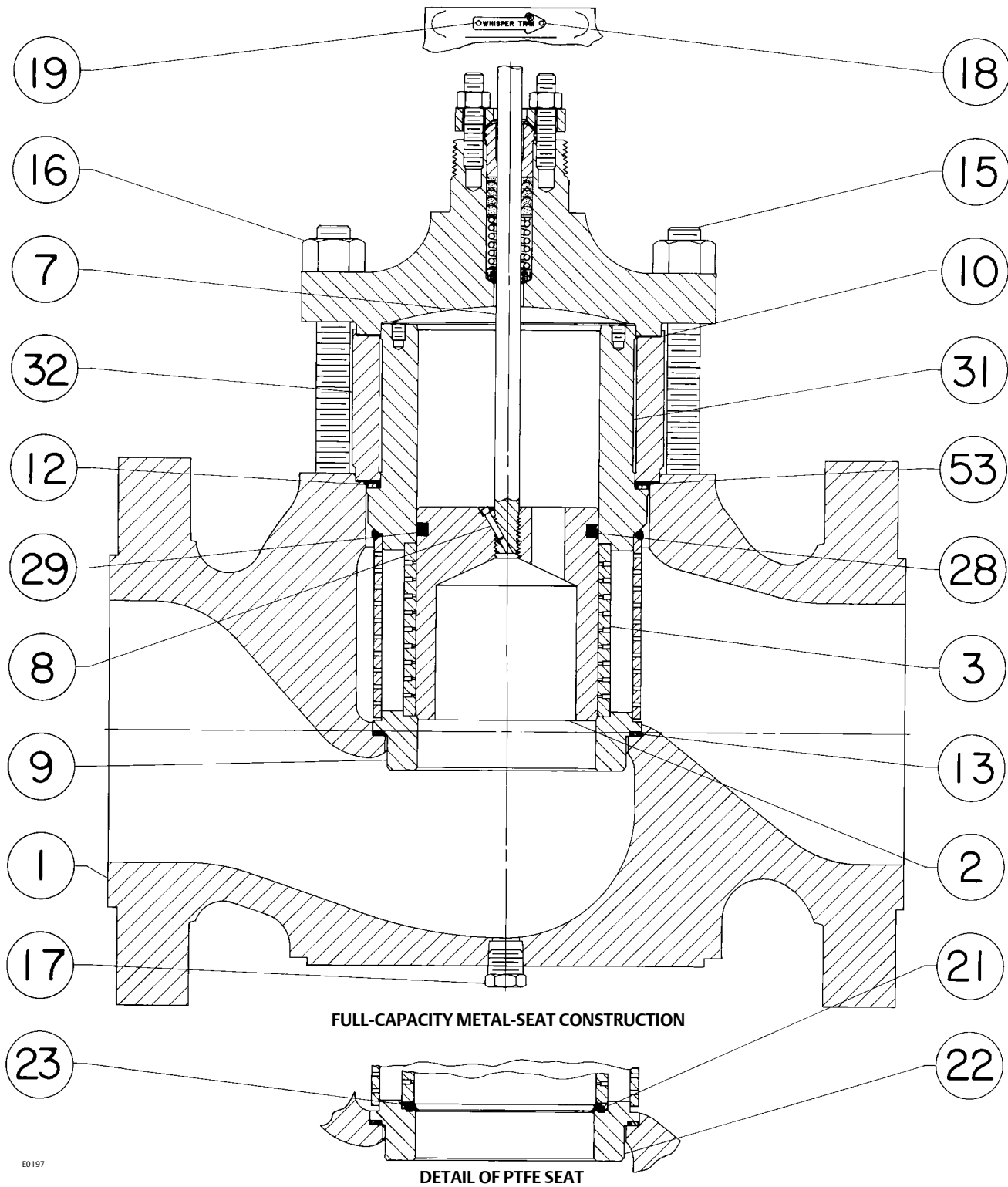
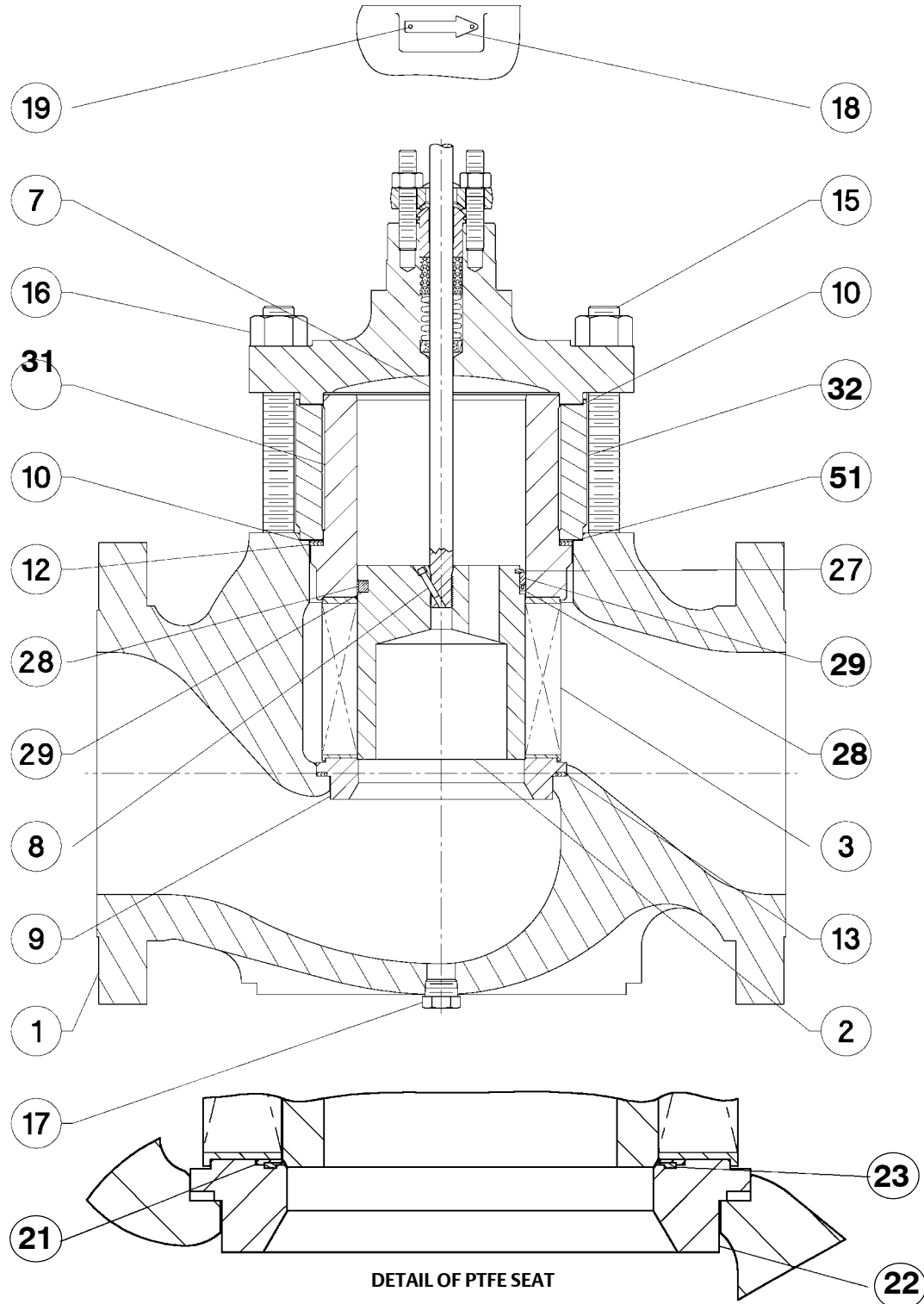
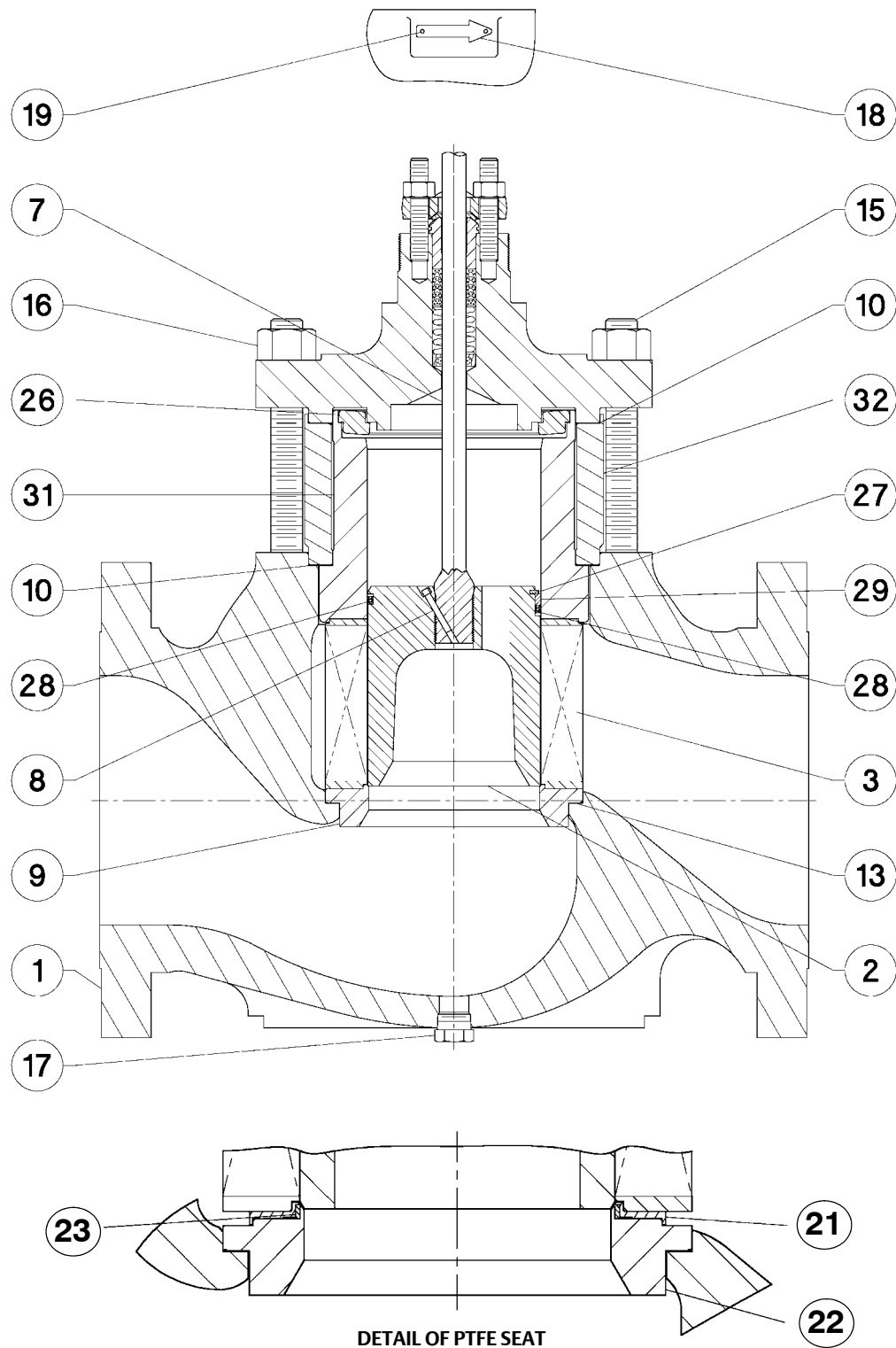


Figure 18. Fisher ET Valve Assembly with WhisperFlo Cage and Optional Drain Plug



E0199

Figure 19. NPS 8 Fisher ET Valve Assembly with WhisperFlo Cage and Optional Drain Plug



E0200

Figure 20. Details of Cavitol III and NPS 8 Fisher ET Valves with Optional Drain Plug

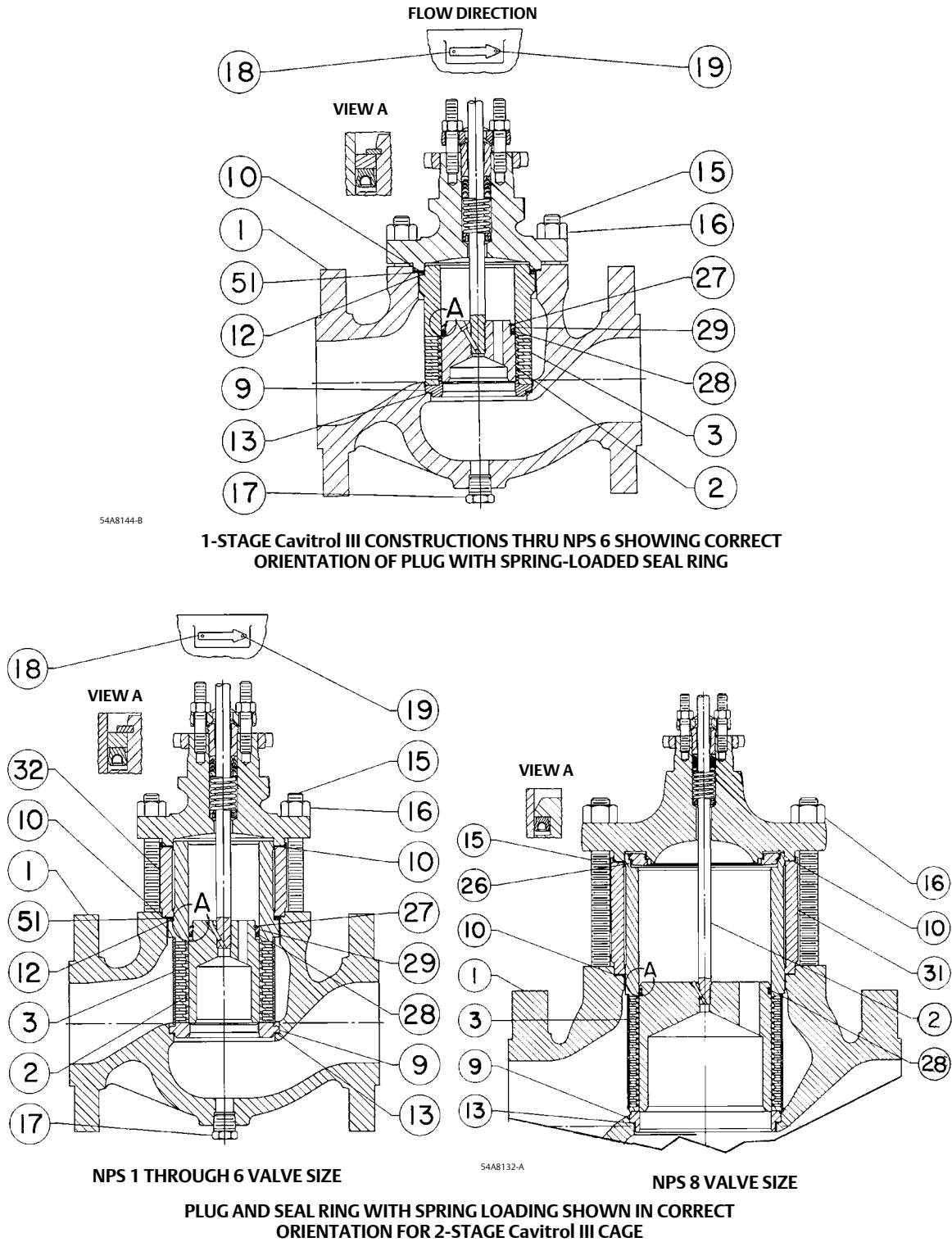
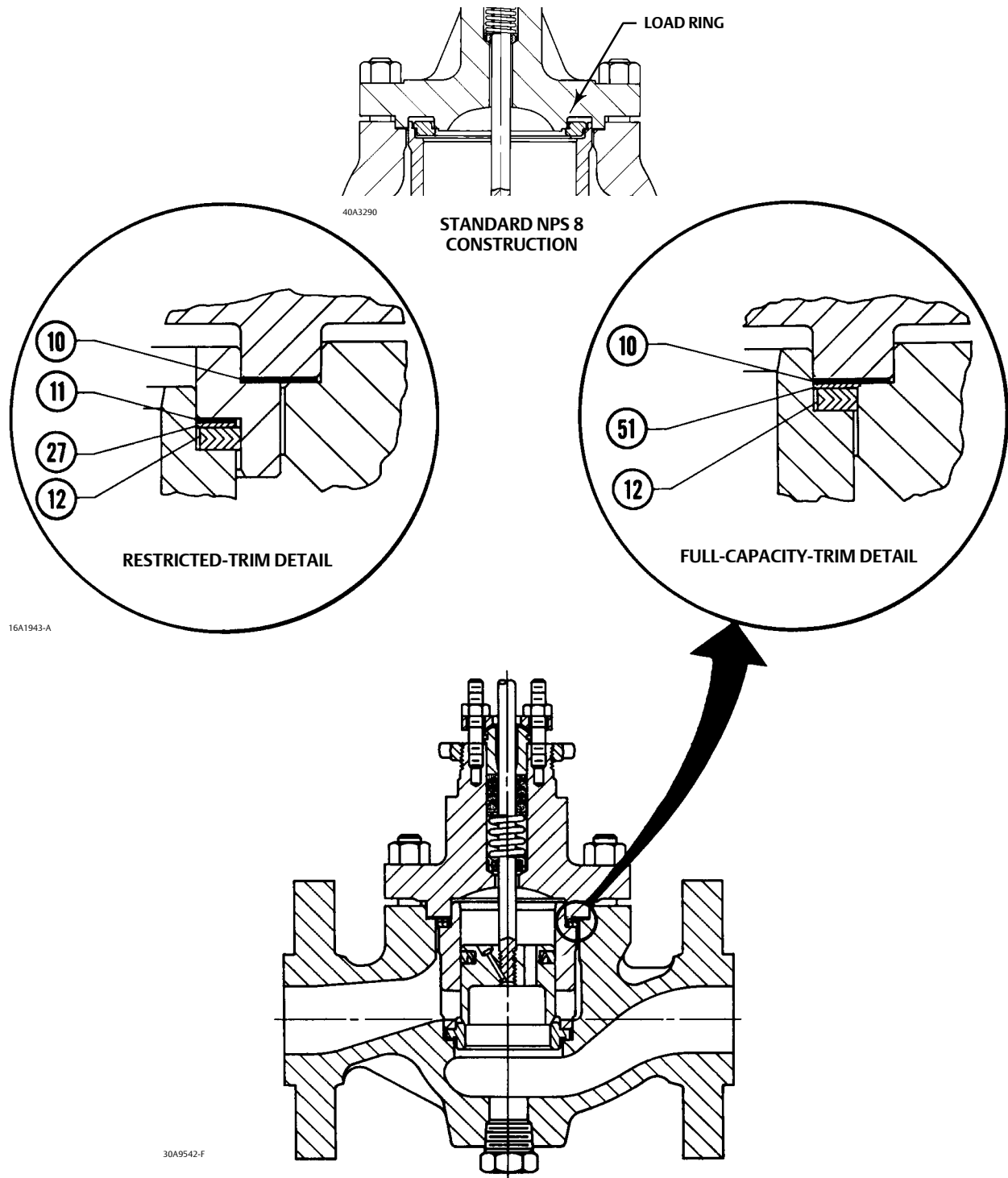


Figure 21. Gasket Set Detail shown with Optional Drain Plug



Actuator Groups

Group 1 54 mm (2-1/8 inches), 71 mm (2-13/16 inches), or 90 mm (3-9/16 inches) Yoke Boss	Group 100 127 mm (5 inches) Yoke Boss 3 inches maximum travel	Group 401 90.5 mm (3-9/16 inches) Yoke Boss 3.25 to 4 inches maximum travel	Group 404 127 mm (5 inches) Yoke Boss 4 inches maximum travel	
			657 657 MO 657-4 657-4 MO 667 667 MO 667-4 667-4 MO	667 667-4
	585C 1B 618 644 & 645	585C 657 1008		Group 405 127 mm (5 inches) Yoke Boss 4 inches maximum travel
	657 & 667—76.2 mm (3 inches) maximum travel		Group 402 90.5 mm (3-9/16 inches) Yoke Boss 4 inches maximum travel	Group 406 127 mm (5 inches) Yoke Boss 4 inches maximum travel
	1008—71.4 mm (2-13/16 inches) Yoke Boss	Group 101 127 mm (5 inches) Yoke Boss 3 inches maximum travel	457-7 585C	667 MO 667-4 MO
		667	Group 403 90.5 mm (3-9/16 inches) Yoke Boss 4 inches maximum travel	Group 407 127 mm (5 inches) Yoke Boss 4 inches maximum travel
		Group 400 71.4 mm (2-13/16 inches) Yoke Boss 4 inches maximum travel	585C 1008	585C 657
		585C	Group 801 90.5 mm (3-9/16 inches) Yoke Boss 8 inches maximum travel	Group 802 127 mm (5 inches) Yoke Boss 8 inches maximum travel
			585C	585C

Key 2* Valve Plug for Constructions with Two-Piece Seal Ring

VALVE SIZE, NPS		STEM DIAMETER		416 STAINLESS STEEL HARDENED (STD)	316 STAINLESS STEEL ⁽¹⁾	316 STAINLESS STEEL w/CoCr-A ON SEAT ⁽¹⁾	316 STAINLESS STEEL w/CoCr-A ON SEAT & GUIDE ⁽¹⁾
ET	EAT	mm	Inches				
1, 1-1/4, or 1-1/2 x 1	1 or 2 x 1	9.5	3/8	1V657146172	1V657135072	11A5315X012	11A5317X012
		12.7	1/2	1V657246172	1V657235072	11A5316X012	11A5318X012
1-1/2	2	9.5	3/8	1V657346172	1V657335072	11A5321X012	10A4438X012
		12.7	1/2	1V657446172	1V657435072	10A4439X012	10A4611X012
2 or 3 x 2	4 x 2	12.7	1/2	1V657546172	1V657535072	11A5324X012	11A5326X012
		19.1	3/4	1V657646172	1V657635072	11A5325X012	11A5327X012
2 x 1	---	12.7	1/2	1V657246172	1V657235072	11A5316X012	11A5318X012
2-1/2 or 4 x 2-1/2	3 or 6 x 2-1/2	12.7	1/2	1V657746172	1V657735072	11A5330X012	11A5332X012
		19.1	3/4	1V657846172	1V657835072	11A5331X012	11A5333X012
2-1/2 x 1-1/2	3 x 1-1/2	12.7	1/2	1V657446172	1V657435072	10A4439X012	10A4611X012
3	4	12.7	1/2	1V657946172	1V657935072	11A5336X012	11A5337X012
		19.1	3/4	1V658046172	1V658035072	11A5014X012	11A5338X012
4	6	12.7	1/2	1V658146172	1V658135072	11A5341X012	11A5344X012
		19.1	3/4	1V6582X0022	1V6582X0072	11A5342X012	11A5345X042
		25.4	1	1V658346172	1V658335072	11A5343X012	11A5346X012
6	---	19.1	3/4	1V658446172	1V658435072	11A5350X012	11A5351X012
		25.4	1	1V658546172	1V658535072	10A5107X012	20A0103X012
		31.8	1-1/4	1V658646172	1V658635072	10A5108X012	20A4608X012

1. Not for use with 17-4PH stainless steel cages above 210°C (410°F).

Keys 2*, 7*, and 8* Valve Plug and Stem Assembly for Plain Bonnet with Two-Piece Seal Ring

VALVE SIZE, NPS		STEM DIAMETER		416 STAINLESS STEEL HARDENED (STD)	316 STAINLESS STEEL ⁽¹⁾	316 STAINLESS STEEL w/CoCr-A ON SEAT ⁽¹⁾	316 STAINLESS STEEL w/CoCr-A ON SEAT & GUIDE ⁽¹⁾
ET	EAT	mm	Inches				
1 or 1-1/4	1	9.5	3/8	1V6571X0032	1V6571X0052	11A5315X032	11A5317X042
		12.7	1/2	1V6572X0022	1V6572X0062	11A5316X022	11A5318X042
1-1/2	2	9.5	3/8	1V6573X0042	1V6573X0052	11A5321X022	10A4438X022
		12.7	1/2	1V6574X0012	1V6574X0032	---	10A4611X042
1-1/2 x 1	2 x 1	9.5	3/8	1V6571X0042	1V6571X0092	---	11A5317X072
		12.7	1/2	1V6572X0042	---	---	11A5318X032
2 or 3 x 2	4 x 2	12.7	1/2	1V6575X0052	1V6575X0062	11A5324X022	11A5326X022
		19.1	3/4	1V6576X0012	---	---	11A5327X032
2 x 1	---	12.7	1/2	1V6572X0022	1V6572X0062	11A5316X022	11A5318X042
2-1/2 or 4 x 2-1/2	3 or 6 x 2-1/2	12.7	1/2	1V6577X0042	1V6577X0062	11A5330X022	11A5332X022
		19.1	3/4	1V6578X0012	1V6578X0022	11A5331X022	---
2-1/2 x 1-1/2	3 x 1-1/2	12.7	1/2	1V6574X0012	1V6574X0032	---	10A4611X112
3	4	12.7	1/2	1V6579X0092	1V6579X0112	11A5336X032	11A5337X082
4	6	12.7	1/2	1V6581X0042	1V6581X0052	11A5341X032	11A5344X022
		19.1	3/4	1V6582X0022	1V6582X0072	---	11A5345X042
6	---	19.1	3/4	1V6584X0042	1V6584X0062	11A5350X032	21A5351X062

1. Not for use with 17-4PH stainless steel cages above 210°C (410°F).

Keys 2*, 7*, and 8* Valve Plug and Stem Assembly for Style 1 Extension Bonnet with Two-Piece Seal Ring

VALVE SIZE, NPS		STEM DIAMETER		416 STAINLESS STEEL HARDENED (STD)	316 STAINLESS STEEL ⁽¹⁾	316 STAINLESS STEEL w/CoCr-A ON SEAT ⁽¹⁾	316 STAINLESS STEEL w/CoCr-A ON SEAT & GUIDE ⁽¹⁾
ET	EAT	mm	Inches				
1 or 1-1/4	1	9.5	3/8	1V6571X0072	1V6571X0062	---	11A5317X082
		12.7	1/2	1V6572X0032	---	11A5316X032	---
1-1/2	2	9.5	3/8	1V6573X0072	---	11A5321X042	10A4438X032
		12.7	1/2	1V6574X0052	---	---	10A4611X112
1-1/2 x 1	2 x 1	9.5	3/8	1V6571X0102	---	---	11A5317X052
		12.7	1/2	1V6572X0152	---	---	---
2 or 3 x 2	4 x 2	12.7	1/2	1V6575X0182	1V6575X0122	11A5324X042	11A5326X062
		19.1	3/4	1V6572X0032	---	11A5316X032	---
2 x 1	---	12.7	1/2	1V6572X0032	---	11A5316X032	---
2-1/2 or 4 x 2-1/2	3 or 6 x 2-1/2	12.7	1/2	1V6577X0052	---	---	11A5332X202
2-1/2 x 1-1/2	3 x 1-1/2	12.7	1/2	1V6574X0052	---	---	10A4611X112
3	4	12.7	1/2	1V6579X0082	1V6579X0072	---	11A5337X062
4	6	12.7	1/2	1V6581X0072	1V6581X0062	---	11A5344X052
6	---	19.1	3/4	1V6584X0052	1V6584X0112	---	21A5351X052

1. Not for use with 17-4PH stainless steel cages above 210°C (410°F).

Key 2* Valve Plug for Spring-Loaded Seal Ring Constructions

VALVE SIZE, NPS		STEM DIAMETER		416 STAINLESS STEEL HARDENED	316 STAINLESS STEEL ⁽¹⁾	316 STAINLESS STEEL w/CoCr-A SEAT & GUIDE ⁽¹⁾
ET	EAT	mm	Inches			
1, 1-1/4, or 1-1/2 x 1	1	9.5	3/8	20A4103X012	20A4103X022	20A4104X012
1-1/2 or 2-1/2 x 1-1/2	2 or 3 x 1-1/2	9.5	3/8	20A6711X012	20A6711X022	22A5941X012
		12.7	1/2	20A4150X012	20A4150X022	20A4151X012
2 or 3 x 2	4 x 2	12.7	1/2	20A4097X012	20A4097X022	20A4099X012
		19.1	3/4	20A4098X012	20A4098X022	20A4100X012
2-1/2 or 4 x 2-1/2	3 or 6 x 2-1/2	12.7	1/2	20A9533X012	20A9533X022	20A9534X012
		19.1	3/4	20A4144X012	20A4144X022	20A4146X012
3	4	12.7	1/2	20A5414X012	20A5414X022	22A3458X012
		19.1	3/4	20A5342X012	20A5342X022	20A5344X012
4	6	12.7	1/2	20A2641X012	20A2641X022	21A0187X012
		19.1	3/4	20A4194X012	20A4194X0A2	20A4197X012
		25.4	1	20A4195X012	20A4195X032	20A4198X012
6	---	19.1	3/4	20A2642X012	20A2642X022	21A8443X012
		25.4	1	20A5621X012	20A5621X022	20A6706X012
8	---	19.1	3/4	21A5356X012	21A5356X022	21A5362X012
		25.4	1	21A5357X012	21A5357X022	21A5363X012
		31.8	1-1/4	21A5358X012	21A5358X022	21A5364X012

1. Not for use with 17-4PH stainless steel cages above 210°C (410°F).

Keys 2*, 7*, and 8* Valve Plug and Stem Assembly for Plain Bonnet for Spring-Loaded Seal Ring Constructions

VALVE SIZE, NPS		STEM DIAMETER		416 STAINLESS STEEL HARDENED	316 STAINLESS STEEL ⁽¹⁾	316 STAINLESS STEEL w/CoCr-A SEAT & GUIDE ⁽¹⁾
ET	EAT	mm	Inches			
1, 1-1/4	1	9.5	3/8	20A4103X052	---	---
1-1/2	2	9.5	3/8	20A6711X032	20A6711X042	22A5941X022
		12.7	1/2	20A4150X062	---	---
1-1/2 x 1	2 x 1	9.5	3/8	20A4103X042	---	---
2 or 3 x 2	4 x 2	12.7	1/2	20A4097X062	20A4097X182	20A4099X102
2-1/2 or 4 x 2-1/2	3 or 6 x 2-1/2	12.7	1/2	20A9533X052	20A9533X062	20A9534X092
2-1/2 x 1-1/2	3 x 1-1/2	12.7	1/2	20A4150X062	---	---
3	4	12.7	1/2	20A5414X062	20A5414X052	22A3458X022
		19.1	3/4	20A5342X082	---	20A5344X042
4	6	12.7	1/2	20A2641X042	20A2641X162	---
		19.1	3/4	20A4194X052	---	---
6	---	19.1	3/4	20A2642X052	20A2642X062	21A8443X032
8	---	19.1	3/4	21A5356X052	21A5356X132	21A5362X062

1. Not for use with 17-4PH stainless steel cages above 210°C (410°F).

Key 2* 1-Stage Cavitrol III Valve Plug (Fisher ET only)

VALVE SIZE, NPS	STEM DIAMETER		420 STAINLESS STEEL	316 STAINLESS STEEL w/CoCr-A ON SEAT & GUIDE ⁽¹⁾
	mm	Inches		
1	12.7	1/2	28A1001X012	28A2226X012
1-1/2	12.7	1/2	28A1002X012	28A2227X012
	12.7	1/2	28A1003X012	28A2228X012
2	19.1	3/4	28A1004X012	28A2229X012
	12.7	1/2	28A1005X012	28A2230X012
2-1/2	19.1	3/4	28A1006X012	28A2231X012
	12.7	1/2	28A1007X012	28A2232X012
3	19.1	3/4	28A1008X012	28A2233X012
	19.1	3/4	28A1010X012	28A2234X012
4	25.4	1	28A1011X012	28A2235X012
	25.4	1	28A1013X012	28A2236X012
6	31.8	1-1/4	28A1014X012	28A2237X012
	25.4	1	28A1016X012	28A2238X012
8	31.8	1-1/4	28A1017X012	28A2239X012

1. Not for use with 17-4PH stainless steel cages above 210°C (410°F).

Key 2* 2-Stage Cavitrol III Valve Plug & Stem Assy (Fisher ET only)

VALVE SIZE, NPS	TRAVEL		ACTUATOR GROUP (FROM PRECEDING TABLE)	STEM DIAMETER		316 STAINLESS STEEL STEM		17-4PH STAINLESS STEEL STEM	
	mm	Inches		mm	Inches	420 HT Valve Plug	316 Stainless Steel Valve Plug w/CoCr-A Seat & Guide	420 HT Valve Plug	316 Stainless Steel Valve Plug w/CoCr-A Seat & Guide
1	25	1	1	12.7	1/2	24A5265X022	24A5519X022	---	---
1-1/2	38	1.5	1	12.7	1/2	24A5266X022	24A5286X022	---	---
2	51	2	1	12.7 19.1	1/2 3/4	24A3038X022 24A5550X022	24A5287X022 24A5551X022	24A3038X032 ---	24A5287X032 ---
2-1/2	64	2.5	1 400 1, 402, 403	12.7 12.7 19.1	1/2 1/2 3/4	24A5267X022 24A5267X032 24A5268X022	24A5288X022 24A5288X032 24A5289X022	24A5267X042 24A5267X052 ---	24A5288X042 24A5288X052 ---
3	76	3	1, 400 1, 402, 403	12.7 19.1	1/2 3/4	24A5269X022 23A9452X012	24A5290X022 24A5291X022	24A5269X032 ---	24A5290X032 ---
4	76	3	1, 402, 403	19.1	3/4	23A5818X022	24A5292X022	---	---
	102	4	401, 402, 403	19.1	3/4	23A5818X032	24A5292X032	---	---
	76	3	100, 101	25.4	1	24A5270X022	24A5293X022	---	---
	102	4	404	25.4	1	24A5270X022	24A5293X022	---	---
	102	4	405, 406	25.4	1	24A5270X042	24A5293X042	---	---
6	102	4	407	25.4	1	24A5270X032	24A5293X032	---	---
	76	3	1	19.1	3/4	23A5803X022	24A5294X022	23A5803X032	24A5294X032
	102	4	401, 403	19.1	3/4	23A5803X022	24A5294X022	23A5803X032	24A5294X032
	102	4	402	19.1	3/4	23A5803X042	24A5294X042	23A5803X052	24A5294X052
	76	3	100, 101	25.4	1	24A3028X042	24A5295X022	---	---
8	102	4	405, 406	25.4	1	24A3028X052	24A5295X032	---	---
	102	4	407	25.4	1	24A3028X062	24A5295X042	---	---
	76	3	1	19.1	3/4	24A1141X092	34A4269X042	24A1141X072	34A4269X052
	102	4	401, 403	19.1	3/4	24A1141X092	34A4269X042	24A1141X072	34A4269X052
	102	4	402	19.1	3/4	24A1141X042	34A4269X062	24A1141X082	34A4269X072
	153	6	801	19.1	3/4	24A1141X032	34A4269X022	24A1141X062	34A4269X032
	76	3	100, 101	25.4	1	24A5273X022	34A4270X022	24A5273X032	34A4270X032
	102	4	404	25.4	1	24A5273X022	34A4270X022	24A5273X032	34A4270X032
	153	6	802	25.4	1	24A5273X022	34A4270X022	24A5273X032	34A4270X032
	102	4	407	25.4	1	24A5273X042	34A4270X042	24A5273X052	34A4270X052
	102	4	405, 406	25.4	1	24A5273X062	34A4270X062	24A5273X072	34A4270X072
	76	3	100, 101	31.8	1-1/4	24A7259X022	34A7260X022	---	---
	102	4	404	31.8	1-1/4	24A7259X022	34A7260X022	---	---
153	6	802	31.8	1-1/4	24A7259X022	34A7260X022	---	---	
102	4	407	31.8	1-1/4	24A7259X032	34A7260X032	---	---	
102	4	405, 406	31.8	1-1/4	24A7259X042	34A7260X042	---	---	

Key 2* Whisper Trim III Valve Plug with Two-Piece Seal Ring (NPS 6 Fisher ET only)

STEM DIAMETER		17-4PH STAINLESS STEEL (H900)	316 STAINLESS STEEL	316 STAINLESS STEEL W/CoCr-A ON SEAT	316 STAINLESS STEEL W/CoCr-A ON SEAT AND GUIDE	316 STAINLESS STEEL W/CoCr-A ON SEAT AND GUIDE(1)
mm	Inches					
19.1	3/4	22A3259X012	22A3259X022	22A3260X012	22A3261X012	22A3267X012
25.4	1	22A3262X012	22A3262X022	22A3263X012	22A3264X012	22A3268X012

1. High temperature.

Key 2* Whisper Trim III Valve Plug for Spring Loaded Seal Ring (NPS 6 Fisher ET only)

STEM DIAMETER		17-4PH (H900)	316 STAINLESS STEEL	316 STAINLESS STEEL W/CoCr-A ON SEAT	316 STAINLESS STEEL W/CoCr-A ON SEAT AND GUIDE
mm	Inches				
19.1	3/4	22A3269X012	22A3269X022	22A3270X012	22A3271X012
25.4	1	22A3272X012	22A3272X022	22A3273X012	22A3274X012

Key 3* Quick Opening Cage

VALVE SIZE, NPS		17-4PH STAINLESS STEEL (H900)	316 STAINLESS STEEL		ALLOY 6
ET	EAT		Chrome Plated	ENC	
1, 1-1/4, 1-1/2 x 1, or 2 x 1	1 or 2 x 1	2U215033272	2U691146102	2U740348932	2U215039102
1-1/2 or 2-1/2 x 1-1/2	2 or 3 x 1-1/2	2U219233272	2U691846102	2U725448932	2U219239102
2 or 3 x 2	4 x 2	2U223433272	2U692146102	2U740448932	2U223439102
2-1/2 or 4 x 2-1/2	3 or 6 x 2-1/2	2U227633272	2U692446102	2U740548932	2U227639102
3	4	2U231833272	2U692746102	2U740648932	2U231839102
4	6	2U236033272	2U693046102	2U740748932	2U236039102
6	---	2U506333272	2U693546102	2U806948932	2U506339102
8	---	20A3249X012	20A4350X012	20A5469X012	20A3249X092

Key 3* Linear Cage

VALVE SIZE, NPS		17-4PH STAINLESS STEEL (H900)	316 STAINLESS STEEL		ALLOY 6
ET	EAT		Chrome Plated	ENC	
1, 1-1/4, 1-1/2 x 1, or 2 x 1	1 or 2 x 1	2U215633272	2U691746102	2U741448932	2U215639102
1-1/2 or 2-1/2 x 1-1/2	2 or 3 x 1-1/2	2U219833272	2U692046102	2U741548932	2U219839102
2 or 3 x 2	4 x 2	2U224033272	2U692346102	2U741648932	2U224039102
2-1/2 or 4 x 2-1/2	3 or 6 x 2-1/2	2U228233272	2U692646102	2U741748932	2U228239102
3	4	2U232433272	2U692946102	2U741848932	2U232439102
4	6	2U236633272	2U693346102	2U741948932	2U236639102
6	---	2U506133272	2U693846102	2U806848932	2U506139102
8	---	20A3247X012	20A4349X012	20A5468X012	20A3247X092

Key 3* Equal Percentage Cage

VALVE SIZE, NPS		17-4PH STAINLESS STEEL (H900)	316 STAINLESS STEEL		ALLOY 6
ET	EAT		Chrome Plated	ENC	
1, 1-1/4, 1-1/2 x 1, or 2 x 1	1 or 2 x 1	2U215333272	2U691346102	2U740848932	2U215339102
1-1/2 or 2-1/2 x 1-1/2	2 or 3 x 1-1/2	2U219533272	2U691946102	2U740948932	2U219539102
2 or 3 x 2	4 x 2	2U223733272	2U692246102	2U741048932	2U223739102
2-1/2 or 4 x 2-1/2	3 or 6 x 2-1/2	2U227933272	2U692546102	2U741148932	2U227939102
3	4	2U232133272	2U692846102	2U741248932	2U232139102
4	6	2U236333272	2U693146102	2U741348932	2U236339102
6	---	2U505933272	2U693746102	2U806748932	2U505939102
8	---	20A3245X012	20A4348X012	20A5467X012	20A3245X092

Key 3* Whisper Trim I Cage

VALVE SIZE, NPS		17-4PH STAINLESS STEEL (H900)
ET	EAT	
1, 1-1/4, 1-1/2 x 1, or 2 x 1	1 or 2 x 1	2V502333272
1-1/2 or 2-1/2 x 1-1/2	2 or 3 x 1-1/2	2V502433272
2 or 3 x 2	4 x 2	2V502533272
2-1/2 or 4 x 2-1/2	3 or 6 x 2-1/2	2V502633272
3	4	2V502733272
4	6	23A8915X032
6	---	23A8913X032

Key 3* Whisper Trim III Cage (NPS 6 Fisher ET only)

LEVEL	416 STAINLESS STEEL	316 STAINLESS STEEL (ENC)	316 STAINLESS STEEL (Cr Cr)
A3	32A3248X012	32A3251X012	32A3336X012
B3	32A3249X012	32A3252X012	32A3337X012
C3	32A3250X012	32A3253X012	32A3338X012
D3	32A6217X012	32A6220X012	32A6741X012

Key 3* Cavitrol III Cage Assembly, 17-4PH stainless steel (H900)

ET VALVE SIZE, NPS	STAGE		
	1	2	Characterized 2
1	38A1018X012	24A5558X012	24A5558X022
1-1/2	38A1019X012	24A5559X012	24A5559X022
2	38A1020X012	24A3031X032	24A3031X022
2-1/2	38A1021X012	24A5560X012	24A5560X022
3	38A1023X012	23A9453X022	23A9453X012
4	38A1025X012	23A5817X032	23A5817X022
6	38A1027X012	23A5804X012	23A5804X022
8	38A1029X012	24A3020X032	24A3020X042

Key 7* Fisher ET Valve Plug Stem, 316 stainless steel (not for Cavitrol III or Whisper Trim III cage)

VALVE SIZE, NPS	STEM DIAMETER & VSC(1) SIZE	PLAIN BONNET(3)					EXTENSION BONNET					
		Stem Length		Part Number	Style 1(4)			Style 2				
		mm	Inches		Stem Length		Part Number	Stem Length		Part Number		
				mm	Inches	mm		Inches				
Full Capacity	1, 1-1/4, or 1-1/2	9.5	3/8	225	8.875	1U388835162	311	12.25	1U217735162	405	15.9375	10A8823X022
		12.7	1/2	300	11.8125	1U389035162	402	15.8125	1U217935162	473	18.625	1U218035162
	2	12.7	1/2	311	12.25	1K586935162	413	16.25	1U226335162	614	24.1875	1U226435162
		19.1	3/4	372	14.625	1U226535162	483	19	1L400135162	---	---	---
	2-1/2 or 3	12.7	1/2	321	12.625	1U230535162	421	16.5625	1U230635162	624	24.5625	1U230735162
		19.1	3/4	381	15	1U230835162	502	19.75	1U444635162	---	---	---
	4	12.7	1/2	321	12.625	1U230535162	421	16.5625	1U230635162	624	24.5625	1U230735162
		19.1	3/4	394	15.5	1K587735162	502	19.75	1U444635162	694	27.3125	1U240035162
		25.4(1)	1(1)	464	18.25	1K759035162	---	---	---	---	---	---
		25.4(2)	1(2)	489	19.25	1U217535162	---	---	---	---	---	---
	6	19.1	3/4	403	15.875	1L996435162	511	20.125	1U507135162	699	27.5	1U524435162
		25.4	1	499	19.625	1N704735162	630	24.8125	1K785135162	---	---	---
31.8		1-1/4	508	20	1K415435162	656	25.8125	1R562435162	---	---	---	
8	19.1	3/4	492	19.375	1K588035162	533	21	1U928235162	---	---	---	
	25.4	1	614	24.1875	1K7891X0012	614	24.1875	1K7891X0012	---	---	---	
	31.8	1-1/4	705	27.4375	1L268835162	705	29.4375	1L268835162	---	---	---	
Restricted Capacity	1-1/2 x 1	9.5	3/8	241	9.375	1U223635162	324	12.75	1U227035162	418	16.4375	1U227235162
		12.7	1/2	311	12.25	1K586935162	413	16.25	1U226335162	486	19.125	1U227335162
	2 x 1 or 2-1/2 x 1-1/2	12.7	1/2	300	11.8125	1U389035162	402	15.8125	1U217935162	605	23.8125	1U3893X0012
		12.7	1/2	311	12.25	1K586935162	413	16.25	1U226335162	614	24.1875	1U226435162
3 x 2	19.1	3/4	372	14.625	1U226535162	483	19	1L400135162	---	---	---	
	12.7	1/2	321	12.625	1U230535162	421	16.5625	1U230635162	624	24.5625	1U230735162	
4 x 2-1/2	19.1	3/4	381	15	1U230835162	502	19.75	1U444635162	681	26.8125	1U232335162	

1. 667 actuator.
 2. 657 or 585C Series actuator.
 3. Plain bonnet is standard for NPS 8 cast iron and WCC valve bodies.
 4. Style 1 extension bonnet is standard for NPS 8 316 SST valve bodies.

Key 7* Whisper Trim III Valve Plug Stem, 316 stainless steel (NPS 6 Fisher ET only)

STEM DIAMETER		PLAIN BONNET	EXTENSION BONNET	
mm	Inches		Style 1	Style 2
19.1	3/4	1U294135162	1U928235162	1U6276X0012
25.4	1	1P847635162	1U627735162	---

Key 7* 1-Stage Cavitrol III Valve Plug Stem (Fisher ET only)

VALVE SIZE, NPS	TRAVEL		ACTUATOR GROUP (FROM PRECEDING TABLE)	STEM DIAMETER		316 STAINLESS STEEL	17-4PH STAINLESS STEEL STEM
	mm	Inches		mm	Inches		
1	19, 25	0.75, 1	1	12.7	1/2	1U389035162	1U3890X0062
1-1/2	19, 22	0.75, 0.875	1	12.7	1/2	1U389035162	1U3890X0062
2	26	1.125	1 1	12.7 19.1	1/2 3/4	1K586935162 1U226535162	10A8840XC82 1U226535382
2-1/2	38	1.5	1 1	12.7 19.1	1/2 3/4	1U230535162 1U230835162	1U2305X0012 1U2308X0082
3	38, 41	1.5, 1.625	1 1	12.7 19.1	1/2 3/4	1U230535162 1U230835162	1U2305X0012 1U2308X0082
4	51, 54	2, 2.125	1	19.1	3/4	1K587735162	1K5877X0022
	54	2.125	402	19.1	3/4	1V142235162	1V1422X0042
	54	2.125	403	19.1	3/4	1U293835162	1U2938X0062
6	51, 54	2, 2.125	100 101	25.4 25.4	1 1	1U217535162 1K759035162	1U217550372 1K7590X0012
	51	2	100	25.4	1	1P847635162	11A3429X252
	57	2.25	100	25.4	1	1N704735162	1N7047X0012
	51	2	100	31.8	1-1/4	1K415435162	1K415435382
	57	2.25	100	31.8	1-1/4	1N920935162	1N9209X0052
8	51, 57	2, 2.25	101 101	25.4 31.8	1 1-1/4	1P405135072 1K775335162	1P4051X0032 1K7753X0012
	76, 86	3, 3.375	100, 101, 404 100, 101, 404	25.4 31.8	1 1-1/4	10A3282X012 1R489535162	10A3282X012 1R4895X0022
	86	3.375	407 407	25.4 31.8	1 1-1/4	11A3429X012 1U9886X0012	1K7783X0052 1U9886X0152

Key 7* Valve Plug Stem for Bellows Seal Bonnet, 316 Stainless Steel

VALVE SIZE, NPS		STEM DIAMETER		STEM LENGTH		PART NUMBER
ET	EAT	mm	Inches	mm	Inches	
1, 1-1/4, 1-1/2, or 1-1/2 X 1	1, 2, or 2 x 1	9.5 12.7	3/8 1/2	222 286	8.75 11.25	1R288535162 1R288835162
2, 2-1/2, 2-1/2 X 1-1/2, or 3	3 or 4	12.7	1/2	314	12.375	1U389235162
---	3 x 1-1/2	12.7	1/2	295	11.625	1U388935162
2 x 1 or 3 x 2	4 x 2	12.7	1/2	305	12	1U389135162
4	6	12.7 19.1	1/2 3/4	327 387	12.875 15.25	2R369335072 1K587635162
4 x 2-1/2	6 x 2-1/2	12.7 19.1	1/2 3/4	327 375	12.875 14.75	2R369335072 1U389435162
6	---	19.1	3/4	387	15.25	1K587635162

Key 9* Fisher EAT Liner

Liner Material	Valve Size, NPS	CL150 Raised Face	CL300 Raised Face	CL600 Raised Face	Socket Weld	Schedule 40 or 80 Butt Weld
416 stainless steel (hardened)	1	1V560146172	1U384246172	1V560246172	1V560146172	1V560146172
	2	1V560346172	1U384346172	1V560546172	1V560346172	1V560346172
	2 x 1	1V560646172	1U385146172	1V387646172	1V560646172	1V560646172
	3	2V561346172	2U384546172	2V561646172	---	2V561346172
	3 x 1-1/2	2V560946172	2U385346172	2V545946172	---	2V560946172
	4	2V562246172	2U384746172	2V561946172	---	2V562246172
	4 x 2	2V561846172	2U385546172	2V561246172	---	2V561846172
	6	2V563146172	2U384946172	2V562846172	---	2U384946172
6 x 2-1/2	2V562646172	2U385746172	2V562346172	---	2U385746172	
316 stainless steel	1	1V560135072	1U384235072	1V560235072	1V560135072	1V560135072
	2	1V560335072	1U384335072	1V560535072	1V560335072	1V560335072
	2 x 1	1V560635072	1U385135072	1V387635072	1V560635072	1V560635072
	3	2V561335072	2U384535072	2V561635072	---	2V561335072
	3 x 1-1/2	2V560935072	2U385335072	2V545935072	---	2V560935072
	4	2V562235072	2U384735072	2V561935072	---	2V562235072
	4 x 2	2V561835072	2U385535072	2V561235072	---	2V561835072
	6	2V563135072	2U384935072	2V562835072	---	2U384935072
6 x 2-1/2	2V562635072	2U385735072	2V562335072	---	2U385735072	

Key 9* Metal-Seat Seat Ring (not for Whisper Trim III or Cavitrol III Cage)

VALVE SIZE, NPS		416 STAINLESS STEEL (HARDENED) ⁽¹⁾	316 STAINLESS STEEL	R30006
ET	EAT			
1, 1-1/4, or 2 x 1	1	1U222546172	1U222535072	1U222539102
1-1/2 x 1	2 x 1	1U222046172	1U222035072	1U222039102
1-1/2 or 2-1/2 x 1-1/2	2 or 3 x 1-1/2	1U221946172	1U221935072	1U221939102
2 or 3 x 2	4 x 2	1U222646172	1U222635072	1U222639102
2-1/2 or 4 x 2-1/2	3 or 6 x 2-1/2	1U222746172	1U222735072	1U222739102
3	4	1U222846172	1U222835072	1U222839102
4	6	1U222946172	1U222933092	1U222939102
6	---	1U508046172	1U508033092	1U508039102
8	---	20A3260X012	20A3260X022	20A3260X152

1. 410 stainless steel (CA15) is used for NPS 6 and 8 full-sized and restricted-trim valves.

Key 9* Cavitrol III Seat Ring (Fisher ET only)

VALVE SIZE, NPS	1-STAGE CAGE		2-STAGE CAGE	
	17-4PH Stainless Steel	Alloy 6 (Cast)	17-4PH Stainless Steel	316 Stainless Steel w/CoCr-A Seat & Bore
1	23A7567X012	23A7567X022	24A5231X012	24A5239X012
1-1/2	23A7568X012	23A7568X022	24A5232X012	24A5240X012
2	23A7569X012	23A7569X022	24A3039X012	24A5241X012
2-1/2	24A1586X012	24A1586X022	24A5233X012	24A5242X012
3	24A3016X012	24A3016X022	23A9450X012	24A5243X012
4	24A1135X012	24A1135X022	23A5813X012	24A5244X012
6	23A5820X032	23A5820X012	23A5802X022	24A5245X012
8	23A9445X022	23A9445X032	24A3021X022	24A5246X012

Key 9* Whisper Trim III Seat Ring (NPS 6 Fisher ET only)

410 Stainless Steel	316 Stainless Steel	316 Stainless Steel w/CoCr-A Seat
21A9794X012	21A9794X022	21A9795X012

Gasket Descriptions

KEY NUMBER	DESCRIPTION	MATERIAL	
		FGM -198° to 593° C (-325° to 1100° F)	
10 ⁽¹⁾	Bonnet Gasket	Graphite/S31600	
11	Cage Gasket		
13	Seat Ring or Liner Gasket		
14 or 20	Adapter Gasket		
12	Spiral-Wound Gasket	N06600/Graphite	
27 or 51	Shim	S31600 (316 SST)	

1. 2 req'd for 2-stage Cavitrol III cage.

Keys 10*, 11*, 12*, 13*, 14*, 20*, 27*, and 51* Gaskets and Shims

Valve Size, NPS		Standard Trim Cage Whisper Trim I Cage Cavitrol III - 1 Stage Cage		Cavitrol III - 2 Stage Cage Whisper Trim III Cage WhisperFlo Cage		VALVE SIZE, NPS		Standard Trim Cage Whisper Trim I Cage Cavitrol III - 1 Stage Cage		Cavitrol III - 2 Stage Cage Whisper Trim III Cage WhisperFlo Cage	
ET	EAT	Key Number	-198 to 593° C (-325 to 1100° F)	Key Number	-198 to 593° C (-325 to 1100° F)	ET	EAT	Key Number	-198 to 593° C (-325 to 1100° F)	Key Number	-198 to 593° C (-325 to 1100° F)
1 or 1-1/4	1	Set 10 12 13 27 or 51	RGASKETX162 1R2859X0042 1R286099442 1R2862X0062 16A1936X012	Set 10 12 13 51	RGASKETX422 1R2859X0042(qty 2) 1R286099442 1R2862X0062 16A1936X012	3	4	Set 10 12 13 27 or 51	RGASKETX202 1R3484X0042 1R348299442 1R3481X0052 16A1940X012	Set 10 12 13 51	RGASKETX462 1R3484X0042(qty 2) 1R348299442 1R3481X0052 16A1940X012
1-1/2	2	Set 10 12 13 27 or 51	RGASKETX172 1R3101X0032 1R309999442 1R3098X0052 16A1937X012	Set 10 12 13 51	RGASKETX432 1R3101X0032(qty 2) 1R309999442 1R3098X0052 16A1937X012	3 x 2	4 x 2	Set 10 11 12 13 14 27 or 51	RGASKETX272 1R3484X0042 1R3298X0032 1R329799442 1R3296X0042 1R3481X0052 16A1938X012	---	---
1-1/2 x 1	2 x 1	Set 10 11 12 13 20 27 or 51	RGASKETX242 1R3101X0032 1R2861X0042 1R286099442 1R3098X0052 1U2152X0042 16A1936X012	---	---	4	6	Set 10 12 13 27 or 51	RGASKETX212 1R3724X0042 1R372299442 1J5047X0062 16A1941X012	Set 10 12 13 51	RGASKETX472 1R3724X0042(qty 2) 1R372299442 1J5047X0062 16A1941X012
2	---	Set 10 12 13 51	RGASKETX182 1R3299X0042 1R329799442 1R3296X0042 16A1938X012	Set 10 12 13 51	RGASKETX442 1R3299X0042(qty 2) 1R329799442 1R3296X0042 16A1938X012	4 x 2-1/2	6 x 2-1/2	Set 10 11 12 13 14 27 or 51	RGASKETX282 1R3724X0042 1R3846X0042 1R384599442 1R3844X0052 1J5047X0062 16A1939X012	---	---
2 x 1	---	Set 10 11 12 13 14 51	RGASKETX252 1R3299X0042 1R2861X0042 1R286099442 1R2862X0062 1R3296X0042 16A1936X012	---	---	6	---	Set 10 12 13 51	RGASKETX222 1U5081X0052 1U508599442 1U5086X0032 16A1942X012	Set 10 12 13 51	RGASKETX482 1U5081X0052(qty 2) 1U508599442 1U5086X0032 16A1942X012
2-1/2	3	Set 10 12 13 27 or 51	RGASKETX192 1R3847X0032 1R384599442 1R3844X0052 16A1939X012	Set 10 12 13 51	RGASKETX452 1R3847X0032(qty 2) 1R384599442 1R3844X0052 16A1939X012	8	---	Set 10 13	RGASKETX232 10A3265X112 10A3266X082	Set 10 13	10A3265X152 10A3265X112(qty 2) 10A3266X082
2-1/2 x 1-1/2	3 x 1-1/2	Set 10 11 12 13 14 27 or 51	RGASKETX262 1R3847X0032 1R3100X0032 1R309999442 1R3098X0052 1R3844X0052 16A1937X012	---	---						

Key 21*, 22*, and 23* PTFE Seat Disk Retainer, Disk Seat, and Disk

VALVE SIZE, NPS		KEY 21 DISK RETAINER, 316 STAINLESS STEEL	KEY 22 DISK SEAT		KEY 23 DISK, PTFE -73 TO 204 °C (-100 TO 400 °F)
ET	EAT		316 Stainless Steel	Alloy 6 (Cast)	
1, 1-1/4, or 2 x 1	1	1V710035072	1V710235072	1V710239102	1V710106242
1-1/2 or 2-1/2 x 1-1/2	2 or 3 x 1-1/2	1V710335072	1V710535072	1V710539102	1V710406242
1-1/2 x 1	2 x 1	1V712135072	1V712235072	1V712239102	1V710106242
2 or 3 x 2	4 x 2	1V710835072	1V710635072	1V710639102	1V710706242
2-1/2 or 4 x 2-1/2	3 or 6 x 2-1/2	1V710935072	1V711135072	1V711139102	1V711006242
3	4	1V711235072	1V711435072	1V711439102	1V711306242
4	6	1V711533092	1V711733092	1V711739102	1V711606242
6	All except Whisper Trim III cage	---	1V711833092	1V712033092	1V7120X0012
	Whisper Trim III cage	---	23A4937X012	23A4938X012	---
8	---	10A4466X012	20A4467X012	20A4467X022	20A4468X012

Key 27* Retaining Ring for Spring-Loaded Seal Ring, 302 SST

VALVE SIZE, NPS		PART NUMBER
ET	EAT	
1, 1-1/4 1-1/2 x 1, or 2 x 1	1 or 2 x 1	10A4211X012
1-1/2 or 2-1/2 x 1-1/2 2 or 3 x 2 2-1/2 or 4 x 2-1/2 3 4 6 (Whisper Trim III only)	2 or 3 x 1-1/2 4 x 2 3 or 6 x 2-1/2 4 6 ---	10A4220X012 10A4210X012 10A4219X012 10A5350X012 10A4225X012 10A5410X012

Key 27* Cavitrol III Retaining Ring for NPS 1 through 6 Fisher ET only, 302 SST

VALVE SIZE, NPS	1-STAGE CAGE	2-STAGE CAGE
1	10A4211X012	11A3405X012
1-1/2	10A4220X012	10A4211X012
2	10A4210X012	10A4220X012
2-1/2	10A4219X012	10A4210X012
3	10A5350X012	10A4219X012
4	10A4225X012	10A4219X012
6	None required	10A5410X012

Key 24* Seal Ring (Fisher EAT)

Key 28* Seal Ring (Fisher ET) (not for Cavitrol III or Whisper Trim III Construction)

VALVE SIZE, NPS		STANDARD, CARBON FILLED PTFE	SPRING-LOADED
ET	EAT		PTFE -73 to 232 °C (-100 to 450 °F)
1, 1-1/4, 1-1/2 x 1, or 2 x 1	1 or 2 x 1	1V659105092	10A4207X012
1-1/2 or 2-1/2 x 1-1/2	2 or 3 x 1-1/2	1V659305092	10A4216X012
2 or 3 x 2	4 x 2	1V550805092	10A4206X012
2-1/2 or 4 x 2-1/2	3 x 2 or 6 x 2-1/2	1V659505092	10A4215X012
3	4	1V659705092	10A5351X022
4	6	1V659905092	10A4223X012
6	---	1V660105092	10A2643X022
8	---	---	10A3261X012

Key 28* Cavitrol III Seal Ring for Fisher ET only, spring loaded PTFE

VALVE SIZE, NPS	1-STAGE CAGE	2-STAGE CAGE
1	10A4207X012	11A3407X042
1-1/2	10A4216X012	10A4207X012
2	10A4206X012	10A4216X012
2-1/2	10A4215X012	10A4206X012
3	10A5351X022	10A4215X012
4	10A4223X012	10A4215X012
6	10A2643X022	10A5411X022
8	10A3261X012	10A2643X022

Key 28* Whisper Trim III Seal (NPS 6 Fisher ET only)

CARBON FILLED PTFE	SPRING LOADED PTFE
11A9729X012	10A5411X022

Key 25* Backup Ring (Fisher EAT)

Key 29* Backup Ring (Fisher ET) (not for Cavitrol III or NPS 8 ET)

VALVE SIZE, NPS		STANDARD CONSTRUCTION			SPRING LOADED SEAL CONSTRUCTION	
ET	EAT	Nitrile -34 to 93°C (-30 to 200°F)	Fluorocarbon ⁽¹⁾ -18 to 204°C (-0 to 400°F)	Ethylene Propylene -40 to 232°C (-40 to 450°F)	416 Stainless Steel	316 Stainless Steel
1, 1-1/4, 1-1/2 x 1, or 2 x 1 1-1/2 or 2-1/2 x 1-1/2 2 or 3 x 2 2-1/2 or 4 x 2-1/2 3 4	1 or 2 x 1 2 or 3 x 1-1/2 4 x 2 3 or 6 x 2-1/2 4 6	1V659003052 1V659203052 1V550703052 1V659403052 1V659603052 1V659803052	1V659005292 1V659205292 1V550705292 1V659405292 1V659605292 1V659805292	1V6590X0042 1V6592X0032 1V5507X0042 1V6594X0032 1V6596X0032 1V6598X0022	10A4209X012 10A4218X022 10A4208X012 10A4217X012 10A5349X012 10A4224X012	10A4209X022 10A4218X012 10A4208X022 10A4217X022 10A5349X022 10A4224X022
6	All except Whisper Trim III cage	---	1V660003052	1V660005292	1V6600X0022	---
	Whisper Trim III cage	---	11A9728X022	11A9728X012	11A9728X042	12A3332X012

1. Not for use with steam or ammonia. Not recommended for water above 82°C (180°F).

Key 29* Cavitrol III Backup Ring, 416 Stainless Steel (not for NPS 8 Fisher ET)

VALVE SIZE, NPS	1-STAGE CAGE	2-STAGE CAGE
1	10A4209X012	11A3404X012
1-1/2	10A4218X022	10A4209X022
2	10A4208X012	10A4218X022
2-1/2	10A4217X012	10A4208X012
3	10A5349X012	10A4217X012
4	10A4224X012	10A4217X012
6	None required	10A5409X012

Keys 3*, 9*, 2*, 28*, 63*, 29*, and 27* TSO Trim Parts for Fisher ET Valves

VALVE SIZE, NPS	PORT, INCH	TRAVEL, INCH	TRIM	STEM DIAMETER		ACTUATOR GROUP	CHARACTERISTIC	KEY 3	KEY 3	KEY 9	KEY 2
				mm	Inch			Cage Full 2-Stage	Cage Characterized 2-Stage	Seat Ring	Plug / Stem Assembly
3	2.6875	3	810 816	12.7	1/2	1 & 400	Cavitrol III	23A9453X022	23A9453X012	28B1302X012 28B1303X012	28B1306X012 28B1306X022
			810 816	19.1	3/4	100 & 101		23A9453X022	23A9453X012	28B1302X012 28B1303X012	27B6604X112 27B6604X122
4	2.6875	3	810	19.1	3/4	1, 402, 403	Cavitrol III	23A5817X032	23A5817X022	28B1307X012	28B1310X012
		4				401, 403					
		4				402					
VALVE SIZE, NPS	PORT, INCH	TRAVEL, INCH	TRIM	STEM DIAMETER		ACTUATOR GROUP	CHARACTERISTIC	KEY 28	KEY 63	KEY 29	KEY 27
				mm	Inch			Seal Ring	Anti-Extrusion Ring	Back-Up Ring	Retaining Ring
3	2.6875	3	810 816	12.7	1/2	1 & 400	Cavitrol III	10A4215X102	22B2617X012	10A4217X012 10A4217X022	10A4219X012 10A4219X082
			810 816	19.1	3/4	100 & 101				10A4217X012 10A4217X022	10A4219X012 10A4219X052
4	2.6875	3	810	19.1	3/4	1, 402, 403	Cavitrol III	10A4215X102	22B2617X012	10A4217X012	10A4219X012
		4				401, 403					
		4				402					

Keys 3*, 7*, 24*, 63*, 25*, and 27* TSO Trim Parts for Fisher ET and EAT Valves⁽¹⁾

VALVE SIZE, NPS		PORT	TRAVEL	STEM DIAMETER		CHARACTERISTIC	KEY 3	KEY 7	KEY 24	KEY 63	KEY 25	KEY 27
ET	EAT	Inch	Inch	mm	Inch		Cage	Plug/Stem Assembly	Seal Ring	Anti-Extrusion Ring	Back-Up Ring	Retaining Ring
3	4	3.25	1.5	12.7	1/2	Linear Equal % Quick Open	2U232433272 2U232133272 2U231833272	27B9567X012	10A5351X112	23B6126X012	10A5349X012	10A5350X012
4	6	4.1875	2	19.1	3/4	Linear Equal % Quick Open	2U236633272 2U236333272 2U236033272	38B0282X012	10A4223X142	21B9341X012	10A4224X012	10A4225X012

1. Trim is 812.

Key 9* TSO Trim Parts for Fisher ET and EAT Valves⁽¹⁾

VALVE SIZE, NPS		PORT, INCH	KEY 9				
ET	EAT		Seat Ring	Seat and Liner			
		CL150 Raised Face		CL300 Raised Face	CL600 Raised Face	Schedule 40 or 80 ButtWeld	
3	4	3.25	37B9563X012	38B0273X012	38B0273X022	38B0273X032	38B0273X012
4	6	4.1875	38B0276X012	38B0277X012	38B0276X022	38B0276X032	38B0276X022

1. Trim is 812.

Keys 63*, 28*, 29*, 27*, 2*, and 9* Fisher ET Full Capacity Trim above 232°C (450°F) using PEEK Anti-Extrusion Rings

VALVE SIZE, NPS	PORT	Use w/ Cage/See Footnote	KEY 63	KEY 28	KEY 29	KEY 27	KEY 2	STEM CONN DIAMETER, INCHES	KEY 9
			Anti-Extrusion Ring	Seal Ring	Back-Up Ring	Retaining Ring	Plug ⁽¹⁾		Seat Ring ⁽¹⁾
1	1.3125	A	23B6125X012	10A4207X032	10A4209X012	10A4211X012	33B6091X012	0.375	21B3686X012
1-1/2	1.875	A	22B4694X012	10A4216X032	10A4218X022	10A4220X012	33B6093X012 33B6094X012	0.375 0.5	21B6970X012
2	2.3125	A	21B9340X012	10A4206X032	10A4208X012	10A4210X012	33B6097X012 33B6098X012	0.5 0.75	10B8254X012
2-1/2	2.875	A	22B2617X012	10A4215X032	10A4217X012	10A4219X012	33B6109X012 33B6110X012	0.5 0.75	21B3687X012
3	3.4375	A	23B6126X012	10A5351X062	10A5349X012	10A5350X012	33B6105X012 33B6106X012	0.5 0.75	23B6127X012
4	4.375	A	21B9341X012	10A4223X032	10A4224X012	10A4225X012	33B6101X012 33B6102X012 33B6111X012	0.5 0.75 1	23B6128X012
6	7	A	22B5998X012	10A2643X032	12B5997X012	14A4652X012	33B6115X012 33B6116X012	0.75 1	29A9703X012
6	5.375	C	21B9342X012	10A5411X032	12A3332X012	10A5410X012	33B6134X012 33B6136X012	0.75 1	33B6146X012
8	8	B	22B9203X012	10A3261X032	11B8325X022	11B8322X012	33B6119X012 33B6120X012 33B6121X012	0.75 1 1.25	29A9704X012

A—Cages - Quick opening, equal percentage, linear, Whisper I.
 B—Cages - Equal percentage, linear - plug & seat ring material CA15 (cast 410).
 C—Cages - Whisper III - plug material 17-4PH H900 - seat ring material forged F6A (SST).
 1. Seat rings with wide bevel seat and plugs with radius seat.

Keys 63*, 28*, 29*, 27*, 2*, and 9* Fisher ET Restricted Trim above 232°C (450°F) using PEEK Anti-Extrusion Rings

VALVE SIZE, NPS	PORT	KEY 63	KEY 28	KEY 29	KEY 27	KEY 2	STEM CONN DIAMETER, INCHES	KEY 9
		Anti-Extrusion Ring	Seal Ring	Back-Up Ring	Retaining Ring	Plug ⁽¹⁾		Seat Ring ⁽¹⁾
1-1/2 x 1	1.3125	23B6125X012	10A4207X032	10A4209X012	10A4211X012	33B6091X012	0.375	22B3550X012
2-1/2 x 1-1/2	1.875	22B4694X012	10A4216X032	10A4218X022	10A4220X012	33B6094X012	0.5	21B6970X012
3 x 2	2.3125	21B9340X012	10A4206X032	10A4208X012	10A4210X012	33B6097X012 33B6098X012	0.5 0.75	10B8254X012
4 x 2-1/2	2.875	22B2617X012	10A4215X032	10A4217X012	10A4219X012	33B6109X012 33B6110X012	0.5 0.75	21B3687X012

Cages - Quick opening, equal percentage, linear, Whisper I.
 1. Seat rings with wide bevel seat and plugs with radius seat.

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67CF Series Installation Sheet

Introduction

This installation sheet covers the installation and startup of the 67CF Series filter regulators. If maintenance is required, refer to the 67CF Series Instruction Manual, form 5469. Contact your local Sales Office to receive a copy of the instruction manual.

Specifications

- **Maximum Inlet Pressure:**
250 psig (17,2)
- **Maximum Outlet Pressure:**
50 psi (3,4 bar) over outlet pressure setting
- **Outlet Pressure Ranges:**
0 to 35 psig (0 to 2,4 bar)
0 to 60 psig (0 to 4,1 bar)
0 to 125 psig (0 to 8,6 bar)
- **Temperature Capabilities with Nitrile (NBR):**
-40° to 180°F (-40° to 82°C)

Installation



WARNING

Personal injury, property damage, equipment damage, or leakage due to escaping gas or bursting of pressure-containing parts may result if this regulator is overpressured or is installed where service conditions could exceed the limits given in the specifications, or where conditions exceed any ratings of the adjacent piping or piping connections. To avoid such injury or damage, provide pressure-relieving or pressure-limiting devices (as required by the appropriate code, regulation, or standard) to

prevent service conditions from exceeding those limits.

The internal relief valve in the Type 67CFR regulator does not provide full overpressure protection. The internal relief valve is designed for minor seat leakage only. If maximum inlet pressure to the Type 67CFR exceeds the maximum pressure ratings of the downstream equipment or exceeds the maximum allowable outlet pressure of the Type 67CFR, additional overpressure protection is required.

1. Regulator operation within ratings does not preclude the possibility of physical damage from external sources or debris in the lines. Regulators should be inspected for damage periodically and after an overpressure condition.
2. Only personnel qualified through training and experience should install, operate, and maintain a regulator. Make sure there is no damage to or foreign material in the regulator and all tubing or piping is free of debris.
3. Install the regulator so that flow is from the IN to the OUT connection as marked on the regulator body.
4. For best drainage, orient the drain valve (key 2) to the lowest possible point on the dripwell (key 5). This orientation may be improved by rotating the dripwell with respect to the body (key 1).



WARNING

A regulator may vent some gas to the atmosphere. In hazardous or flammable gas service, vented gas may accumulate and cause personal injury, death, or property damage due to fire or explosion. Vent a regulator in hazardous gas service to a remote, safe location away from air



67CF Series

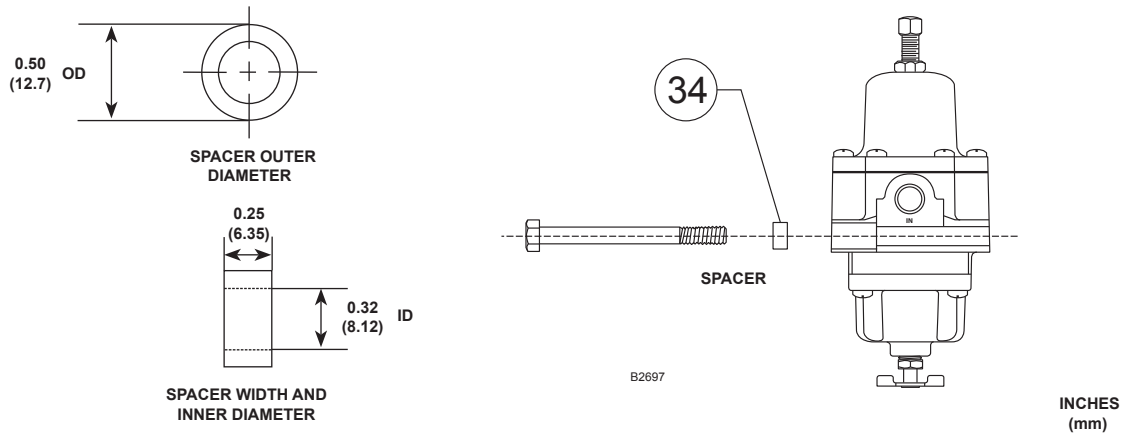


Figure 1. Spacer Diameter and Installation

intakes or any hazardous area. The vent line or stack opening must be protected against condensation or clogging.

5. A clogged spring case vent hole may cause the regulator to function improperly. To keep this vent hole from being plugged (and to keep the spring case from collecting moisture, corrosive chemicals, or other foreign material) orient the vent to the lowest possible point on the spring case or otherwise protect it. Inspect the vent hole regularly to make sure it is not plugged. Spring case vent hole orientation may be changed by rotating the spring case with respect to the body. A 1/4 NPT spring case vent may be remotely vented by installing tubing or piping into the vent.
6. For regulator shutdown, install upstream block and vent valves and downstream block and vent valves (if required), or provide some other suitable means of properly venting the regulator inlet and outlet pressures.
7. Apply a good grade of pipe compound to the male pipe threads before making connections, making sure not to get the pipe compound inside the regulator.
8. Install tubing fitting or piping into the 1/4 NPT inlet connection on the body (key 1) and into the 1/4 NPT body outlet connection.
9. The second 1/4 NPT outlet can be used for a gauge or other use. If not used, it must be plugged.
10. When installing a 67CF Series regulator in an existing installation, it may be necessary to use spacers to adapt the installation. If the mounting bolts are too long, place a spacer on the bolt. To be sure the regulator is secure, the

bolts should have at least two full threads of engagement.

Startup and Adjustment

1. With proper installation completed and downstream equipment properly adjusted, slowly open the upstream and downstream shutoff valve (when used) while using pressure gauges to monitor pressure.



WARNING

To avoid personal injury, property damage, or equipment damage caused by bursting of pressure containing parts or explosion of accumulated gas, never adjust the control spring to produce an outlet pressure higher than the upper limit of the outlet pressure range for that particular spring. If the desired outlet pressure is not within the range of the control spring, install a spring of the proper range.

2. If outlet pressure adjustment is necessary, monitor outlet pressure with a gauge during the adjustment procedure. The regulator is adjusted by loosening the locknut (key 19), if used, and turning the adjusting screw or handwheel (key 18) clockwise to increase or counterclockwise to decrease the outlet pressure setting. Tighten the locknut to maintain the adjustment position.

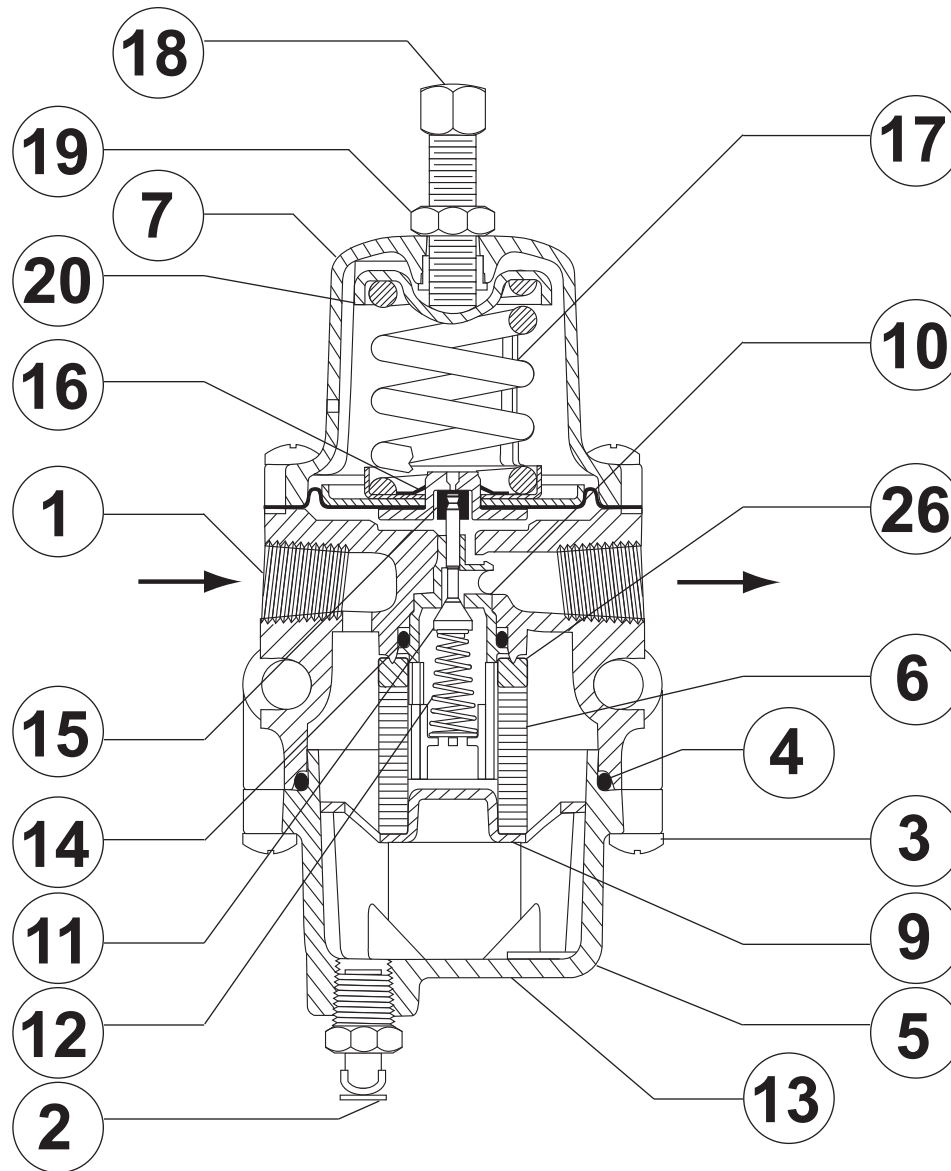


Figure 2. 67CF Series Assembly Drawings

Parts List

Key	Description
1	Body
2	Drain Valve
3	Flange Screw
4*	O-Ring
5	Dripwell
6*	Filter Element
7	Spring Case
9	Filter Retainer
10 ^{*(1)}	Valve Cartridge
11 ^{*(1)}	Valve Plug
12 ^{*(1)}	Valve Spring
13 ^{*(1)}	Valve Retainer
14 ^{*(1)}	O-Ring
15 ^{*(1)}	Soft Seat

Key	Description
16*	Diaphragm Assembly
17	Spring
18	Adjusting Screw
19	Locknut
20	Upper Spring Seat
22	Pressure Gauge
23	1/4-Inch Pipe Plug
24	Tire Valve
26*	Filter Gasket
31	Panel Mounting Nut
32	Wire Seal
33	Closing Cap
34	Spacer

^{*(1)}Recommended Spare Part

1. Valve cartridge assembly includes keys 10, 11, 12, 13, 14, 15.

67CF Series

Industrial Regulators

Emerson Process Management Regulator Technologies, Inc.

USA - Headquarters
McKinney, Texas 75069-1872 USA
Tel: 1-800-558-5853
Outside U.S. 1-972-548-3574

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For further information visit www.emersonprocess.com/regulators

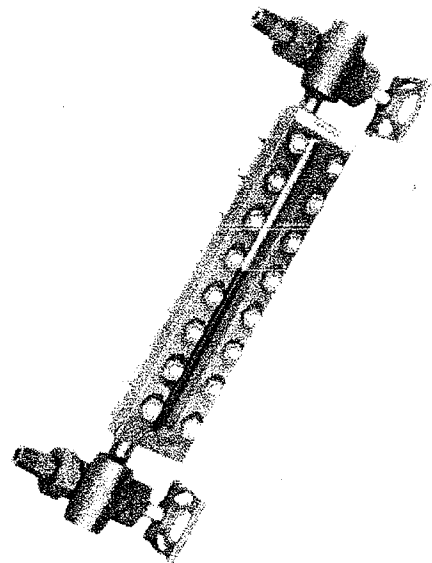
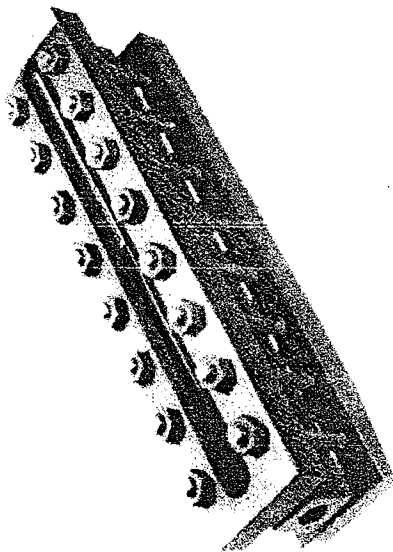
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M & M Quality

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Fax.: (905) 670-0899



Quality Machine & Metalworks Inc.

Manufacture of liquid level gauges and there associated valves.

Quality Machine & Metalworks Inc. is the only Canadian manufacturer of flat glass liquid level gauges and their associated valves. The company has been manufacturing this product since 1987. In addition to this product line, the company also offers valve assemblies for tubular glass. Originally, Quality Machine & Metalworks Inc. was sub-contracted to another Canadian company as their liquid level gauge manufacturer. Since that time, Q. M. & M. Inc. has the following accreditations for their gauges and valves.

- **ASME B16.34**
- **ISO 9002**

In addition to these Q. M. & M. Inc. has CRN numbers registered with the following:

- Alberta Boilers Safety Association, ABSA.
- Ontario Ministry of Consumer and Commercial Relations, Pressure Vessel Safety Branch, PVSB

These gauges and valves are suitable for many applications. The various industries in which this type of instrumentation is found includes the following:

- Oil and Petroleum (Pressure Vessel)
- Petrochemical (Pressure Vessel)
- Chemical (Pressure Vessel)
- Pulp and Paper (Steam Boiler)
- Pharmaceutical (Steam Boiler)
- Power and Process (Steam Boiler)

Quality Machine & Metalworks Inc. is currently registered on the Vendors Listing for Imperial Oil Limited and Petro-Canada. Registration as an approved supplier with the other major oil companies is pending. Q. M. & M. Inc. offers liquid level gauge in a medium pressure series and in a high pressure series. A low pressure series will be available in the immediate future. A series is available for extreme pressure applications.

- Q20, medium pressure For pressures up to 3,000 psi @ 100°F
- Q30, high pressure For pressures up to 4,000 psi @ 100°F
- Q40, extreme pressure For pressures up to 5,000 psi @ 100°F

The gauges are available in the nine standard glass sizes and are also available in up to nine multiple sections. For low temperature applications, Quality Machine & Metalworks Inc. can also provide the appropriate frost shields which are available in five different lengths of extension. All of the series of gauges are available in both reflex and transparent models, and furthermore, are available in the following service levels.

Series Q20 Liquid Level Gauges

Standard construction includes a solid one-piece chamber machined from bar, machined steel covers, tempered glass, alloy steel bolts and nuts. Recessed gasket seats prevent gasket movement. Series Q20 gauges are available in a variety of materials to meet specific corrosive conditions. All standard chamber materials (carbon and stainless steels) are NACE MR-01-75 acceptable materials. Non-frost extensions, illuminators, support brackets, Kel-F shields, mica shields and special alloys are available.

- Temperature range to 600°F
 Recessed gasket seats in both chamber and cover.
 Visible length from 3 3/4" up
- Quality Liquid level Gauges
 Comply with all requirements of ASME B16.34
- A rugged flat glass gauge for medium pressure applications

PRESSURE / TEMPERATURE RATINGS

(Flanged gauges take flanged rating when lower)

TRANSPARENT GLASS SIZE									
Deg°F	1	2	3	4	5	6	7	8	9
100	2000	1875	1750	1625	1500	1375	1250	1125	1000
200	1825	1710	1595	1480	1370	1255	1140	1025	910
300	1775	1665	1555	1445	1335	1220	1110	995	885
400	1715	1610	1500	1395	1285	1180	1070	960	855
500	1620	1520	1415	1315	1215	1115	1010	910	810
600	1480	1385	1295	1200	1110	1015	925	830	735
SATURATED STEAM USING MICA									
	600	600	600	600	550	500	450	400	350

REFLEX GAUGE GLASS SIZE									
Deg°F	1	2	3	4	5	6	7	8	9
100	3000	2875	2750	2625	2500	2375	2250	2125	2000
200	2735	2620	2505	2395	2280	2165	2050	1940	1825
300	2660	2550	2440	2325	2215	2105	1995	1885	1775
400	2565	2460	2355	2245	2140	2035	1925	1820	1715
500	2425	2325	2225	2120	2020	1920	1820	1720	1620
600	2215	2125	2030	1940	1845	1755	1660	1570	1480
SATURATED STEAM RATING 300 WSP									

% of Rating	100%	90%	50%
CHAMBER MATERIAL	CARBON STEEL, STAINLESS STEEL SERIES 300 OR 300L	MONEL	BRASS
GASKETING	BONDED COMPRESSED FIBERS OR TEFLON GLASS FILLED		PURE TEFLON KEL-F (SHIELDS)

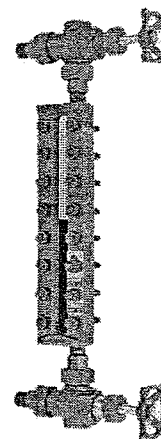
TEST PRESSURE: All gauges are hydrostatically tested by Quality prior to shipment @ 1-1/2 times the design pressure rating at 100°F

SERIES Q 20

Pressures up to 3000psi@ 100°F
 CRN ØC4222.52 / ØF4223.52



Q19-T-20



Q19-R-20

Series Q20 Gauge Specifications

Lengths

Series Q20 gauges are available in nine standard visible glass lengths. Multiples of the same size windows (up to nine sections) in a single piece bar stock liquid chamber are used for longer lengths.

Connections

Standard Series Q20 Gauges are furnished with 1/2 or 3/4 inch NPT female end connections. Other connections available: 1/2 or 3/4 inch NPT female or male, side or back, flanged ends, side or back to suit mating connections.

Liquid Chambers

Machined from bar stock with recessed gasket seats.

Covers

All covers are manufactured to be interchangeable.

Bolt & Nuts

Alloy steel to ASTM Standards.

Glass

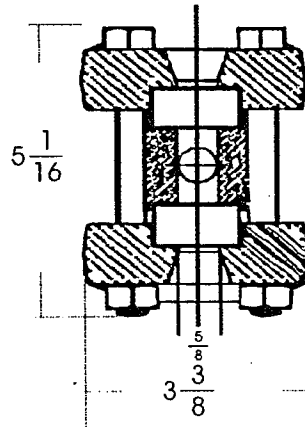
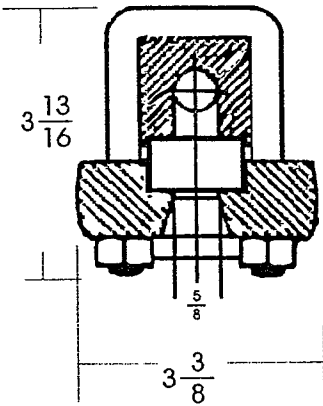
The tempered glass must be protected from corrosive substances such as caustic acid and hydrofluoric acid. Only transparent glass with mica or Kel-f shields must be used in these applications.

Gaskets

Precision die cut from the highest quality materials.

Protection

All carbon steel parts are coated both externally and internally with a high quality rust inhibitor. This coating serves as a superior bonding base for paint. It is recommended that all Q20 Gauges be installed with Quality Gauge Valves, having safety ball checks, which help provide protection against physical injury and loss of product should glass breakage occur.



Single Section Reflex Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q11-R-20	3 3/4	5 1/4	3 1/2	3 7/8	8
Q12-R-20	4 3/4	6 1/4	4 1/2	4 7/8	9
Q13-R-20	5 3/4	7 1/4	5 1/2	5 7/8	11
Q14-R-20	6 3/4	8 1/4	6 1/2	6 7/8	12
Q15-R-20	7 7/8	9 3/8	7 5/8	8	14
Q16-R-20	9 1/8	10 5/8	8 7/8	9 1/4	16
Q17-R-20	10 1/2	11 3/4	10	10 3/8	18
Q18-R-20	11 7/8	13 3/8	11 5/8	12	20
Q19-R-20	12 5/8	14 1/8	12 3/8	12 3/4	21

Single Section Transparent Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q11-T-20	3 3/4	5 1/4	3 1/2	3 7/8	12
Q12-T-20	4 3/4	6 1/4	4 1/2	4 7/8	14
Q13-T-20	5 3/4	7 1/4	5 1/2	5 7/8	17
Q14-T-20	6 3/4	8 1/4	6 1/2	6 7/8	19
Q15-T-20	7 7/8	9 3/8	7 5/8	8	21
Q16-T-20	9 1/8	10 5/8	8 7/8	9 1/4	24
Q17-T-20	10 1/2	11 3/4	10	10 3/8	27
Q18-T-20	11 7/8	13 3/8	11 5/8	12	30
Q19-T-20	12 5/8	14 1/8	12 3/8	12 3/4	32

Two Section Reflex Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q23-R-20	13	14 1/2	12 3/4	13 1/8	22
Q24-R-20	15	16 1/2	14 3/4	15 1/8	25
Q25-R-20	17 1/4	18 3/4	17	17 3/8	28
Q26-R-20	19 3/4	21 1/4	19 1/2	19 7/8	32
Q27-R-20	22	23 1/2	21 3/4	22 1/8	35
Q28-R-20	25 1/4	26 3/4	25	25 3/8	40
Q29-R-20	26 3/4	28 1/4	26 1/2	26 7/8	43

Two Section Transparent Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q23-T-20	13	14 1/2	12 3/4	13 1/8	33
Q24-T-20	15	16 1/2	14 3/4	15 1/8	38
Q25-T-20	17 1/4	18 3/4	17	17 3/8	43
Q26-T-20	19 3/4	21 1/4	19 1/2	19 7/8	49
Q27-T-20	22	23 1/2	21 3/4	22 1/8	54
Q28-T-20	25 1/4	26 3/4	25	25 3/8	61
Q29-T-20	26 3/4	28 1/4	26 1/2	26 7/8	64

Three Section Reflex Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q36-R-20	30 3/8	31 7/8	30 1/8	30 1/2	48
Q37-R-20	33 3/4	35 1/4	33 1/2	33 7/8	53
Q38-R-20	38 5/8	40 1/8	38 3/8	38 3/4	60
Q39-R-20	40 7/8	42 3/8	40 5/8	41	64

Three Section Transparent Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q36-T-20	30 3/8	31 7/8	30 1/8	30 1/2	73
Q37-T-20	33 3/4	35 1/4	33 1/2	33 7/8	80
Q38-T-20	38 5/8	40 1/8	38 3/8	38 3/4	92
Q39-T-20	40 7/8	42 3/8	40 5/8	41	97

Four Section Reflex Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q47-R-20	45 1/2	47	45 1/4	45 5/8	71
Q48-R-20	52	53 1/2	51 3/4	52 1/8	80
Q49-R-20	55	56 1/2	54 3/4	55 1/8	85

Four Section Transparent Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q47-T-20	45 1/2	47	45 1/4	45 5/8	107
Q48-T-20	52	53 1/2	51 3/4	52 1/8	122
Q49-T-20	55	56 1/2	54 3/4	55 1/8	129

Five Section Reflex Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q57-R-20	57 1/4	58 3/4	57	57 3/8	88
Q58-R-20	65 3/8	66 7/8	65 1/8	65 1/2	100
Q59-R-20	69 1/8	70 5/8	68 7/8	69 1/4	106

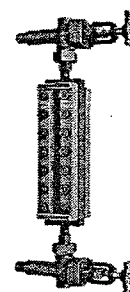
Five Section Transparent Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q57-T-20	57 1/4	58 3/4	57	57 3/8	134
Q58-T-20	65 3/8	66 7/8	65 1/8	65 1/2	152
Q59-T-20	69 1/8	70 5/8	68 7/8	69 1/4	161

Series Q30 Liquid Level Gauges

Series Q30 Liquid Level Gauges are high pressure liquid level gauges with pressure ratings up to 4000 PSI @ 100 F°. Series Q30 liquid level gauges are available in both reflex and transparent application. These gauges are designed with a heavy duty chamber machined out of solid bar stock, complete with sectional gauge covers and gauge glasses. These gauges are assembled with special bolts and nuts that compliment the service level of the gauge. The pressure rating shown in the tables is for the standard non-asbestos or grafoil and carbon steel chamber, as well as the stainless steel series 300 or 300L. The pressure is only 50% for Kel-F shields and pure teflon. The pressure is 80% for 25% glass filled teflon gaskets. Lower temperature applications are possible with the variation in metallic material. Construction of 316 stainless steel with grafoil gaskets are rated to 326 F°.



Q17-T-30



Q17-R-30

PRESSURE / TEMPERATURE RATINGS

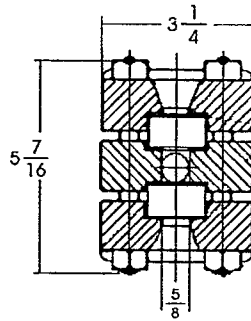
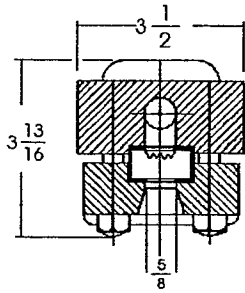
(Flanged gauges take flanged rating when lower)

TRANSPARENT GLASS SIZE									
	1	2	3	4	5	6	7	8	9
Test Pressure	4500	4350	4125	3900	3750	3570	3375	3150	3000
Deg.°F 100	3000	2900	2750	2600	2500	2380	2250	2100	2000
200	2850	2775	2620	2500	2350	2260	2125	2020	1900
300	2775	2550	2450	2340	2250	2120	2000	1900	1775
400	2520	2410	2310	2200	2100	1980	1890	1760	1675
500	2325	2240	2140	2050	1925	1850	1750	1650	1550
600	2050	1950	2290	1800	1720	1640	1525	1450	1350
750	1700	1600	1550	1470	1400	1330	1260	1200	1100
SATURATED STEAM USING MICA									
	750	750	750	750	750	750	750	750	750

REFLEX GAUGE GLASS SIZE									
	1	2	3	4	5	6	7	8	9
Test Pressure	6000	5775	5625	5400	5250	5025	4830	4650	4500
Deg.°F 100	4000	3850	3750	3600	3500	3325	3220	3100	3000
200	3795	3675	3580	3425	3320	3200	3090	2980	2850
300	3590	3470	3350	3245	3120	3000	2890	2780	2660
400	3320	3210	3110	3000	2900	2790	2680	2570	2460
500	3075	2960	2875	2750	2675	2560	2460	2355	2265
600	2785	2700	2600	2500	2410	2320	2220	2130	2040
750	2300	2220	2150	2070	2000	1900	1820	1720	1650
SATURATED STEAM RATING 300 WSP									

% of Rating	100%	90%	50%
CHAMBER MATERIAL	CARBON STEEL, STAINLESS STEEL SERIES 300 OR 300L	MONEL	BRASS
GASKETING	BONDED COMPRESSED FIBERS OR TEFLON GLASS FILLED		PURE TEFLON KEL-F (SHIELDS)

TEST PRESSURE: All gauges are hydrostatically tested by Quality prior to shipment @ 1-1/2 times the design pressure rating at 100°F.



Series Q30 Gauge Specifications

Lengths

Series Q30 gauges are available in nine standard visible glass lengths. Multiples of the same size windows (up to nine sections) in a single piece bar stock liquid chamber are used for longer lengths.

Connections

Standard Series Q30 Gauges are furnished with 1/2 or 3/4 inch NPT female end connections. Other connections available: 1/2 or 3/4 inch NPT female or male, side or back, flanged ends, side or back to suit mating connections.

Liquid Chambers

Machined from bar stock with recessed gasket seats.

Covers

All covers are manufactured to be interchangeable.

Bolt & Nuts

Alloy steel to ASTM Standards.

Glass

The tempered glass must be protected from corrosive substances such as caustic acid and hydrofluoric acid. Only transparent glass with mica or Kel-f shields must be used in these applications.

Gaskets

Precision die cut from the highest quality materials.

Protection

All carbon steel parts are coated both externally and internally with a high quality rust inhibitor.

This coating serves as a superior bonding base for paint. It is recommended that all Q30 Gauges be installed with Quality Gauge Valves, having safety ball checks, which help provide protection against physical injury and loss of product should glass breakage occur.

Single Section Reflex Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch	Approx. Weight lb.	
Q11-R-30	3 3/4	6 1/4	3 1/2	3 7/8	13
Q12-R-30	4 3/4	7 1/4	4 1/2	4 7/8	14
Q13-R-30	5 3/4	8 1/4	5 1/2	5 7/8	17
Q14-R-30	6 3/4	9 1/4	6 1/2	6 7/8	19
Q15-R-30	7 7/8	10 3/8	7 5/8	8	22
Q16-R-30	9 1/8	11 5/8	8 7/8	9 1/4	25
Q17-R-30	10 1/4	12 3/4	10	10 3/8	28
Q18-R-30	11 7/8	14 3/8	11 5/8	12	31
Q19-R-30	12 5/8	15 1/8	12 3/8	12 3/4	32

Single Section Transparent Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch	Approx. Weight lb.	
Q11-T-30	3 3/4	6 1/4	3 1/2	3 7/8	17
Q12-T-30	4 3/4	7 1/4	4 1/2	4 7/8	19
Q13-T-30	5 3/4	8 1/4	5 1/2	5 7/8	23
Q14-T-30	6 3/4	9 1/4	6 1/2	6 7/8	26
Q15-T-30	7 7/8	10 3/8	7 5/8	8	29
Q16-T-30	9 1/8	11 5/8	8 7/8	9 1/4	33
Q17-T-30	10 1/4	12 3/4	10	10 3/8	37
Q18-T-30	11 7/8	14 3/8	11 5/8	12	41
Q19-T-30	12 5/8	15 1/8	12 3/8	12 3/4	43

Two Section Reflex Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch	Approx. Weight lb.	Approx. Weight lb.
Q23-R-30	13	15 1/2	12 3/4	13 1/8	34
Q24-R-30	15	17 1/2	14 3/4	15 1/8	38
Q25-R-30	17 1/4	19 3/4	17	17 3/8	43
Q26-R-30	19 3/4	22 1/4	19 1/2	19 7/8	49
Q27-R-30	22	24 1/2	21 3/4	22 1/8	53
Q28-R-30	25 1/4	27 3/4	25	25 3/8	61
Q29-R-30	26 3/4	29 1/4	26 1/2	26 7/8	65

Two Section Transparent Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch	Approx. Weight lb.	Approx. Weight lb.
Q23-T-30	13	15 1/2	12 3/4	13 1/8	45
Q24-T-30	15	17 1/2	14 3/4	15 1/8	51
Q25-T-30	17 1/4	19 3/4	17	17 3/8	58
Q26-T-30	19 3/4	22 1/4	19 1/2	19 7/8	66
Q27-T-30	22	24 1/2	21 3/4	22 1/8	72
Q28-T-30	25 1/4	27 3/4	25	25 3/8	82
Q29-T-30	26 3/4	29 1/4	26 1/2	26 7/8	86

Three Section Reflex Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch	Approx. Weight lb.	
Q36-R-30	30 3/8	32 7/8	30 1/8	30 1/2	73
Q37-R-30	33 3/4	36 1/4	33 1/2	33 7/8	80
Q38-R-30	38 5/8	41 1/8	38 3/8	38 3/4	91
Q39-R-30	40 7/8	43 1/8	40 5/8	41	96

Three Section Transparent Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch	Approx. Weight lb.	
Q36-T-30	30 3/8	32 7/8	30 1/8	30 1/2	98
Q37-T-30	33 3/4	36 1/4	33 1/2	33 7/8	107
Q38-T-30	38 5/8	41 1/8	38 3/8	38 3/4	123
Q39-T-30	40 7/8	43 1/8	40 5/8	41	129

Four Section Reflex Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch	Approx. Weight lb.	
Q47-R-30	45 1/2	48	45 1/4	45 5/8	107
Q48-R-30	52	54 1/2	51 3/4	52 1/8	121
Q49-R-30	55	57 1/2	54 3/4	55 1/8	128

Four Section Transparent Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch	Approx. Weight lb.	
Q47-T-30	45 1/2	48	45 1/4	45 5/8	143
Q48-T-30	52	54 1/2	51 3/4	52 1/8	163
Q49-T-30	55	57 1/2	54 3/4	55 1/8	172

Five Section Reflex Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch	Approx. Weight lb.	
Q56-R-30	57 1/4	59 3/4	57	57 3/8	135
Q58-R-30	65 3/8	67 7/8	65 1/8	65 1/2	152
Q59-R-30	69 1/8	69 1/8	68 7/8	69 1/4	160

Five Section Transparent Gauges					
Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch	Approx. Weight lb.	
Q57-T-30	57 1/4	59 3/4	57	57 3/8	179
Q58-T-30	65 3/8	67 7/8	65 1/8	65 1/2	203
Q59-T-30	69 1/8	69 1/8	68 7/8	69 1/4	215

**Series Q66 & Q67 Gauge Valves
 for Reflex or Transparent Flat Glass Gauges.**

These valves have a dropped forged body with a cast iron hand-wheel. Longevity is assured a stainless steel seat, stainless steel stem and stainless steel ball check. All carbon steel parts are coated with a rust inhibitor.

Q66 Valve : Offset pattern with female NPT gauge connection.

Q67 Valve : Offset pattern with union gauge connection.

Pressure rating 4000 lbs @ 100°F, 1500 lbs @ 750°F

Common features for series Q66 and Q67.

- Safety shut-off.** The valves are equipped with stainless steel ball check to shut off flow automatically in case of glass breakage.
- Offset pattern.** These valves are designed so that the gauge and the drain connections are offset 7/8 inch from the centre line of the vessel connections. Due to offset pattern, the gauge could be cleaned by removing the drain plug or valve without disassembling the gauge.
- Quick close feature.** The Q66 and Q67 Valves may be converted, in the field, from plain to quick closing, by replacement of sleeve and stem. Quick closing valve stems have quadruple thread for full closing or opening in 1/4 turn.
- Regrindable,** renewable seat. The seat may be reground. The seat may be renewed.

Extra features for Q67 valve compared to Q66 valve.

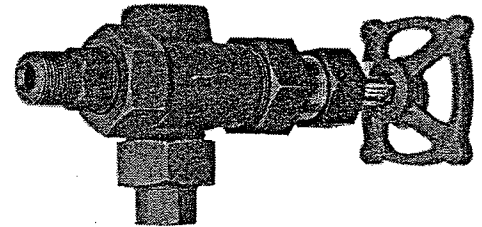
The Q67 valve has a union gauge connection which allows a top or bottom gauge to be turned to any desired angle for the most suitable visibility. It also allows for removal of the gauge without removing the valves. This feature saves time when the gauge must be cleaned.

Standard connections for Q66 and Q67 series.

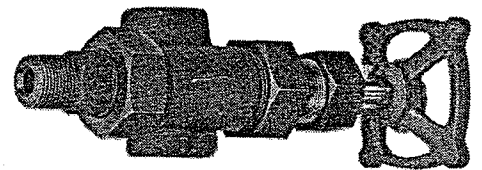
- Vessel** - 3/4 inch NPT male
- Drain** - 1/2 inch NPT female
- Gauge** - 1/2 inch NPT female

Optional connection

- Vessel**
 - 1/2 inch male or female
 - 3/4 inch female
 - socket weld, flanged or solid shank
- Gauge**
 - 3/4 inch female for Q66
 - 1/2 inch or 3/4 male on union for Q67
 - 1/4 inch or 3/4 inch female on Q67



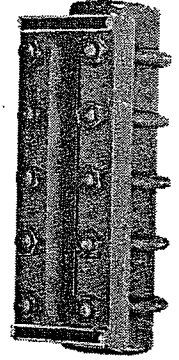
Q67 Gauge Valves



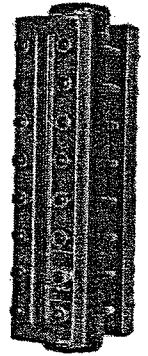
Q66 Gauge Valves

Series Q10 Large Chamber Liquid Level Gauges

Large Chamber Gauges are specifically designed for liquids which have the tendency to surge or boil. These gauges reduce the boiling effects of entrained gas. They help to reduce liquids being vaporized under critical low pressure and help to reduce boiling the liquids when temperature exceeds the boiling point. Series Q10 Gauges are available in both reflex and transparent applications. These gauges are designed with heavy wall steel tubing as a chamber, complete with sectional covers and gauge glasses. The final assembly of these gauges are accomplished using specially designed bolts. The gauge glasses are specially processed, heat treated and tempered. Standard connections for these gauges are 3/4 inch NPT female end connections. Additionally, 1/2 inch or 3/4 inch NPT side connections are available. Also 2 inch flanged or scarfed for welding connections which provide unrestricted flow through the chamber, may be specified. All carbon steel parts are rust proofed.



**QRL-10
(REFLEX)**



**QTL-10
(TRANSPARENT)**

PRESSURE / TEMPERATURE RATINGS

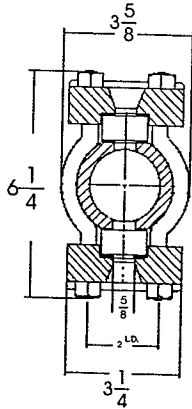
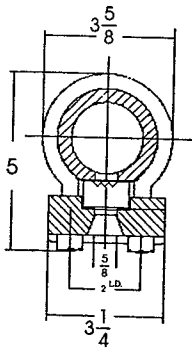
(Flanged gauges take flanged rating when lower)

		TRANSPARENT GLASS SIZE								
Test Pressure Deg. °F		1	2	3	4	5	6	7	8	9
100	1800	1200	1110	1020	930	850	760	680	590	500
200	1080	1000	920	840	760	680	600	530	450	
300	960	890	830	750	680	620	540	470	400	
400	850	790	720	670	600	540	480	420	360	
500	730	680	630	570	520	470	420	360	310	
600	620	570	530	480	440	400	360	310	270	
750	440	410	380	350	320	280	260	230	200	

		REFLEX GAUGE GLASS SIZE								
Test Pressure Deg. °F		1	2	3	4	5	6	7	8	9
100	3600	2400	2250	2100	1940	1800	1640	1500	1340	1200
200	2220	2090	1950	1810	1670	1540	1400	1260	1130	
300	2050	1920	1800	1680	1540	1430	1300	1180	1060	
400	1860	1750	1640	1530	1420	1320	1200	1100	1000	
500	1690	1600	1500	1400	1300	1210	1110	1010	920	
600	1520	1430	1350	1260	1180	1100	1010	920	850	
750	1250	1190	1120	1060	1000	940	870	810	760	

% of Rating	100%		90%	50%
CHAMBER MATERIAL	CARBON STEEL, STAINLESS STEEL SERIES 300 OR 300L		MONEL	BRASS
GASKETING	BONDED COMPRESSED FIBERS OR TEFLON GLASS FILLED			PURE TEFLON KEL-F (SHIELDS)

TEST PRESSURE: All gauges are hydrostatically tested by Quality prior to shipment @ 1-1/2 times the design pressure rating at 100°F



Series Q10 Gauge Specifications

Lengths

Series Q10 gauges are available in nine standard visible glass lengths. Multiples of the same size windows (up to nine sections) in a single piece steel pipe stock liquid chamber are used for longer lengths.

Connections

Standard Series Q10 Gauges are furnished with 1/2 or 3/4 inch NPT female end connections. Other connections available: 1/2 or 3/4 inch NPT female or male, side or back, flanged ends, side or back to suit mating connections.

Liquid Chambers

Machined from pipe and steel tubing with recessed gasket seats.

Covers

All covers are manufactured to be interchangeable.

Bolt & Nuts

Alloy steel to ASTM Standards.

Glass

The tempered glass must be protected from corrosive substances such as caustic acid and hydrofluoric acid. Only transparent glass with mica or Kel-f shields must be used in these applications.

Gaskets

Precision die cut from the highest quality materials.

Protection

All carbon steel parts are coated both externally and internally with a high quality rust inhibitor.

This coating serves as a superior bonding base for paint. It is recommended that all Q10 Gauges be installed with Quality Gauge Valves, having safety ball checks which help provide protection against physical injury and loss of product should glass breakage occur.

Single Section Reflex Gauges

Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q11-RL-10	3 3/4	5 1/2	3 1/2	3 7/8	10
Q12-RL-10	4 3/4	6 1/2	4 1/2	4 7/8	11
Q13-RL-10	5 3/4	7 1/2	5 1/2	5 7/8	13
Q14-RL-10	6 3/4	8 1/2	6 1/2	6 7/8	14
Q15-RL-10	7 7/8	9 3/8	7 5/8	8	17
Q16-RL-10	9 1/8	10 5/8	8 7/8	9 1/4	19
Q17-RL-10	10 1/4	11 3/4	10	10 3/8	22
Q18-RL-10	11 7/8	13 3/8	11 5/8	12	24
Q19-RL-10	12 5/8	14 1/8	12 3/8	12 3/4	25

Single Section Transparent Gauges

Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q11-TL-10	3 3/4	5 1/2	3 1/2	3 7/8	14
Q12-TL-10	4 3/4	6 1/2	4 1/2	4 7/8	17
Q13-TL-10	5 3/4	7 1/2	5 1/2	5 7/8	20
Q14-TL-10	6 3/4	8 1/2	6 1/2	6 7/8	23
Q15-TL-10	7 7/8	9 3/8	7 5/8	8	25
Q16-TL-10	9 1/8	10 5/8	8 7/8	9 1/4	29
Q17-TL-10	10 1/4	11 3/4	10	10 3/8	32
Q18-TL-10	11 7/8	13 3/8	11 5/8	12	36
Q19-TL-10	12 5/8	14 1/8	12 3/8	12 3/4	38

Two Section Reflex Gauges

Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q23-RL-10	13	15 1/2	12 3/4	13 1/8	26
Q24-RL-10	15	17 1/2	14 3/4	15 1/8	30
Q25-RL-10	17 1/4	19 1/4	17	17 3/8	34
Q26-RL-10	19 3/4	22 1/4	19 1/2	19 7/8	38
Q27-RL-10	22	24 1/2	21 3/4	22 1/8	42
Q28-RL-10	25 1/4	27 3/4	25	25 3/8	48
Q29-RL-10	26 3/4	29 1/4	26 1/2	26 7/8	52

Two Section Transparent Gauges

Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q23-TL-10	13	15 1/2	12 3/4	13 1/8	40
Q24-TL-10	15	17 1/2	14 3/4	15 1/8	46
Q25-TL-10	17 1/4	19 1/4	17	17 3/8	52
Q26-TL-10	19 3/4	22 1/4	19 1/2	19 7/8	59
Q27-TL-10	22	24 1/2	21 3/4	22 1/8	65
Q28-TL-10	25 1/4	27 3/4	25	25 3/8	73
Q29-TL-10	26 3/4	29 1/4	26 1/2	26 7/8	77

Three Section Reflex Gauges

Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q36-RL-10	30 3/8	32 7/8	30 1/8	30 1/2	58
Q37-RL-10	33 3/4	36 1/4	33 1/2	33 7/8	64
Q38-RL-10	38 5/8	41 1/8	38 3/8	38 3/4	72
Q39-RL-10	40 7/8	43 1/8	40 5/8	41	77

Three Section Transparent Gauges

Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q36-TL-10	30 3/8	32 7/8	30 1/8	30 1/2	88
Q37-TL-10	33 3/4	36 1/4	33 1/2	33 7/8	96
Q38-TL-10	38 5/8	41 1/8	38 3/8	38 3/4	110
Q39-TL-10	40 7/8	43 1/8	40 5/8	41	116

Four Section Reflex Gauges

Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q47-RL-10	45 1/2	48	47	47 3/8	85
Q48-RL-10	52	54 1/2	53 1/2	53 7/8	96
Q49-RL-10	55	57 1/2	56 1/2	56 1/2	102

Four Section Transparent Gauges

Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q47-TL-10	45 1/2	48	47	47 3/8	128
Q48-TL-10	52	54 1/2	53 1/2	53 7/8	146
Q49-TL-10	55	57 1/2	56 1/2	56 1/2	155

Five Section Reflex Gauges

Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q57-RL-10	57 1/2	59 3/4	58 3/4	59 1/8	88
Q58-RL-10	65 3/8	67 7/8	66 7/8	67 1/4	100
Q59-RL-10	69 1/8	71 5/8	70 5/8	71	106

Five Section Transparent Gauges

Model No.	Visible Glass Inch	Overall Length Inch.	Minimum Centres Side Connections 1/2 inch 3/4 inch		Approx. Weight lb.
Q57-TL-10	57 1/2	59 3/4	58 3/4	59 1/8	134
Q58-TL-10	65 3/8	67 7/8	66 7/8	67 1/4	152
Q59-TL-10	69 1/8	71 5/8	70 5/8	71	161

Installation

Inspect and consider the following points before installation of Quality Gauges and Valves.

- Upon receipt of a liquid level gauge , check all components carefully for any possible damage incurred during shipment. If any damage is evident or suspected, do not attempt installation.
- Make sure the gauge chamber is not supporting any pipeline in order to avoid any undue strain on the gauge.
- When the gauge is longer than four feet or weighs more than one hundred pounds, consider supporting the gauge with brackets, especially when there is any vibration. This will prevent any overloading of the gauge and valve connections.
- To prevent injury or loss of product should glass breakage occur, always provide shut off valves with an automatic ball check between the gauge and the vessel. It is highly recommended that one uses Quality Valves with Quality Gauges.
- Bolt torque is very important for the proper operation of liquid level gauges. Due to gauge gaskets compressing over a period of time, the bolt torque should be checked before the gauge is installed. The gauge should always be isolated from the process system by closing the upper and lower valves. Drain the gauge to relieve pressure before performing any torque inspections or any general maintenance.
- Make sure that the model number and assembly number stamped on the name plate is as your purchase order indicates. Also verify the operating condition at the installation site is the same as indicated on your purchase order and that those conditions correspond to the technical data for that particular gauge.

Torque for :

standard gasket of grafoil	30 - 35 ft.lb.
25% glass filled Teflon	20 ft.lb
Pure Teflon and Kel-F shield	15 ft.lb.

- The user must create maintenance schedules, safety manuals and inspection reports for the use of liquid level gauges and valves. The onus is on the end user of the product since the end user is most familiar with the application and process conditions.

Extra Features for Q77BL Valve compared to Q76BL.

The Q77BL Valve has a union gauge connection which allows a top and bottom connected gauge to be turned to any chosen angle for the most suitable visibility. This feature also makes possible the removal of the gauge without removing the valves.

Optional Features

Bleed Fitting:

A bleed fitting is available making it possible to bleed pressure from the valve and connected instruments without breaking the threaded connections. The bleed fitting is designed so its stem can not be withdrawn accidentally. It is tapped for 1/8" NPT connection.

Ballcheck:

Valves may be furnished with a ballcheck which shuts off the flow of medium in case of a upstream rupture. Nos. Q77BL may have a downstream or upstream ballcheck. For downstream install in bottom valve only when used in conjunction with end connected gauges.

Standard connections for Q66 and Q67 series.

Vessel	- 3/4 inch NPT male , non-union
Drain	- 1/2 inch NPT female
Gauge	- 1/2 inch NPT female

Optional connection

Vessel	- 1/2 inch or 1 inch male or weld end or flanged to requirements
Gauge	- 1/4 , 1/2 , or 3/4 inch male or female

**Series Q76BL & Q77BL Gauge Valves
 for Reflex or Transparent Flat Glass Gauges.**

These valves are designed for use with flat glass gauges, instrument piping and for applications requiring a lightweight valve. They have a bolted bonnet and Outer Stem & Yoke construction.

Pressure rating 3000 lbs @ 100°F.

Q76BL Valve: Offset pattern with female NPT gauge connection.

Q77BL Valve: Offset pattern with union gauge connection.

Common features for Series Q76BL and Q77BL.

•Safety shut-off:

The valves are equipped with a stainless steel ball check to shut off flow automatically in case of glass breakage.

•Offset pattern:

These valve are designed so that the gauge and the drain connections are offset 7/8 inch from the centre line of the vessel connections. Due to offset pattern, the gauge could be cleaned by removing the drain plug, without disassembling the gauge.

•OS & Y and back-seating stem:

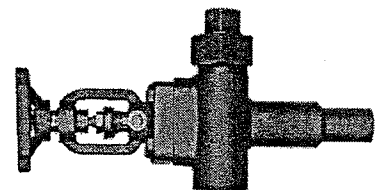
The forged yoke supports the stem away from the valve body so the threaded portion of the stem is unaffected by the heat and does not come into contact with any process fluids. The stem has a back-seating which allows for re-packing the valve under pressure.

•Renewable Seat:

The removable seat may be replaced.



Q76 BL Gauge Valves



Q77 BL Gauge Valves

**Series Q66 & Q67 Gauge Valves
 for Reflex or Transparent Flat Glass Gauges.**

These valves have a dropped forged body with a cast iron hand-wheel. Longevity is assured a stainless steel seat, stainless steel stem and stainless steel ball check. All carbon steel parts are coated with a rust inhibitor.

Q66 Valve : Offset pattern with female NPT gauge connection.

Q67 Valve : Offset pattern with union gauge connection.

Pressure rating 4000 lbs @ 100°F, 1500 lbs @ 750°F

Common features for series Q66 and Q67.

- Safety shut-off.** The valves are equipped with stainless steel ball check to shut off flow automatically in case of glass breakage.
- Offset pattern.** These valves are designed so that the gauge and the drain connections are offset 7/8 inch from the centre line of the vessel connections. Due to offset pattern, the gauge could be cleaned by removing the drain plug or valve without disassembling the gauge.
- Quick close feature.** The Q66 and Q67 Valves may be converted, in the field, from plain to quick closing, by replacement of sleeve and stem. Quick closing valve stems have quadruple thread for full closing or opening in 1/4 turn.
- Regrindable,** renewable seat. The seat may be reground. The seat may be renewed.

Extra features for Q67 valve compared to Q66 valve.

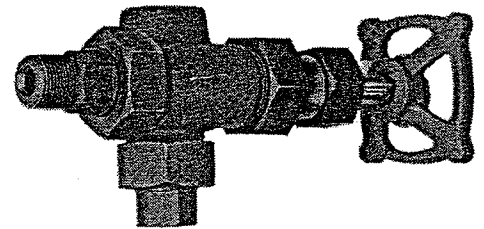
The Q67 valve has a union gauge connection which allows a top or bottom gauge to be turned to any desired angle for the most suitable visibility. It also allows for removal of the gauge without removing the valves. This feature saves time when the gauge must be cleaned.

Standard connections for Q66 and Q67 series.

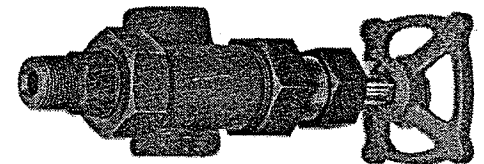
- Vessel** - 3/4 inch NPT male
- Drain** - 1/2 inch NPT female
- Gauge** - 1/2 inch NPT female

Optional connection

- Vessel**
 - 1/2 inch male or female
 - 3/4 inch female
 - socket weld, flanged or solid shank
- Gauge**
 - 3/4 inch female for Q66
 - 1/2 inch or 3/4 male on union for Q67
 - 1/4 inch or 3/4 inch female on Q67



Q67 Gauge Valves



Q66 Gauge Valves

**Series Q66 & Q67 Gauge Valves
 for Reflex or Transparent Flat Glass Gauges.**

These valves have a dropped forged body with a cast iron hand-wheel. Longevity is assured a stainless steel seat, stainless steel stem and stainless steel ball check. All carbon steel parts are coated with a rust inhibitor.

Q66 Valve : Offset pattern with female NPT gauge connection.

Q67 Valve : Offset pattern with union gauge connection.

Pressure rating 4000 lbs @ 100°F, 1500 lbs @ 750°F

Common features for series Q66 and Q67.

- Safety shut-off.** The valves are equipped with stainless steel ball check to shut off flow automatically in case of glass breakage.
- Offset pattern.** These valves are designed so that the gauge and the drain connections are offset 7/8 inch from the centre line of the vessel connections. Due to offset pattern, the gauge could be cleaned by removing the drain plug or valve without disassembling the gauge.
- Quick close feature.** The Q66 and Q67 Valves may be converted, in the field, from plain to quick closing, by replacement of sleeve and stem. Quick closing valve stems have quadruple thread for full closing or opening in 1/4 turn.
- Regrindable,** renewable seat. The seat may be reground. The seat may be renewed.

Extra features for Q67 valve compared to Q66 valve.

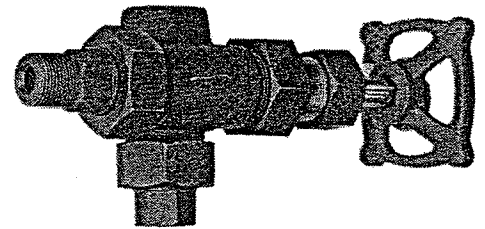
The Q67 valve has a union gauge connection which allows a top or bottom gauge to be turned to any desired angle for the most suitable visibility. It also allows for removal of the gauge without removing the valves. This feature saves time when the gauge must be cleaned.

Standard connections for Q66 and Q67 series.

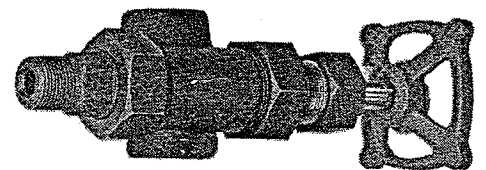
- Vessel** - 3/4 inch NPT male
- Drain** - 1/2 inch NPT female
- Gauge** - 1/2 inch NPT female

Optional connection

- Vessel**
 - 1/2 inch male or female
 - 3/4 inch female
 - socket weld, flanged or solid shank
- Gauge**
 - 3/4 inch female for Q66
 - 1/2 inch or 3/4 male on union for Q67
 - 1/4 inch or 3/4 inch female on Q67



Q67 Gauge Valves



Q66 Gauge Valves

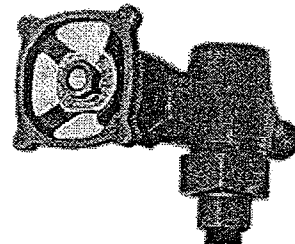
**SERIES Q 146 & Q 147 GAUGE VALVES
 FOR REFLEX OR TRANSPARENT FLAT GLASS GAUGES**

These valves are manufactured for a different variety of services such as standard trim, sour gas trim, NACE Trim and Low Temperature. All valves have a dropped forged body with screwed bonnet and integral seat. These valves have a unique floating shank tail piece for up to 1/4 " inch variation in vessel connection centre distance.

Pressure rating 2500 lbs @ 100°F, 1400 lbs @ 750°F

COMMON FEATURES FOR SERIES Q146 & Q147

The valves are equipped with a stainless steel ball check to shut off flow automatically in case of glass breakage. The bonnet is part of the valve body in the form of a thread. A union vessel connection which makes it easy to install valves on to the vessel and allows 1/4 inch variation in vessel centers. Union connection could be 1/2 inch or 3/4 inch N.P.T., spherical 1/2 inch, or flanged. These valves have offset pattern bodies which means that the gauge connection and drain are off center by 7/8 inch from the center line of the vessel connections. Due to offset pattern, the gauge could be cleaned by removing the drain plug on valve without disassembling the gauge. The material is dropped forged steel bodies that conform to ASTM requirements, the hand wheel is malleable iron.



Q147

EXTRA FEATURES FOR Q147 VALVE COMPARED TO Q146 VALVE

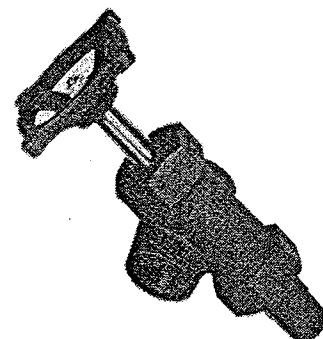
Q147 valve have union gauge connection which could be 1/2 inch or 3/4 inch female connections.

STANDARD CONNECTIONS FOR Q146 AND Q147 SERIES

- Vessel - 3/4 inch N.P.T. male
- Drain - 1/2 inch N.P.T. female
- Gauge - 1/2 inch N.P.T. female

Optional Connections

- Vessel
 - 1/2 inch male or female
 - 3/4 inch female or male
 - socket weld, flanged or solid shank
- Gauge
 - 3/4 female for Q146
 - 1/2 inch or 3/4 inch male or female on union for Q147



Q 146

SERIES Q156 & Q136 VALVES FOR TUBULAR GAUGE GLASS

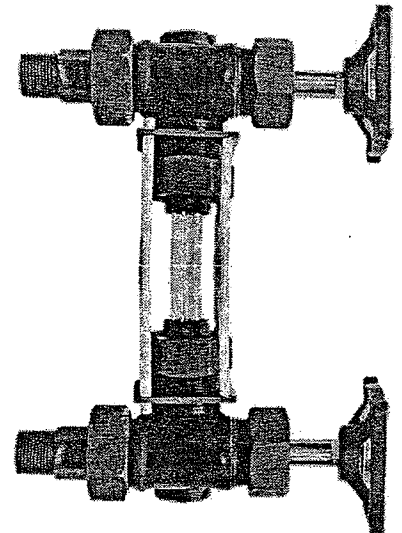
These valves are manufactured for different types of connections. All valves have forged bodies of carbon steel or of stainless steel as per the requirement. All carbon steel are rust proofed. High quality borosilicate tubular glass should be used with these valves. The pressure rating is dependent on length of the glass tube and pressure rating of the type of glass.

COMMON FEATURES

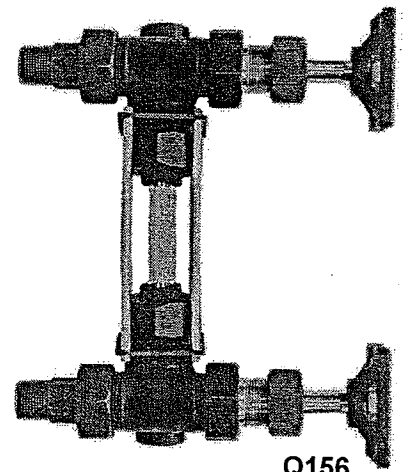
- 1 $\frac{3}{4}$ inch or $\frac{1}{2}$ inch, or flanged, union or non-union connection
- 2 $\frac{3}{4}$ inch or $\frac{1}{2}$ inch drain
- 3 $\frac{3}{4}$ inch tubular glass
- 4 Glass gland is designed to prevent torque on the tube
- 5 Ball check to automatically stop flow in the event of the tube breakage
- 6 Four guard rods with holder to protect glass
(Plastic tubular shields can be used)
- 7 Offset body pattern to allow cleaning of tube by drain plug removal

EXTRA FEATURES FOR Q156 COMPARED TO Q136

- A Sleeve construction which allows:
 - 1/ Quick closing
 - 2/ back seating to protect packing
- B Seat can be replaced



Q136



Q156

IMPORTANT DIMENSIONS.

Visible Glass:	centre to centre minus 5 $\frac{5}{8}$ inch
Tubular Glass Length:	centre to centre minus 2 $\frac{3}{8}$ inch
Guard Rods Length:	centre to centre minus 2 $\frac{3}{8}$ inch

Q175, Q170, SERIES GAUGES
CARBON STEEL, BRASS, BRONZE & STAINLESS STEEL(316)

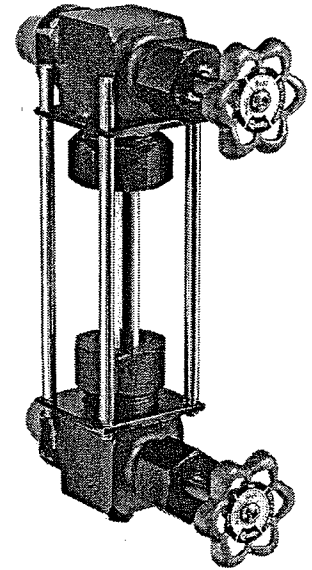
AUTOMATIC or NON AUTOMATIC for LIQUID LEVEL upto 500 PSI at 450 F - SUBJECT TO LIMITATIONS OF GLASS TUBE

Automatic valves come with corrosion-resistant ball checks. 316 stainless steel valves come with 316 Stainless Steel ball checks. These valves are designed for standard straight through flow with 1/2" or 3/4" vessel connection. These valves can be put together with highly durable pyrex glass tube or high pressure tube of 5/8" or 3/4" diameter. Guard rods and a round plexiglass cover are available to protect glass tube.

For both Q 170 & Q 175 assembly:

- Glass tubing is 1" less than fixing centre
- Protective guard rods are 1" less than fixing centre

For fixing centres greater than 36", Quality Machining and Metalworks Inc. recommends a mid point support brace, which is also available in all materials.



Q 170, Q 175

MODEL #	MATERIAL	VESSEL CONNECTION	SIZE OF TUBE
Q170 CSA	Carbon Steel	1/2"	5/8"
Q170 BRA	Brass	1/2"	5/8"
Q170 BZA	Bronze	1/2"	5/8"
Q170 SA	316 S.S. Wetted Parts	1/2"	5/8"
Q170 SSA	316S.S. Const.	1/2"	5/8"
Q175 CSA	Carbon Steel	3/4"	3/4"
Q175 BRA	Brass	3/4"	3/4"
Q175 BZA	Bronze	3/4"	3/4"
Q175 SA	316 S.S. Wetted Parts	3/4"	3/4"
Q175 SSA	316S.S. Const.	3/4"	3/4"

A self-adhesive vinyl transparent linear scale can be used on tubular glass or round plexiglass cover to indicate liquid level more accurately. The linear scale is available in both metric and imperial measurement.

Quality Machining & Metalworks Inc.

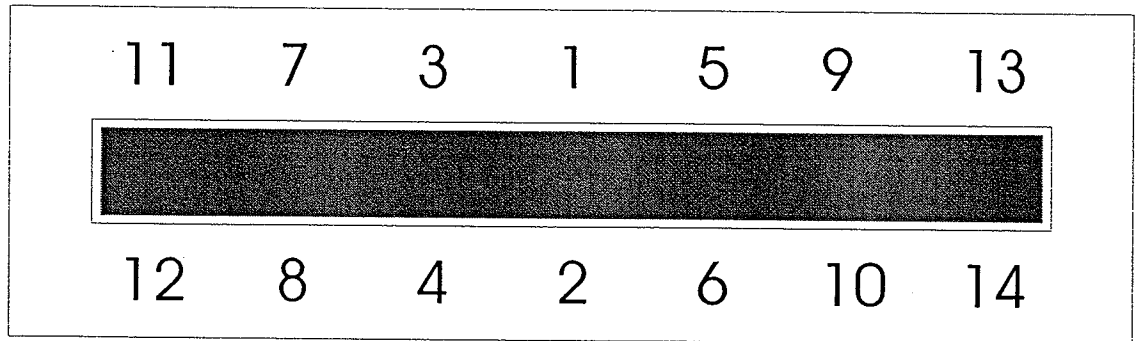
Quality Gauge Assembly

Numbers indicate proper bolt torquing sequence

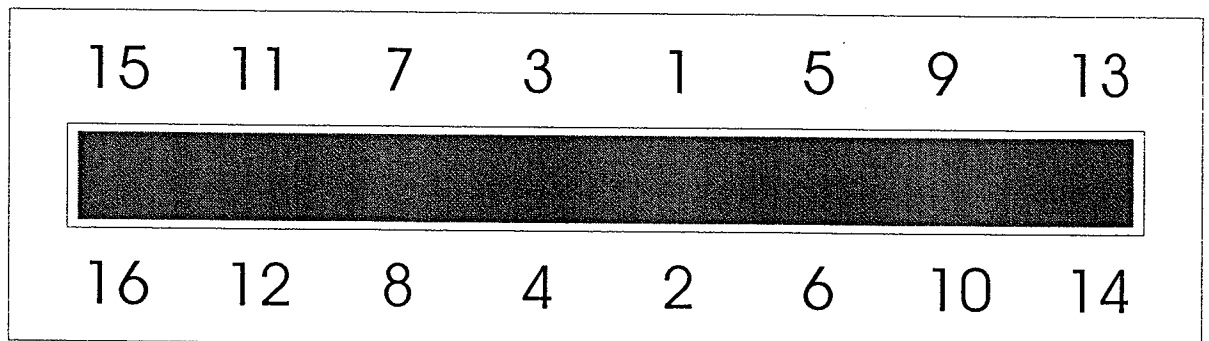
For Q10 & Q20 Series torque at 32 ft.lb

For Q30 Series torque at 42 ft.lb

Even pair
of bolts



Even pair
of bolts



Operating Instructions

All Quality Gauges should be slowly brought into service. These gauges should be warmed up at a slow and even rate when they are used with a vessel containing hot fluid. This is accomplished by slowly and carefully opening the shut-off valve. Wait until the gauge is fully warmed up and free of any signs of leakage before proceeding with the operating process. The gauges should be isolated periodically for the bolt torque to be checked. The shut-off valve must be fully open while the gauge is in operation. A partially open valve will prevent automatic ball checks from seating.

Danger:

Never exceed the pressure rating. This could result in mechanical failure of the gauge components and cause a serious personal injury, death or property damage.

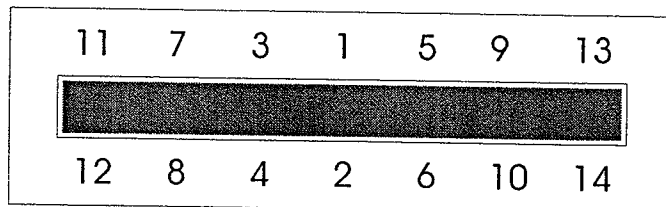
Maintenance Procedures

Gauge Glass should be given regular and careful attention. Inspect glass for any clouding, etching, scratching, cracks or corrosion. Shields showing any signs of clouding, wear or deterioration, are an indication that the gauge glass has been exposed or could be exposed to the contained fluid. Check for gasket leaks. Check for leaks in the connections.

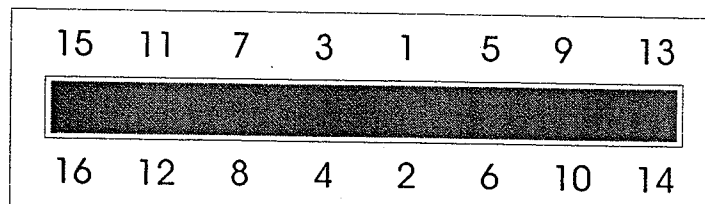
Quality Machining & Metalworks Inc. Quality Gauge Assembly

Numbers indicate proper bolt torquing sequence
 For Q10 & Q20 Series torque at 32 ft.lb
 For Q30 Series torque at 42 ft.lb

Even pair
 of bolts

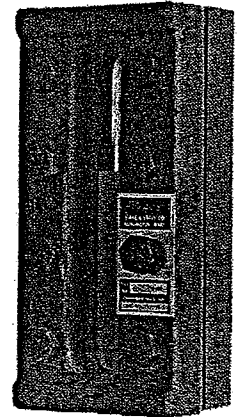


Even pair
 of bolts



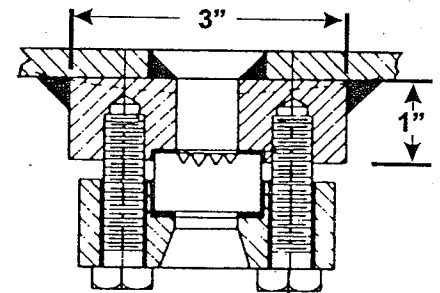
Series QRW-20 & QTW-20
Reflex or Transparent Weld Pad Gauges

These gauges are designed so that they can be welded directly on to a pressure vessel. Weld pad gauges are used where regular gauge and valve construction is impractical, due to space, solid matter in the suspension and thermal stresses on the gauge glass from the associated piping. Weld Pad Gauges are available in both reflex and transparent applications. These gauges are designed to take pressure within the gauge itself. These gauges are not designed to replace the tank strength lost due to slotting the pressure vessel. It is therefore impossible give a pressure rating to the Weld Pad Gauge.



QRW-20

Glass Size	Cap Screws Per Section	Visible Glass (Inch)	Number of Sections Overall Length (Inch)			
			1	2	3	4
1	6	3 3/4	5 1/4	10 1/2	15 3/4	21
2	6	4 3/4	6 1/4	12 1/2	18 3/4	25
3	8	5 3/4	7 1/4	14 1/2	21 3/4	29
4	10	6 3/4	8 1/4	16 1/2	24 3/4	33
5	10	7 7/8	9 3/8	18 3/4	28 1/8	37 1/2
6	12	9 1/8	10 5/8	21 1/4	31 7/8	42 1/2
7	14	10 1/4	11 3/4	23 1/2	35 1/4	47
8	16	11 7/8	13 3/8	26 3/4	40 1/8	53 1/2
9	16	12 5/8	14 1/8	28 1/4	42 3/8	56 1/2



QRW-20
Cross Section



Installation

Inspect and consider the following points before installation of Quality Gauges and Valves.

- Upon receipt of a liquid level gauge, check all components carefully for any possible damage incurred during shipment. If any damage is evident or suspected, do not attempt installation.
- Make sure the gauge chamber is not supporting any pipeline in order to avoid any undue strain on the gauge.
- When the gauge is longer than four feet or weighs more than one hundred pounds, consider supporting the gauge with brackets, especially when there is any vibration. This will prevent any overloading of the gauge and valve connections.
- To prevent injury or loss of product should glass breakage occur, always provide shut off valves with an automatic ball check between the gauge and the vessel. It is highly recommended that one uses Quality Valves with Quality Gauges.
- Bolt torque is very important for the proper operation of liquid level gauges. Due to gauge gaskets compressing over a period of time, the bolt torque should be checked before the gauge is installed. The gauge should always be isolated from the process system by closing the upper and lower valves. Drain the gauge to relieve pressure before performing any torque inspections or any general maintenance.
- Make sure that the model number and assembly number stamped on the name plate is as your purchase order indicates. Also verify the operating condition at the installation site is the same as indicated on your purchase order and that those conditions correspond to the technical data for that particular gauge.

Torque for :

standard gasket of grafoil	30 - 35 ft.lb.
25% glass filled Teflon	20 ft.lb
Pure Teflon and Kel-F shield	15 ft.lb.

- The user must create maintenance schedules, safety manuals and inspection reports for the use of liquid level gauges and valves. The onus is on the end user of the product since the end user is most familiar with the application and process conditions.

Rosemount™ 5300 Series

Superior Performance Guided Wave Radar Level and Interface Transmitter



1.0 About this guide

This Quick Start Guide provides basic guidelines for Rosemount 5300 Series Transmitters. Refer to the Rosemount 5300 Reference Manual (document number 00809-0100-4530) for more instructions. Manuals are available electronically on www.rosemount.com.

⚠ WARNING

Failure to follow safe installation and service guidelines could result in death or serious injury.

- Make sure the transmitter is installed by qualified personnel and in accordance with applicable code of practice.
- Use the equipment only as specified in this Quick Start Guide and the Reference Manual. Failure to do so may impair the protection provided by the equipment.
- Any substitution of non-authorized parts or repair, other than exchanging the complete transmitter head or probe assembly, may jeopardize safety and is prohibited.

Explosions could result in death or serious injury.

- Verify that the operating environment of the transmitter is consistent with the appropriate hazardous locations specifications. See “Product certifications” on page 23.
- To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.
- Before connecting a HART[®], FOUNDATION[™] Fieldbus, or Modbus[®] based communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- To avoid process leaks, only use O-rings designed to seal with the corresponding flange adapter.

Electrical shock can result in death or serious injury.

- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.
- Make sure the main power to the Rosemount 5300 Series Transmitter is off and the lines to any other external power source are disconnected or not powered while wiring the transmitter.
- Ground device on non-metallic tanks (e.g. fiberglass tanks) to prevent electrostatic charge build-up.

Probes with non-conducting surfaces

Probes covered with plastic and/or with plastic discs may generate an ignition-capable level of electrostatic charge under certain extreme conditions. Therefore, when the probe is used in a potentially explosive atmosphere, appropriate measures must be taken to prevent electrostatic discharge.

Eliminate the risk of ESD discharge prior to dismantling the transmitter head from the probe.

Probes may generate an ignition-capable level of electrostatic charge under extreme conditions. During any type of installation or maintenance in a potentially explosive atmosphere the responsible person should make sure that any ESD risks are eliminated before attempting to separate the probe from the transmitter head.

Contents

Confirm system readiness (4-20 mA only)	page 3
Mount transmitter on tank	page 4
Connect the wiring	page 9
Configure	page 17
Safety Instrumented Systems (4-20 mA only)	page 19
Adjust probe length	page 20
Product certifications	page 23

2.0 Confirm system readiness (4-20 mA only)

2.1 Confirm HART revision capability

If using HART-based control or asset management systems, confirm the HART 7 capability of such systems prior to commissioning and installation. Not all systems are capable of communicating with the HART Revision 7 protocol. This transmitter can be configured for either HART Revision 5 or 7.

2.2 Confirm correct Device Driver

- Verify that the correct Device Driver (DD/DTM™) is loaded on your systems to ensure proper communication. See [Table 1](#).
- Download the Device Driver from www.rosemount.com/LevelSoftware

Table 1. Rosemount 5300 Device Revisions and Files

Firmware version ⁽¹⁾	Find Device Driver	
	HART universal revision	Device revision ⁽²⁾
2F0 and later	7	4
	5	3
2A2 - 2D2	5	3

1.Firmware version is printed on the transmitter head label, e.g. SW 2E0.

2.Device revision is printed on the transmitter head label, e.g. HART Dev Rev 4.

2.3 Switch HART revision mode

If the HART configuration tool is not capable of communicating with HART Revision 7, the device will load a generic menu with limited capability.

To switch the HART revision mode from the Generic Menu:

- Go to **Manual Setup > Device Information > Identification > Message**.
- In the *Message* field, enter “HART5” or “HART7”.

3.0 Mount transmitter on tank

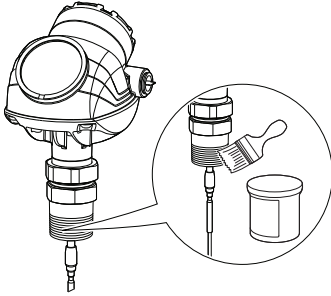
For flexible single lead probes ordered with weight unmounted (option code WU), refer to section “Adjust probe length” on page 20 before mounting the transmitter.

3.1 Threaded / flange / Tri Clamp tank connection

Step 1: Seal and protect the threads

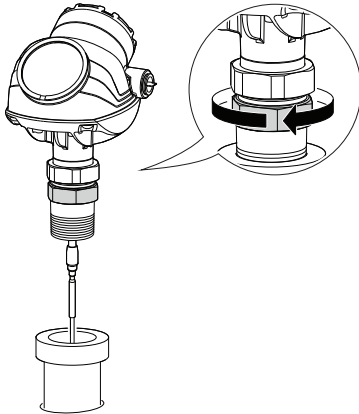
Use anti-seize paste or PTFE tape according to your site procedures.

⚠ Only for NPT threaded tank connection.

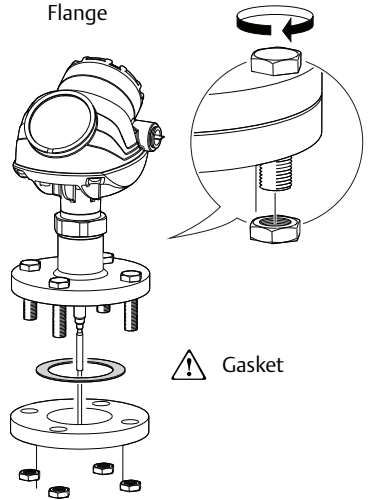


Step 2: Mount the device on tank

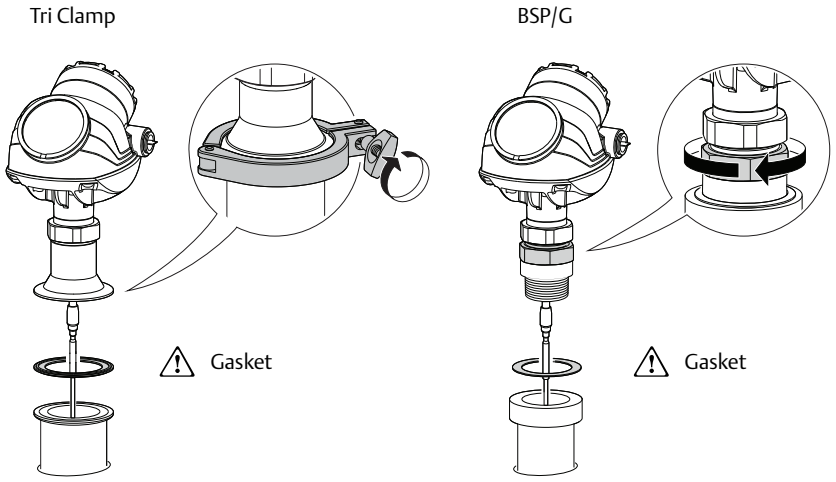
NPT



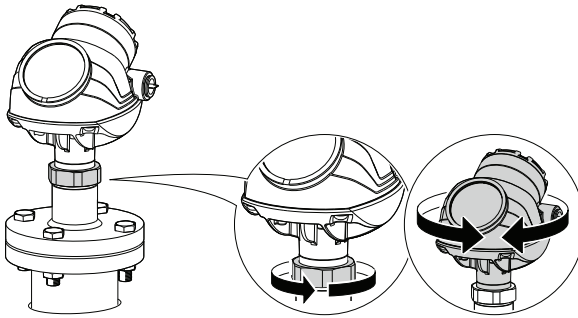
Flange



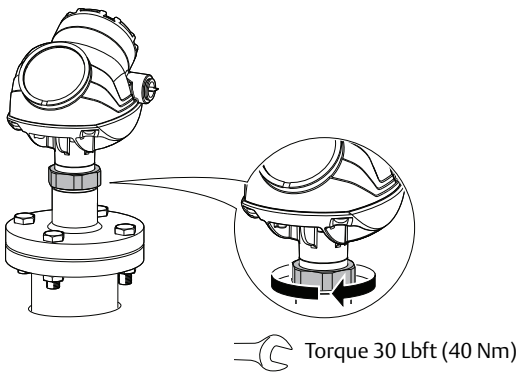
Step 2: Continued...



Step 3: Adjust display orientation (optional)

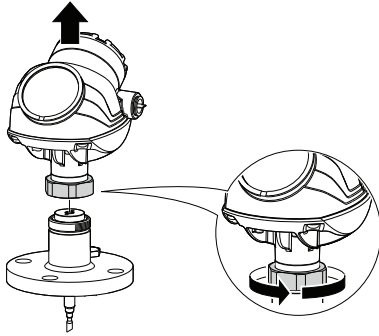


Step 4: Tighten the nut

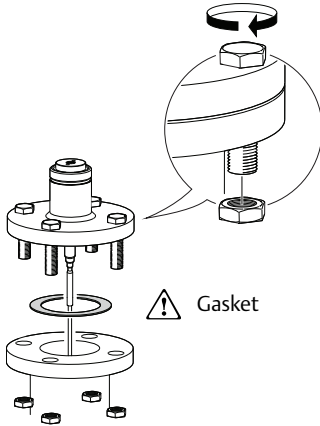


3.2 Remote housing

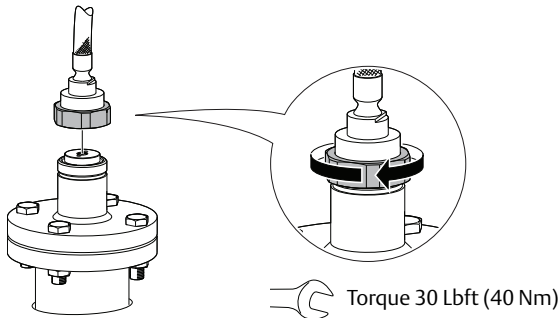
Step 1: Carefully remove the transmitter



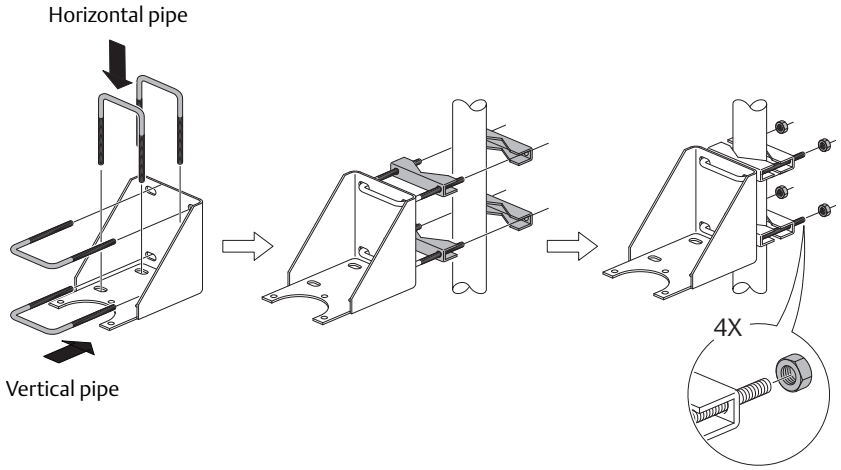
Step 2: Mount the probe on tank



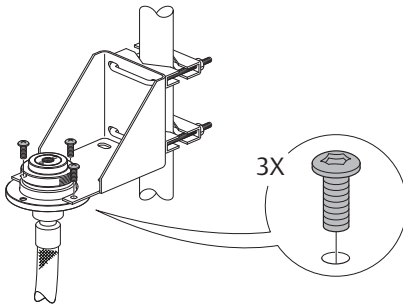
Step 3: Mount the remote connection on the probe



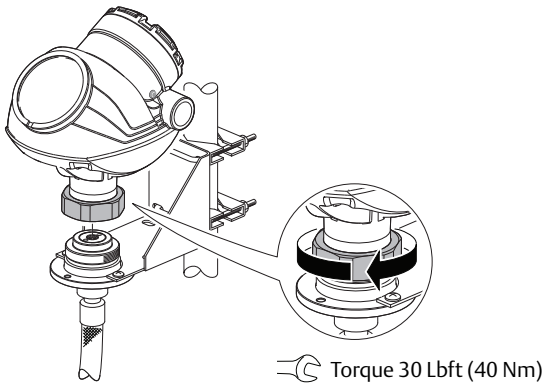
Step 4: Mount the bracket to the pipe



Step 5: Fasten the housing support



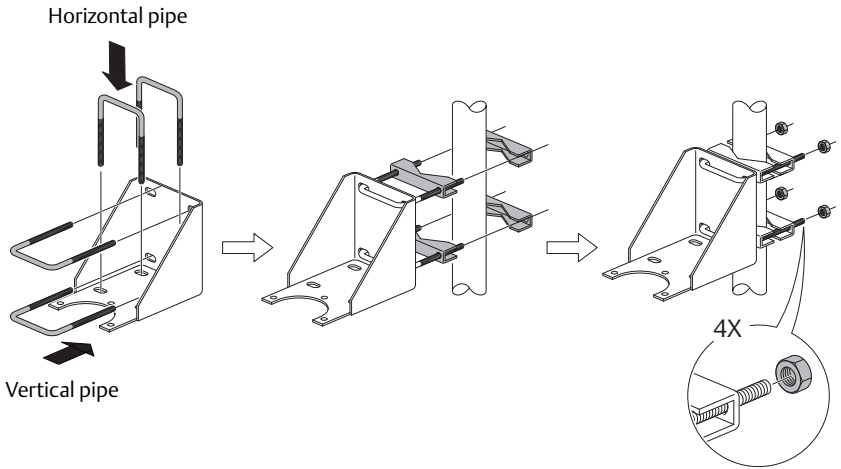
Step 6: Mount the transmitter head



3.3 Bracket mounting

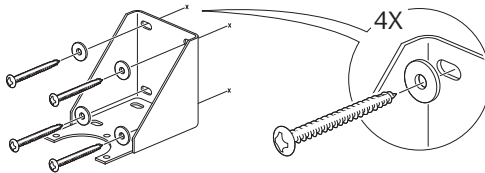
Step 1: Mount the bracket to the pipe/wall

On pipe

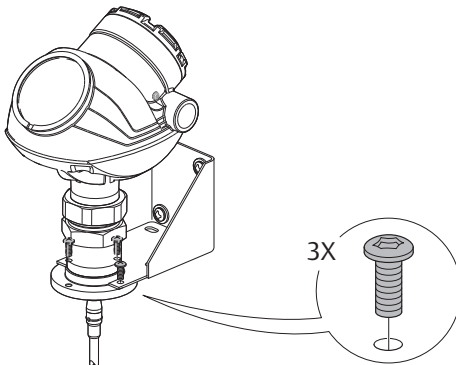


On wall

Use screws suitable for the purpose.



Step 2: Mount the transmitter with probe to the bracket



4.0 Connect the wiring

4.1 Cable selection

Use shielded twisted pair wiring (18-12 AWG).

For the RS-485 bus, use shielded twisted pair wiring, preferably with an impedance of 120 Ω (typically 24 AWG).

4.2 Cable gland/conduit

For explosion-proof/flameproof installations, only use cable glands or conduit entry devices certified explosion-proof or flameproof.

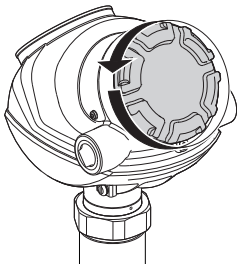
4.3 Power supply (Vdc)

Approval type	HART	FOUNDATION Fieldbus	RS-485 with Modbus
None	16 - 42.4	9 - 32	8-30 (max. rating)
Non-sparking/energy limited	16 - 42.4	9 - 32	N/A
Intrinsically safe	16 - 30	9 - 30	N/A
FISCO	N/A	9 - 17.5	N/A
Explosion-proof/Flameproof	20 - 42.4	16 - 32	8-30 (max. rating)

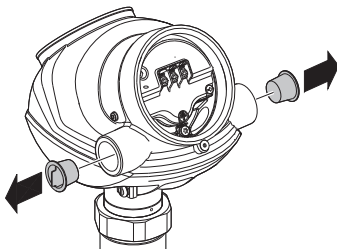
4.4 Procedure

Step 1: Verify that the power supply is disconnected

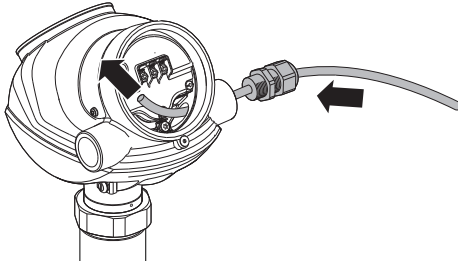
Step 2: Remove the cover



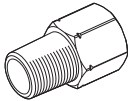
Step 3: Remove the plastic plugs



Step 4: Pull the cable through cable gland/conduit



Adapters are required if M20 glands are used.



Step 5: Connect the cable wires

See the wiring diagrams on [page 13-16](#).

Step 6: Ensure proper grounding

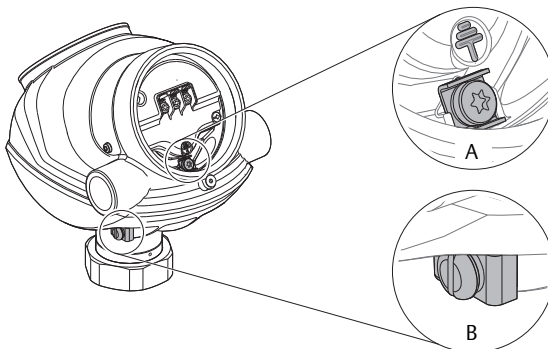
Make sure grounding is done (including IS ground inside Terminal compartment) according to Hazardous Locations Certifications, national and local electrical codes.

Transmitter housing grounding

The most effective transmitter housing grounding method is a direct connection to earth ground with minimal ($< 1 \Omega$) impedance.

There are two grounding screw connections provided (see [Figure 1](#)).

Figure 1. Ground Screws



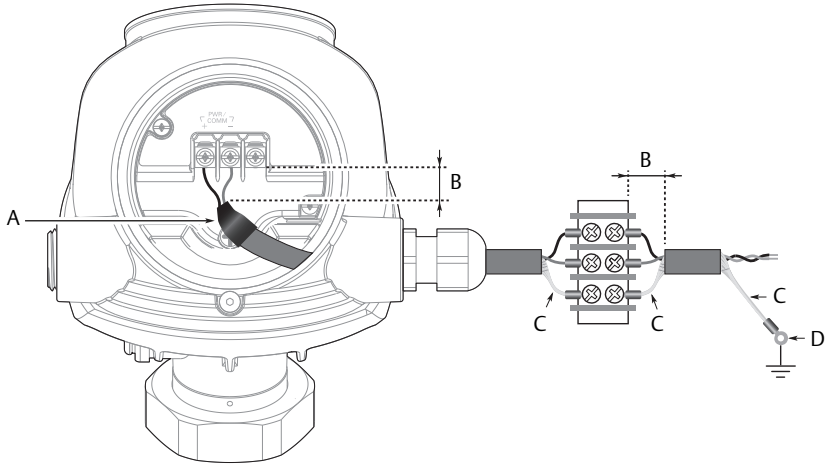
- A. Internal ground screw
- B. External ground screw

Signal cable shield grounding

Make sure the instrument cable shield is:

- trimmed close and insulated from touching the transmitter housing.
- continuously connected throughout the segment.
- connected to a good earth ground at the power supply end.

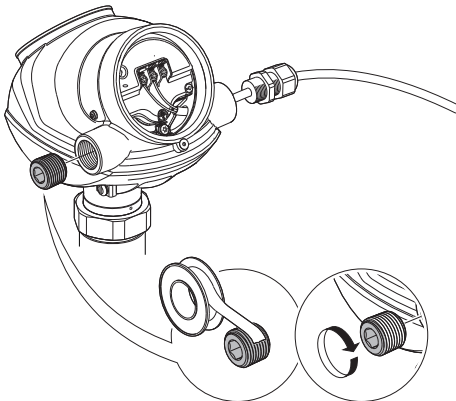
Figure 2. Cable Shield



- A. Insulate shield
- B. Minimize distance
- C. Trim shield and insulate
- D. Connect shield back to the power supply ground

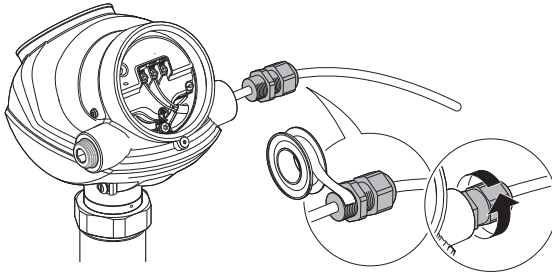
Step 7: Seal any unused port with the enclosed metal plug

Apply PTFE tape or other sealant to the threads.



Step 8: Tighten the cable gland

Apply PTFE tape or other sealant to the threads.



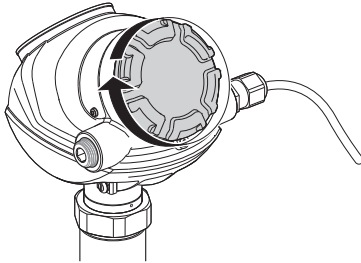
Note

Make sure to arrange the wiring with a drip loop.



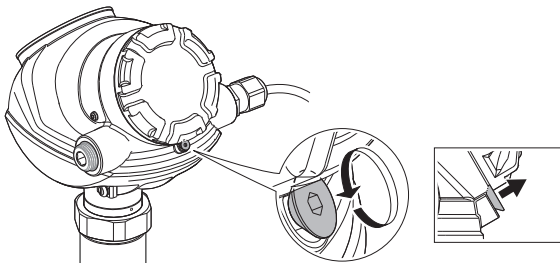
Step 9: Mount the cover

Make sure the cover is fully engaged to meet Explosion-proof requirements.



Step 10: Lock the cover with the locking screw

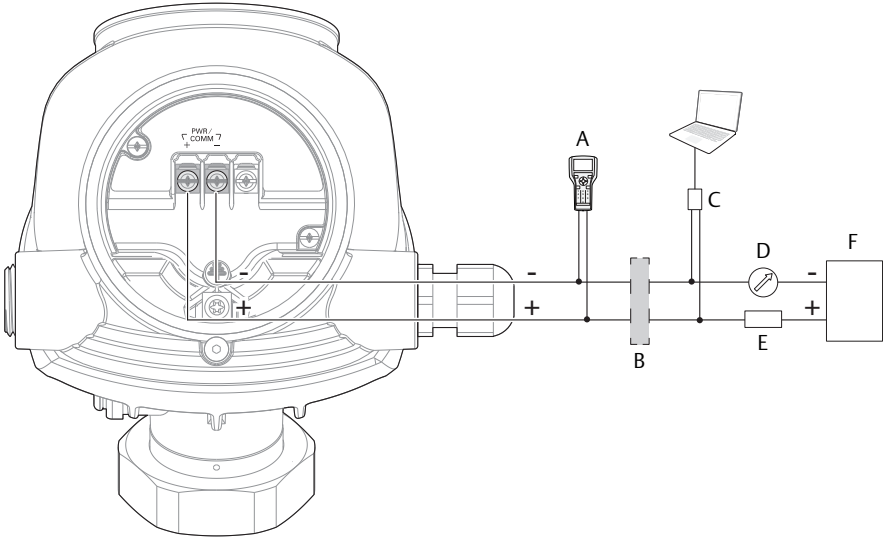
Required for ATEX, IECEx, NEPSI, INMETRO, and TIIS installations only.



Step 11: Connect the power supply

4.5 4-20 mA/HART communication

Figure 3. Wiring Diagram



- A. Field Communicator
- B. Approved IS barrier (for Intrinsically Safe installations only)
- C. HART modem
- D. Current meter
- E. Load resistance ($\geq 250 \Omega$)
- F. Power supply

Note

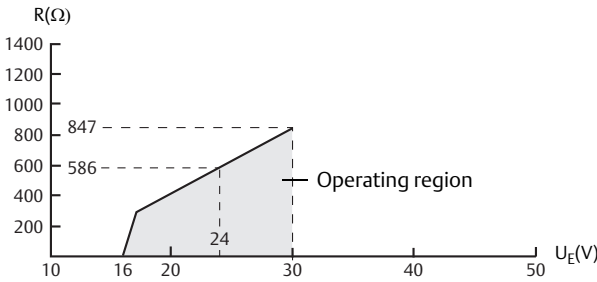
Rosemount 5300 Series Transmitters with Flameproof/explosion-proof output have a built-in barrier; no external barrier needed.

Load limitations

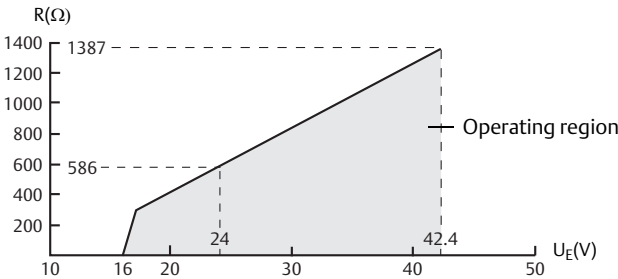
For HART communication, a minimum loop resistance of 250 Ω is required. For maximum loop resistance, see Figure 4.

Figure 4. Maximum Loop Resistance

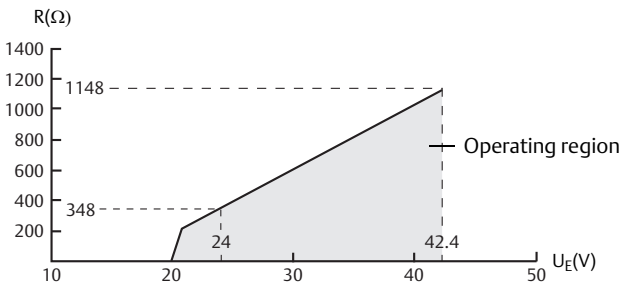
Intrinsically safe installations



Non-hazardous and Non-sparking/energy limited installations



Explosion-proof/flameproof (Ex d) installations



$R(\Omega)$: Maximum Loop Resistance

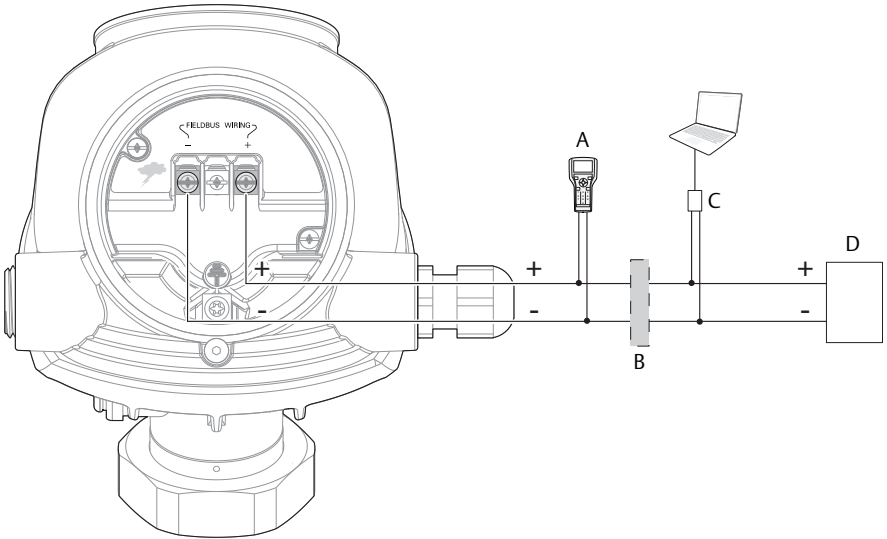
$U_E(V)$: External Power Supply Voltage

Note

For the Ex d case, the diagram is only valid if the HART load resistance is at the + side and if the - side is grounded, otherwise the load resistance value is limited to 435 Ω.

4.6 FOUNDATION Fieldbus

Figure 5. Wiring Diagram



- A. Field Communicator
- B. Approved IS barrier (for Intrinsically Safe installations only)
- C. FOUNDATION Fieldbus modem
- D. Power supply

Note

Rosemount 5300 Series Transmitters with Flameproof/explosion-proof output have a built-in barrier; no external barrier needed.

4.7 RS-485 with Modbus communication

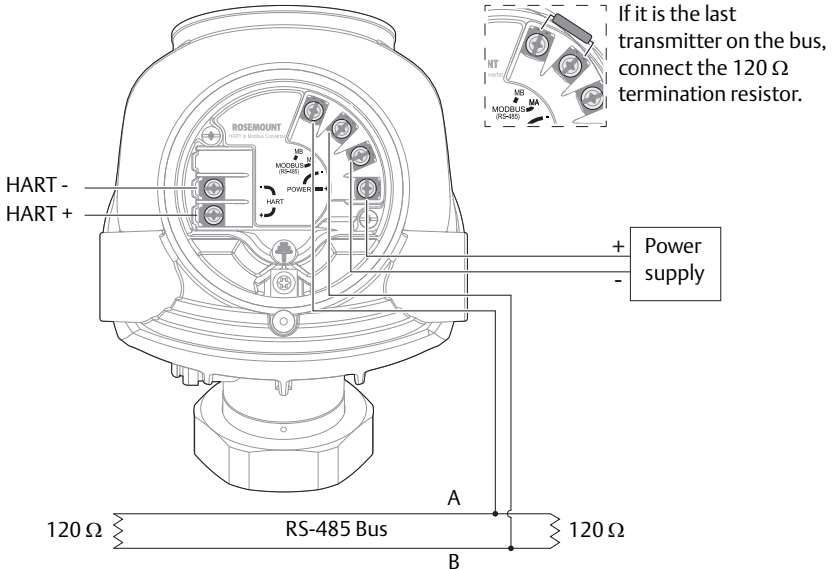
See the Rosemount 5300 Series Reference Manual (document number 00809-0100-4530) for details.

Power consumption

< 0.5 W (with HART address = 1)

< 1.2 W (including four HART slaves)

Figure 6. Wiring Diagram



Note

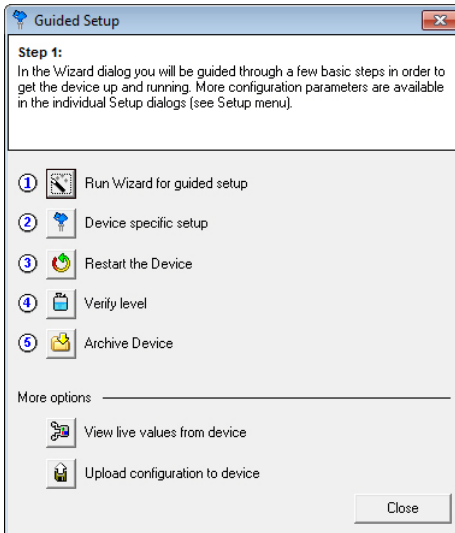
Rosemount 5300 Series Transmitters with Flameproof/Explosion-proof output have a built-in barrier; no external barrier needed.

5.0 Configure

Basic configuration can easily be done either with Rosemount Radar Master, a Field Communicator, the AMS™ Suite, DeltaV™, or any other DD (Device Description) or DTM compatible host system. For advanced configuration features, Rosemount Radar Master is recommended.

5.1 Rosemount Radar Master

1. Start Rosemount Radar Master (RRM).
2. Connect to the desired transmitter.
3. In the *Guided Setup* window, click **Run Wizard for guided setup** and follow the instructions.



4. Continue with steps 2 to 5 in the Guided Setup.
5. Click **View live values from device** to verify that the transmitter works correctly.

5.2 AMS Device Manager or Field Communicator

Step 1: Connect to device

AMS Device Manager

1. Start AMS Device manager.
2. Select **View > Device Connection View**.
3. In the *Device Connection View*, double-click the modem icon.
4. Double-click the device icon.

Field Communicator

1. Turn on the Field Communicator.
2. From the *Main Menu*, tap the HART or Fieldbus symbol.
The Field Communicator now connects to the device.

Step 2: Configure device

HART Device Revision 3

1. Select **Configure/Setup > Basic Setup**.
2. Configure steps 1- 6 in the Basic Setup.
(Variable Mapping, Probe, Geometry, Environment, Volume, and Analog Out)
3. Select **Finish**.
4. Select **Device Specific Setup**.
5. Select **Restart Device**.

HART Device Revision 4

1. Select **Configure > Guided Setup**.
2. Select **Level Measurement Setup** and follow the instructions.
3. Select **Device Specific Setup**.
4. Run **Verify Level** to check your level measurement.
5. Consider optional setup, such as **Volume** and **Display**.

FOUNDATION Fieldbus

1. Select **Configure > Guided Setup**.
2. Select **Level Measurement Setup** and follow the instructions.
3. Optional: Select **Volume Calculation Setup**.
4. Select **Device Specific Setup**.
5. Select **Restart Measurement**.

Table 2. FOUNDATION Fieldbus Parameters

Function	Parameter
Probe type	TRANSDUCER_1100 > PROBE_TYPE
Probe length	TRANSDUCER_1100 > PROBE_LENGTH
Hold off distance/Upper null zone	TRANSDUCER_1100 > GEOM_HOLD_OFF_DIST
Tank height	TRANSDUCER_1100 > GEOM_TANK_HEIGHT
Mounting type	TRANSDUCER_1100 > MOUNTING_TYPE
Pipe/chamber/nozzle inner diameter	TRANSDUCER_1100 > PIPE_DIAMETER
Nozzle height	TRANSDUCER_1100 > NOZZLE_HEIGHT
Measurement mode	TRANSDUCER_1100 > MEAS_MODE
Product dielectric range ⁽¹⁾	TRANSDUCER_1100 > PRODUCT_DIELEC_RANGE
Upper product dielectric constant ⁽²⁾	TRANSDUCER_1100 > UPPER_PRODUCT_DC
Process condition (rapid level changes)	TRANSDUCER_1100 > ENV_ENVIRONMENT
Volume calculation method	TRANSDUCER_1300 > VOL_VOLUME_CALC_METHOD
Tank diameter (only for ideal tank shapes)	TRANSDUCER_1300 > VOL_IDEAL_DIAMETER
Tank length/height (only for ideal tank shapes)	TRANSDUCER_1300 > VOL_IDEAL_LENGTH
Volume offset	TRANSDUCER_1300 > VOL_VOLUME_OFFSET

1. Applicable to “Liquid Product Level” and “Solid Product Level” measurement modes.
2. Applicable to “Interface Level with submerged” and “Product Level and Interface Level” measurement modes.

6.0 Safety Instrumented Systems (4-20 mA only)

For Safety Certified installations, refer to the Rosemount 5300 Series Reference Manual (document number 00809-0100-4530).

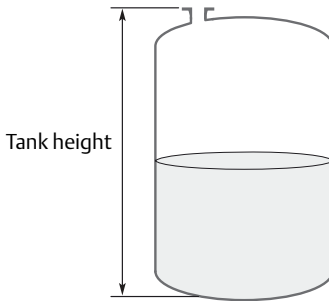
7.0 Adjust probe length

This section describes how to adjust the length of flexible single lead probes with weight unmounted (option code WU).

For other probe types, refer to Section 3 in the Rosemount 5300 Reference Manual (document number 00809-0100-4530).

Step 1: Measure tank height

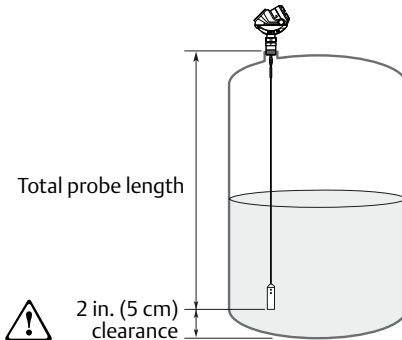
Tank height:



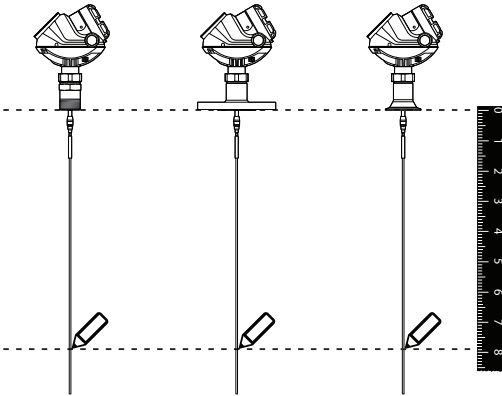
Step 2: Calculate total probe length

Total probe length = Tank height – 2 in. (5 cm)

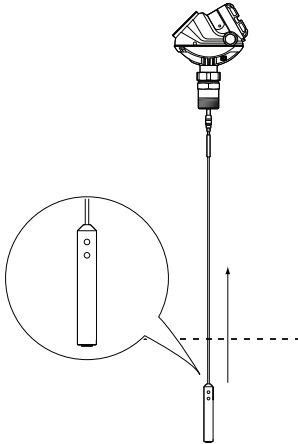
Total probe length:



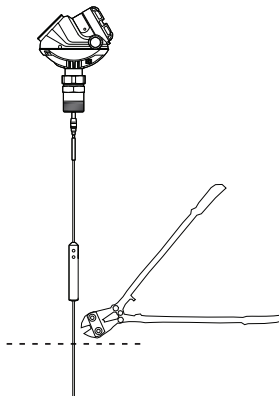
Step 3: Mark where to cut the probe



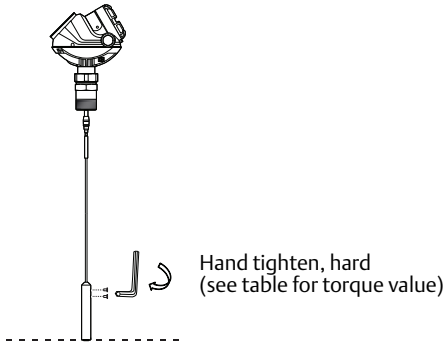
Step 4: Slide the weight up



Step 5: Cut the probe at the mark



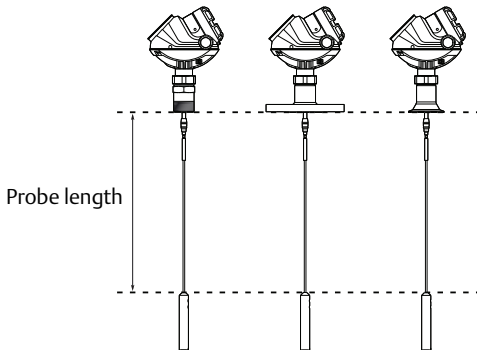
Step 6: Fasten the weight



Weight material	Torque (Nm)
Stainless steel	5
Alloy C-276	2.5
Alloy 400	2.5
Duplex 2205	2.5

Step 7: Update transmitter configuration to the new probe length

Probe length:



8.0 Product certifications

8.1 EU conformity

The EC declaration of conformity can be found on [page 32](#). The most recent revision of the EC declaration of conformity can be found at EmersonProcess.com/Rosemount.

8.2 Safety Instrumented Systems (SIS)

SIL 3 Capable: IEC 61508 certified by an accredited 3rd party agency for use in safety instrumented systems up to SIL 3 (Minimum requirement of single use (1oo1) for SIL 2 and redundant use (1oo2) for SIL 3).

For more information, go to:
<http://www.rosemount.com/safety>

8.3 Hazardous locations certifications

North-American certifications

Factory Mutual (FM) Approval

Project ID: 3020497

E5 Explosion-proof

Explosionproof-Intrinsically Safe for Class I, Div. 1, Groups B, C, and D.
Dust-ignition-proof for Class II/III, Div. 1, Groups E, F, and G with Intrinsically Safe connections to Class I, II, III, Div. 1, Groups B, C, D, E, F, and G.
Temp. Code T4
Ambient temperature limits: -50 °C to +70 °C⁽¹⁾
Seal not required.
Approval valid for HART, FOUNDATION Fieldbus, and Modbus options.

I5, IE Intrinsically Safe, Non-Incendive, and FISCO model

Intrinsically Safe for Class I, II, III, Div. 1, Groups A, B, C, D, E, F, and G.
Class I, Zone 0, AEx ia IIC T4 when installed per Control Drawing: 9240 030-936.
Non-Incendive for Class I, II, Div. 2, Groups A, B, C, D, F, and G. Suitable for Class III, Div. 2; 4-20 mA/HART model: $U_i = 30 \text{ Vdc}$, $I_i = 130 \text{ mA}$, $P_i = 1.0 \text{ W}$, $C_i = 7.26 \text{ nF}$, $L_i = 0 \text{ }\mu\text{H}$.
Max. operation: 42.4 V, 25 mA
FOUNDATION Fieldbus model: $U_i = 30 \text{ Vdc}$, $I_i = 300 \text{ mA}$, $P_i = 1.3 \text{ W}$, $C_i = 0 \text{ nF}$, $L_i = 0 \text{ H}$.
Max. operation: 32 V, 25 mA
FISCO model: $U_i = 17.5 \text{ Vdc}$, $I_i = 380 \text{ mA}$, $P_i = 5.32 \text{ W}$, $L_i = C_i = 0$.
Temp. Code T4
Ambient temperature limits: -50 °C to +70 °C⁽¹⁾
Approval valid for HART, FOUNDATION Fieldbus, and FISCO options.

1. +60 °C with FOUNDATION Fieldbus or FISCO option.

Specific Conditions of Use:

1. **WARNING:** Potential Electrostatic Charging Hazard – The enclosure is constructed from a non-metallic material. To prevent the risk of electrostatic sparking the plastic surface should only be cleaned with a damp cloth.
2. **WARNING:** The apparatus enclosure contains aluminum and is considered to constitute a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact or friction.

Canadian Standards Association (CSA) Approval

Certificate: 1514653

Product options bearing the Dual Seal marking meets the Dual Seal Requirements of ANSI/ISA12.27.01-2003.

Dual seal annunciation

The breach of the secondary seal is annunciated via product leakage from the antenna's vents. The leakage will be visible and/or audible from the transmitter head's threads.

Dual seal maintenance

No maintenance required. Verify proper operation by keeping leak path free from ice or contamination.

E6 Explosion-proof with internal intrinsically safe circuits [Exia]

Class I, Div. 1, Groups B, C, and D;

Class II, Div. 1 and 2, Groups E, F, and G;

Class III

Temp Code T4.

Ambient temperature limits -50 °C to +70 °C⁽¹⁾

WARNING: The substitution of components may impair intrinsic safety.

Approval valid for HART, FOUNDATION Fieldbus, and Modbus options.

I6, IF Intrinsically Safe Exia

Class I, Division 1, Groups A, B, C, and D.

Temperature code T4.

4-20 mA/HART model: $U_i = 30$ Vdc, $I_i = 130$ mA, $P_i = 1.0$ W, $C_i = 7.26$ nF, $L_i = 0$ μ H.

FOUNDATION Fieldbus model: $U_i = 30$ Vdc, $I_i = 300$ mA, $P_i = 1.3$ W, $C_i = 0$ nF, $L_i = 0$ μ H.

FISCO model: $U_i = 17.5$ Vdc, $I_i = 380$ mA, $P_i = 5.32$ W, $C_i = 0$ nF, $L_i = 0$ μ H.

Installation drawing: 9240 030-937

Ambient temperature limits: -50 °C to + 70 °C⁽¹⁾

WARNING: The substitution of components may impair intrinsic safety.

Approval valid for HART, FOUNDATION Fieldbus, and FISCO options.

1. +60 °C with FOUNDATION Fieldbus or FISCO option.

European certifications

ATEX Approval

Specific Conditions for Safe Use (X):

Valid for E1, I1, and IA approvals only.

1. The intrinsically safe circuits do not withstand the 500V AC test as specified in IEC 60079-11:2012 clause 6.4.13.
2. Potential ignition hazards by impact or friction need to be considered according to EN 60079-0:2012 clause 8.3 (for EPL Ga and EPL Gb) and clause 8.4 (for EPL Da and EPL Db), when the transmitter enclosure and antennas exposed to the exterior atmosphere of the tank, is made with light metals containing aluminium or titanium. The end user shall determine the suitability with regard to avoid hazards from impact and friction.
3. Parts of the rod-antennas, for type 5300 are non-conducting material covering metal surfaces. The area of the non-conducting part exceeds the maximum permissible areas for Group III according to EN 60079-0:2012 clause 7.4.3: Therefore, when the antenna is used in a potentially explosive atmosphere group III, EPL Da, appropriate measures must be taken to prevent electrostatic discharge.
4. The Ex ia version of model 5300 FISCO field device may be supplied by an "Ex ib" FISCO power supply, when the power supply is certified with three separate safety current limiting devices and voltage limitation which meets the requirements for type Ex ia.
5. 1/2" NPT threads need to be sealed for dust and water ingress protection, IP 66, IP 67 or 'Ex t', EPL Da or Db is required.

E1 Flameproof

Certificate: Nemko 04ATEX1073X



II 1/2G Ex d ia IIC T4 Ga/Gb

II 1D Ex ta IIIC T79 °C⁽¹⁾ Da

-40 °C ≤ Ta ≤ +70 °C⁽²⁾

Um = 250 V

Approval valid for the HART, FOUNDATION Fieldbus, and Modbus options.

I1, IA Intrinsically safe and FISCO model

Certificate: Nemko 04ATEX1073X



II 1G Ex ia IIC T4 Ga

II 1/2G Ex ia/ib IIC T4 Ga/Gb⁽³⁾

II 1D Ex ta IIIC T79 °C⁽¹⁾ Da

-50 °C ≤ Ta ≤ +70 °C⁽²⁾

4-20 mA/HART model: $U_i \leq 30$ V, $I_i \leq 130$ mA, $P_i < 1.0$ W, $C_i = 7.26$ nF, $L_i = 0$ μH.

FOUNDATION Fieldbus model: $U_i \leq 30$ Vdc, $I_i \leq 300$ mA, $P_i \leq 1.5$ W, $C_i = 4.95$ nF, $L_i = 0$ μH.

FISCO model: $U_i \leq 17.5$ Vdc, $I_i \leq 380$ mA, $P_i \leq 5.32$ W, $C_i = 4.95$ nF, $L_i \leq 1$ μH.

Installation Drawing: 9240 030-938

Approval valid for HART, FOUNDATION Fieldbus, and FISCO options.

1. +69 °C with FOUNDATION Fieldbus or FISCO option.

2. +60 °C with FOUNDATION Fieldbus or FISCO option.

3. Valid for the FISCO option only.

N1 Type n

Certificate: Nemko 10ATEX1072

⊕ II 3G Ex nAnL IIC T4 Gc (-50 °C < Ta < +70 °C⁽¹⁾)

4-20 mA/HART model: $U_i = 42.2 \text{ V}$, $I_i = 23 \text{ mA}$, $P_i = 1.0 \text{ W}$, $C_i = 7.25 \text{ nF}$, $L_i = 0 \text{ } \mu\text{H}$

FOUNDATION Fieldbus model: $U_i = 32 \text{ V}$, $I_i = 21 \text{ mA}$, $P_i = 0.7 \text{ W}$, $C_i = 4.95 \text{ nF}$, $L_i = 0 \text{ } \mu\text{H}$

⊕ II 3G Ex nL IIC T4 Gc (-50 °C < Ta < +70 °C⁽¹⁾)

4-20 mA/HART model: $U_n = 42.4 \text{ Vdc}$

FOUNDATION Fieldbus model: $U_n = 32 \text{ Vdc}$

Installation drawing: 9240 031-957

Approval valid for HART and FOUNDATION Fieldbus options.

IECEx certifications**IECEx Approvals****Special Conditions for Safe Use (X):**

Valid for E7, I7, and IG approvals only.

1. The intrinsically safe circuits do not withstand the 500V AC test as specified in IEC 60079-11:2012 clause 6.4.13.
2. Potential ignition hazards by impact or friction need to be considered according to IEC 60079-0:2012 clause 8.3 (for EPL Ga and EPL Gb) and clause 8.4 (for EPL Da and EPL Db), when the transmitter enclosure and antennas exposed to the exterior atmosphere of the tank, is made with light metals containing aluminium or titanium. The end user shall determine the suitability with regard to avoid hazards from impact and friction.
3. Parts of the rod-antennas, for type 5300 are non-conducting material covering metal surfaces and the area of the non-conducting part exceeds the maximum permissible areas for Group III according to IEC 60079-0:2011 clause 7.4.3. Therefore, when the antenna is used in a potentially explosive atmosphere Group III, EPL Da, appropriate measures must be taken to prevent electrostatic discharge.
4. The Ex ia version of model 5300 FISCO field device may be supplied by an [Ex ib] FISCO power supply when the power supply is certified with three separate safety current limiting devices and voltage limitation which meets the requirements for type Ex ia.
5. ½" NPT threads need to be sealed for dust and water ingress protection, IP 66, IP 67 or 'Ex t', EPL Da or Db is required.

E7 Flameproof:

Certificate: IECEx NEM 06.0001X

Ex d ia IIC T4 Ga/Gb (-40 °C ≤ Ta ≤ +70 °C⁽¹⁾)

Ex ta IIIC T 79 °C⁽²⁾ Da (-40 °C ≤ Ta ≤ +70 °C⁽¹⁾)

$U_m = 250 \text{ V}$

Approval valid for HART, FOUNDATION Fieldbus, and Modbus options.

1. +60 °C with FOUNDATION Fieldbus or FISCO option.

2. +69 °C with FOUNDATION Fieldbus or FISCO option.

I7, IG Intrinsically safe and FISCO model

Certificate: IECEx NEM 06.0001X

Ex ia IIC T4 Ga (-50 °C ≤ Ta ≤ +70 °C⁽¹⁾)Ex ia/ib IIC T4 Ga/Gb⁽²⁾Ex ta IIIC T 79 °C⁽³⁾ Da (-50 °C ≤ Ta ≤ +70 °C)4-20 mA/HART model: U_i = 30 Vdc, I_i = 130 mA, P_i = 1.0 W, C_i = 7.26 nF, L_i = 0 μHFOUNDATION Fieldbus model: U_i = 30 Vdc, I_i = 300 mA, P_i = 1.5 W, C_i = 4.95 nF, L_i = 0 μHFISCO model: U_i = 17.5 Vdc, I_i = 380 mA, P_i = 5.32 W, C_i = 4.95 nF, L_i < 0 μH

Installation drawing: 9240 030-938

Approval valid for HART, FOUNDATION Fieldbus, and FISCO options.

N7 Type n

Certificate: IECEx NEM 10.0005

Ex nA nL IIC T4 Gc

4-20 mA/HART model: 42.4 Vdc, 23 mA

FOUNDATION Fieldbus model: 32 Vdc, 21 mA

Ex nL IIC T4 Gc

4-20 mA/HART model: U_i = 42.4 V, I_i = 23 mA, P_i = 1.0 W, C_i = 7.25 nF, L_i = 0 μHFOUNDATION Fieldbus model: U_i = 32 V, I_i = 21 mA, P_i = 0.7 W, C_i = 4.95 nF, L_i = 0 μH

Approval valid for HART and FOUNDATION Fieldbus options.

Brazilian certifications**INMETRO approvals****Special Conditions for Safe Use (X):**

Letter X in the number of the certificate indicates the following special condition(s) for safe use:

- For models 530xFxxxxxxxxxE1..., 530xFxxxxxxxxKA..., 530xFxxxxxxxxKB... or 530xFxxxxxxxxKC... and when the sensor area requires an EPL Ga, the installation of the transmitter on the process wall must be done in a way that ensures the minimum degree of protection IP67 in the connection, in compliance with regulation ABNT NBR IEC 60529.
- The intrinsically safe circuit did not withstand the dielectric rigidity tests with 500 Vca as specified in clause 6.4.12 of regulation IEC 60079-11.
- Probes covered with plastic or plastic discs should have a non-conductive area not exceeding the maximum permitted area for the MC group, which is 4 cm². Therefore, when an antenna is used in a potentially explosive atmosphere, appropriate measures should be taken by the user to prevent electrostatic discharge.
- This equipment contains light metals. The equipment must be installed in a way that the risk of impact or friction with other metal surfaces is eliminated.
- The Ex ia version of the field device of model FISCO 5300 can be provided with a FISCO [Ex ib] power supply when the power supply is certified with three current limiter safety devices separately and with limitation of voltage, complying with the requirements of the Ex ia model.

1. +60 °C with FOUNDATION Fieldbus or FISCO option.

2. Valid for the FISCO option only.

3. +69 °C with FOUNDATION Fieldbus or FISCO option.

Certificate: NCC 14.2258X

Standards: ABNT NBR IEC: 60079-0:2013, 60079-1:2009, 60079-11:2013,
60079-26:2008, 60079-31:2011

E2 Flameproof

4-20 mA/HART model:

Ex d ia IIC T4 Gb/Ga

Ex ta IIIC T79 °C

$-40\text{ °C} \leq T_a \leq +70\text{ °C}$

$U_m: 250\text{ V}$

FOUNDATION Fieldbus model:

Ex d ia IIC T4 Gb/Ga

Ex ta IIIC T69 °C

$-40\text{ °C} \leq T_a \leq +60\text{ °C}$

$U_m: 250\text{ V}$

Modbus RS-485 model:

Ex d ia IIC T4 Gb/Ga

Ex ta IIIC T79 °C

$-40\text{ °C} \leq T_a \leq +70\text{ °C}$

$U_m: 250\text{ V}$

I2 Intrinsically safe

4-20 mA/HART model:

Ex ia IIC T4 Ga

Ex ta IIIC T79 °C

$-50\text{ °C} \leq T_a \leq +70\text{ °C}$

$U_i = 30\text{ V}$, $I_i = 130\text{ mA}$, $P_i = 1.0\text{ W}$, $L_i = 0\text{ }\mu\text{H}$, $C_i = 7.26\text{ nF}$

FOUNDATION Fieldbus model:

Ex ia IIC T4 Ga

Ex ta IIIC T69 °C

$-50\text{ °C} \leq T_a \leq +60\text{ °C}$

$U_i = 30\text{ V}$, $I_i = 300\text{ mA}$, $P_i = 1.5\text{ W}$, $L_i = 0\text{ }\mu\text{H}$, $C_i = 4.95\text{ nF}$

Installation drawing: 9240030-938

IB FISCO model

FISCO Field Device

Ex ia IIC T4 Ga

Ex ia/ib IIC T4 Ga/Gb

Ex ta IIIC T69 °C

$-50\text{ °C} \leq T_a \leq +60\text{ °C}$

$U_i = 17.5\text{ Vdc}$, $I_i = 380\text{ mA}$, $P_i = 5.32\text{ W}$, $L_i < 1\text{ }\mu\text{H}$, $C_i = 4.95\text{ nF}$

Installation drawing: 9240 030-938

Chinese certifications

National Supervision and Inspection Center for Explosion Protection and Safety of Instrumentation (NEPSI) Approvals

Special Conditions for Safe Use (X):

Refer to Certificates GYJ 111230X and GYJ 13.1387.

E3 Flameproof

4-20 mA/HART model:

Ex d ia IIC T4 (-40 °C < Ta < +70 °C) DIP A20 T_A 79 °C

FOUNDATION Fieldbus model:

Ex d ia IIC T4 (-40 °C < Ta < +60 °C) DIP A20 T_A 69 °C

Approval valid for HART, FOUNDATION Fieldbus, and Modbus options.

I3 Intrinsically safe

4-20 mA/HART model:

Ex ia IIC T4 (-50 °C < Ta < +70 °C) DIP A20 T_A 79 °C

U_i = 30 V, I_i = 130 mA, P_i = 1.0 W, C_i = 7.26 nF, L_i = 0 μH

FOUNDATION Fieldbus model:

Ex ia IIC T4 (-50 °C < Ta < +60 °C) DIP A20 T_A 69 °C

U_i = 30 V, I_i = 300 mA, P_i = 1.5 W, C_i = 4.95 nF, L_i = 0 μH

Approval valid for HART and FOUNDATION Fieldbus options.

IC FOUNDATION Fieldbus FISCO model

Ex ia IIC T4 (-50 °C < Ta < +60 °C) DIP A20 T_A 69 °C

U_i = 17.5 V, I_i = 380 mA, P_i = 5.32 W, C_i = 4.95 nF, L_i < 0.1 μH

N3 Type n

4-20 mA/HART model:

Ex nA nL IIC T4 Gc (-50 °C < Ta < +70 °C)

U_n = 42.4 V, L_i = 0 μH

FOUNDATION Fieldbus model:

Ex nA nL IIC T4 Gc (-50 °C < Ta < +60 °C)

U_n = 32 V

Japanese certifications

Technology Institution of Industrial Safety (TIIS) Approval

Special Conditions for Safe Use (X):

Refer to certificate TC20104 and TC20192.

E4 Flameproof:

4-20 mA/HART model:

Transmitter: Ex d [ia] IIC T4X

-20 ~ +60 °C

DC 20 - 42.4 V

$U_m = 250$ V

$U_o = 22.2$ V

$I_o = 177.5$ mA

$P_o = 0.985$ W

Probe: Ex ia IIC T4X

FOUNDATION Fieldbus model:

Transmitter: Ex d [ia] IIC T4X

-20 ~ +60 °C

DC 16 - 32 V

$U_m = 250$ V

$U_o = 22.2$ V

$I_o = 177.5$ mA

$P_o = 0.985$ W

Probe: Ex ia IIC T4X

Installation drawing: 05300-00548

Approval valid for HART and FOUNDATION Fieldbus options.

EAC certifications

Technical Regulations Customs Union (EAC)

5300 Transmitters comply with the Technical Regulations of the Customs Union TP TC 012/2011; GOST R IEC 60079-0-2011; GOST R IEC 60079-1-2011; GOST R IEC 60079-11-2010; GOST 31610.26-2012/IEC 60079-26:2006

Certificate: RU C-SE.ГБ05.B.00537

Special Conditions for Safe Use (X):

1. Transmitters with Exia marking shall be powered with intrinsic safety barriers certified for compliance.
2. Inductance and capacity of intrinsically safe transmitter circuits, including parameters of cables to be connected, shall not exceed max. values indicated on the intrinsic safety barriers at the side of a hazardous area.
3. Transmitters do not withstand the 500 VAC hipot test for 1 minute.
4. External electric circuits shall be connected to the transmitters via cable entries that were certified for compliance.
5. Unused cable entries of transmitters shall be closed with the plugs that were certified for compliance.
6. Appropriate measures shall be taken to prevent electrostatic discharge if transmitter probes are covered with plastic and/or with plastic discs.
7. To avoid an ignition hazard due to mechanical impact or friction when the aluminum housing transmitters are installed in zone 0.

EM EAC Explosion-proof

4-20 mA/HART model:

Ga/Gb Ex ia/db ia IIC T1...T4 X (-40 °C ≤ Ta ≤ +70 °C)

Um: 250 V

Max. operation: 42.4 V, 25 mA

FOUNDATION Fieldbus model:

Ga/Gb Ex ia/db ia IIC T1...T4 X (-40 °C ≤ Ta ≤ +60 °C)

Um: 250 V

Max. operation: 32 V, 21 mA

Modbus RS-485:

Ga/Gb Ex ia/db ia IIC T1...T4 X (-40 °C ≤ Ta ≤ +70 °C)

Um: 250 V

Max. operation: 30 V, 1.2 W

IM EAC Intrinsically Safe

4-20 mA/HART model:

0Ex ia IIC T1...T4 Ga X (-50 °C ≤ Ta ≤ +70 °C)

U_i = 30 V, I_i = 130 mA, P_i = 1 W, L_i = 0 μH, C_i = 7.26 nF

FOUNDATION Fieldbus model:

0Ex ia IIC T1...T4 Ga X (-50 °C ≤ Ta ≤ +60 °C)

U_i = 30 V, I_i = 300 mA, P_i = 1.5 W, L_i = 0 μH, C_i = 4.95 nF

FISCO model:

0Ex ia IIC T1...T4 Ga X or 0Ex ia/ib IIC T1...T4 Ga/Gb X (-50 °C ≤ Ta ≤ +60 °C)

U_i = 17.5 V, I_i = 380 mA, P_i = 5.32 W, L_i = 1 μH, C_i = 4.95 nF

8.4 Other certifications

U1 Overfill prevention

Certificate: Z-65.16-476

TÜV-tested and approved by DIBt for overfill prevention according to the German WHG regulations.

Approval valid for HART and FOUNDATION Fieldbus options.



Suitability for intended use

Compliant with NAMUR NE 95, version 07.07.2006 "Basic Principles of Homologation".

Type approval certifications (Marine/shipboard approvals)**SBS** American Bureau of Shipping (ABS)**SDN** Det Norske Veritas (DNV)**SLL** Lloyd's Register**SBV** Bureau Veritas

8.5 EC Declaration of Conformity

Figure 7. Rosemount 5300 EC Declaration of Conformity

EC Declaration of Conformity

No: 5300

We,

Rosemount Tank Radar AB
Box 13045
S-402 51 GÖTEBORG
Sweden

declare under our sole responsibility that the product,

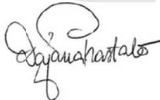
Rosemount 5300 Series Level and Interface Transmitter

manufactured by,

Rosemount Tank Radar AB
Box 13045
S-402 51 GÖTEBORG
Sweden

to which this declaration relates, is in conformity with the provisions of the European Community Directives, including amendments, as shown in the attached schedule.

Assumption of conformity is based on the application of the harmonized standards and, when applicable or required, a European Community notified body certification, as shown in the attached schedule.




(signature)

Dajana Prastalo
(name - printed)

Manager Product Approvals

(function name - printed)

2015-05-21
(date of issue)



ROSEMOUNT

**Schedule
No: 5300**

EMC, Electromagnetic Compatibility Directive (2004/108/EC)

EN 61326-1:2013

ATEX, Explosive Atmospheres Directive (94/9/EC)

Nemko 04ATEX1073X

Intrinsic Safety (Hart@ 4-20mA):

Equipment Group II, Category 1 G, Ex ia IIC T4 Ga

Intrinsic Safety (Foundation® Fieldbus, Foundation® Fieldbus FISCO):

Equipment Group II, Category 1 G, Ex ia IIC T4 Ga

Equipment Group II, Category 1/2 G, Ex ia/ib IIC T4 Ga/Gb

Flameproof: Equipment Group II, Category 1/2 G, Ex d ia IIC T4 Ga/Gb

Dust: Equipment Group II, Category 1 D, Ex ta IIIC T69°C/T79°C Da

EN 60079-0:2012; EN 60079-1:2007; EN 60079-11:2012; EN 60079-26:2007;
EN 60079-31:2009

Nemko 10ATEX1072

Type of protection N, Non-sparking: Equipment Group II, Category 3 G, Ex nAnL IIC T4 Gc

Type of protection N, Energy Limited: Equipment Group II, Category 3 G, Ex nL IIC T4 Gc

EN60079-0:2009; EN60079-15:2005

ROSEMOUNT



**Schedule
No: 5300**

ATEX Notified Body for EC Type Examination Certificates and Type Examination Certificates

Nemko AS [Notified Body Number: 0470]
Gautadalléen 30
0314 OSLO
Norway

ATEX Notified Body for Quality Assurance

Det Norske Veritas Certification AS [Notified Body Number: 0575]
Veritasveien 1
1322 HØVIK
Norway





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Modbus is a registered trademark of Modicon, Inc.
DTM is a trademark of the FDT group.
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Rosemount™ 2120

Full-featured Vibrating Fork Liquid Level Switch



- Designed for operation in process temperatures of -40 to 302 °F (-40 to 150 °C)
- Electronic self-checking and condition monitoring
- Increased safety, **SIL2**-certified to IEC 61508 as required by IEC 61511 and **SIL3** capable
- Adjustable switching delay for turbulent or splashing applications
- “Fast Drip” fork design gives a quicker response time, especially with viscous liquids
- General area, explosion-proof/flameproof, and intrinsically safe options

Overview of the Rosemount 2120



The Quick Release kit is a new optional set of accessories. It makes inspection, proof-testing, and servicing easier than ever (see Table 2 on page 8 for accessories)



There is a variety of plug-in electronics options, with each having an adjustable mode and switching delay (see “Electrical connections” on page 11)



‘Fast drip’ forks

Measurement principle

The Rosemount 2120 is designed using the principle of a tuning fork. A piezo-electric crystal oscillates the forks at their natural frequency. Changes to this frequency are continuously monitored. The frequency of the vibrating fork sensor changes depending on the medium in which it is immersed. The denser the liquid, the lower the frequency.

When used as a **low level alarm**, the liquid in the tank or pipe drains down past the fork, causing a change of natural frequency that is detected by the electronics and switches the output state.

When the Rosemount 2120 is used as a **high level alarm**, the liquid rises in the tank or pipe, making contact with the fork which then causes the output state to switch.

Key features and benefits

- Function virtually unaffected by flow, bubbles, turbulence, foam, vibration, solids content, coating products, liquid properties, and product variations
- The Rosemount 2120 is designed for operation in process temperatures from -40 to 302 °F (-40 to 150 °C)
- A ‘heartbeat’ LED indicates its operating state. The LED also flashes when the switch output is ‘off’ and is constantly lit when ‘on’
- Adjustable switching delay prevents false switching in turbulent or splashing applications
- ‘Fast Drip’ fork design gives quicker response time, especially with viscous liquids. Rapid wet-to-dry and dry-to-wet time setting for highly responsive switching
- Fork shape is optimized for hand polishing to meet hygienic requirements
- Magnetic test point makes functional test easy
- No moving parts or crevices for virtually no maintenance

Contents

Overview of the Rosemount 2120	page 2	Specifications	page 9
Ordering Information	page 4	Product Certifications	page 13
Spare Parts and Accessories	page 8	Dimensional Drawings	page 15

Fit and forget

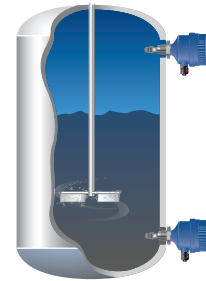
- Once installed, the Rosemount 2120 is ready to go. It needs no calibration and requires minimum installation
- The ‘heartbeat’ LED gives an instant visual indication that the unit is operational
- Functional testing of the instrument and system is easy with a magnetic test point
- You can install, and forget it

Superior performance

- The Rosemount 2120 is a popular choice for high and low level alarm and pump control duties for its simplicity, ease of use, and reliability
- Functionality is virtually unaffected by flow, turbulence, bubbles, foam, or vibration
- The ‘Fast Drip’ design allows the liquid to be quickly drawn away from the fork tip when mounted horizontally, making the Rosemount 2120 quicker and more responsive in high density or viscous liquid applications
- With a user-selectable time delay feature, the risk of false switching is minimized in turbulent or splashing applications

Applications

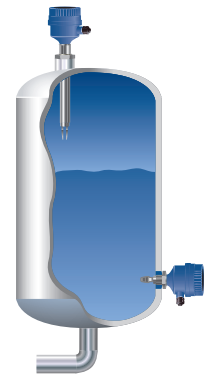
- Overfill protection
- High and low point level alarms
- Pump control or limit detection
- Run dry or pump protection
- Hygienic applications
- High-temperature applications
- Wireless applications



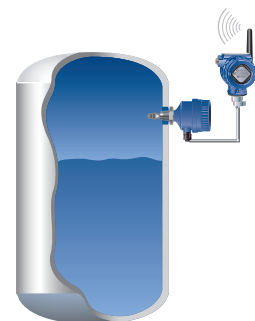
High and low level alarm



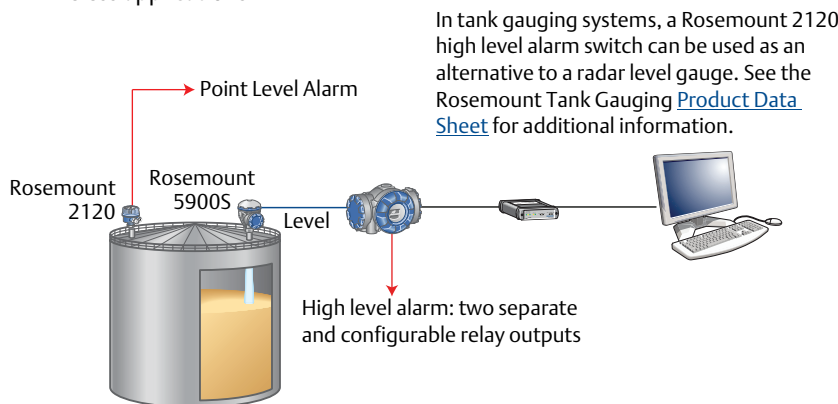
High-temperature applications



Pump control / limit detection



Wireless applications using a Rosemount 702 Discrete Transmitter



Ordering Information

Specification and selection of product materials, options, or components must be made by the purchaser of the equipment. See [page 9](#) for more information on Material Selection.

Table 1. Rosemount 2120 Ordering Information

The starred options (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Model	Product description	
2120	Vibrating Fork Liquid Level Switch / -40...302 °F (-40...150 °C)	
Materials of construction: process connection/fork		
D	316/316L Stainless Steel (1.4401/1.4404) dual certified	★
F ⁽¹⁾	ECTFE copolymer, coated 316/316L SST (1.4401/1.4404)	
C	Alloy C (UNS N10002), Alloy C-276 (UNS N10276), Solid	
Process connection size / type		
0A	3/4-in. BSPT (R) Thread	★
0B	3/4-in. BSPP (G) Thread	★
0D	3/4-in. NPT Thread	★
1A	1-in. BSPT (R) Thread	★
1B	1-in. BSPP (G) Thread	★
1D	1-in. NPT Thread	★
1P	1-in. BSPP (G), O-ring, Hygienic Fitting	★
5R	1 1/2-in. (38 mm) Tri Clamp, Hygienic Fitting	★
2R	2-in. (51 mm) Tri Clamp, Hygienic Fitting	★
1G	1-in. ASME B16.5 Class 150 Raised Face (RF) Flange	★
1H	1-in. ASME B16.5 Class 300 Raised Face (RF) Flange	★
1J	1-in. ASME B16.5 Class 600 Raised Face (RF) Flange	★
5G	1 1/2-in. ASME B16.5 Class 150 Raised Face (RF) Flange	★
5H	1 1/2-in. ASME B16.5 Class 300 Raised Face (RF) Flange	★
2G	2-in. ASME B16.5 Class 150 Raised Face (RF) Flange	★
2H	2-in. ASME B16.5 Class 300 Raised Face (RF) Flange	★
3G	3-in. ASME B16.5 Class 150 Raised Face (RF) Flange	★
3H	3-in. ASME B16.5 Class 300 Raised Face (RF) Flange	★
4G	4-in. ASME B16.5 Class 150 Raised Face (RF) Flange	★
4H	4-in. ASME B16.5 Class 300 Raised Face (RF) Flange	★
1K	DN25, EN1092 PN 10/16 Flange	★
1L	DN25, EN1092 PN 25/40 Flange	★
1M	DN25, EN1092 PN 63 Flange	★
1N	DN25, EN1092 PN 100 Flange	★
5K	DN40, EN1092 PN 10/16 Flange	★
5L	DN40, EN1092 PN 25/40 Flange	★

Table 1. Rosemount 2120 Ordering Information

The starred options (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

2K	DN50, EN1092 PN 10/16 Flange	★
2L	DN50, EN1092 PN 25/40 Flange	★
7K	DN65, EN1092 PN 10/16 Flange	★
7L	DN65, EN1092 PN 25/40 Flange	★
3K	DN80, EN1092 PN 10/16 Flange	★
3L	DN80, EN1092 PN 25/40 Flange	★
4K	DN100, EN1092 PN 10/16 Flange	★
4L	DN100, EN1092 PN 25/40 Flange	★
5J	1½-in. ASME B16.5 Class 600 Raised Face (RF) Flange	
2J	2-in. ASME B16.5 Class 600 Raised Face (RF) Flange	
3J	3-in. ASME B16.5 Class 600 Raised Face (RF) Flange	
4J	4-in. ASME B16.5 Class 600 Raised Face (RF) Flange	
5M	DN40, EN1092 PN 63 Flange	
5N	DN40, EN1092 PN 100 Flange	
2M	DN50, EN1092 PN 63 Flange	
2N	DN50, EN1092 PN 100 Flange	
7M	DN65, EN1092 PN 63 Flange	
7N	DN65, EN1092 PN 100 Flange	
3M	DN80, EN1092 PN 63 Flange	
3N	DN80, EN1092 PN 100 Flange	
4M	DN100, EN1092 PN 63 Flange	
4N	DN100, EN1092 PN 100 Flange	
SA	25A, 10K, JIS B2220 Flange	
SB	25A, 20K, JIS B2220 Flange	
TA	40A, 10K, JIS B2220 Flange	
TB	40A, 20K, JIS B2220 Flange	
UA	50A, 10K, JIS B2220 Flange	
UB	50A, 20K, JIS B2220 Flange	
VA	80A, 10K, JIS B2220 Flange	
VB	80A, 20K, JIS B2220 Flange	
ZA	100A, 10K, JIS B2220 Flange	
ZB	100A, 20K, JIS B2220 Flange	
XX ⁽²⁾	Customer Specific	

Table 1. Rosemount 2120 Ordering Information

The starred options (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Electronic type		Available certifications	
T	Direct load switching (Mains 2-wire) 20 to 264 Vac 50/60Hz, 20 to 60 Vdc	NA, E1, E5, E6, E7, EM, G5, G6	★
G	PNP/PLC (3-wire) 20 to 60 Vdc	NA, E1, E5, E6, E7, EM, G5, G6	★
V	Relay DPCO, 20 to 264 Vac 50/60Hz, 20 to 60 Vdc	NA, E1, E5, E6, E7, EM, G5, G6	★
E	Relay DPCO, 9...30 Vdc	E5 and G5	★
K	NAMUR	All	★
H	8/16 mA	All	★
Surface finish		Available connections	
1	Standard surface finish	All	★
2 ⁽³⁾	Hand polished (Ra < 0.4 μm)	Hygienic Connection Only	★
Product certifications		Electronic types allowed	Available housings
NA ⁽⁴⁾	No Hazardous Locations Certifications	All except D option	All
G5 ⁽⁵⁾	FM Ordinary Locations (unclassified, safe area)	All	Y, T
G6 ⁽⁶⁾	CSA Ordinary Locations (unclassified, safe area)	All except D option	Y, T
E1	ATEX Flameproof	All except D option	X, S
E5 ⁽⁵⁾	FM Explosion-proof	All	Y, T
E6 ⁽⁶⁾	CSA Explosion-proof	All except D option	Y, T
E7	IECEX Explosion-proof	All except D option	X, S
EM	Technical Regulation Customs Union (EAC), Flameproof	All except D option	X, S
I1	ATEX Intrinsic Safety	K, H	All
I5	FM Intrinsic Safety	K, H	All
I6	CSA Intrinsically Safe	K, H	All
I7	IECEX Intrinsic Safety	K, H	All
IM	Technical Regulation Customs Union (EAC), Intrinsic. Safe	K, H	All
Housing		Available certifications	
A	Glass Filled Nylon, M20 conduits/cable threads	NA, I1, I5, I6, and I7	★
D	Glass Filled Nylon, 1/2-in. ANPT conduits/cable threads	NA, I1, I5, I6, and I7	★
X	Aluminum Alloy, M20 conduits/cable threads	All except G5, G6, E5, E6	★
Y	Aluminum Alloy, 3/4-in. ANPT conduits/cable threads	All except E1 and E7	★
S	Stainless Steel, M20 conduits/cable threads	All except G5, G6, E5, E6	★
T	Stainless Steel 3/4-in. ANPT conduits/cable threads	All except E1 and E7	★
Fork length		Available connection	
A	Standard length 1.7 in. (44 mm)	All except flanged options	★
H ⁽⁷⁾	Standard length flange 4.0 in. (102 mm)	All flanged options	★
E ⁽⁸⁾	Extended, customer specified length in tenths of inches	All except 1-in. BSPP O-ring (1P)	★
M ⁽⁸⁾	Extended, customer specified length in millimeters	All except 1-in. BSPP O-ring (1P)	★

Table 1. Rosemount 2120 Ordering Information

The starred options (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Specific extended fork length		
0000	Factory default length (only if Fork Length A or H is selected)	★
XXXX ⁽⁸⁾	Specific customer specified length in tenths of inches, or millimeters (XXXX mm or XXX.X inches)	★
Typical Model Number: 2120 D 0A K 1 I1 A 0000		

Options (include with the selected model number)

Calibration data certification		
Q4	Certificate of functional test	★
Material traceability certification		
Q8 ⁽⁷⁾⁽⁹⁾	Material traceability certification per EN 10204 3.1	★
Material certification		
Q15 ⁽⁷⁾⁽⁹⁾	NACE [®] MR0175 / ISO 15156	★
Q25 ⁽⁷⁾⁽⁹⁾	NACE MR0103	★
Safety certification		
Q5 ⁽¹⁰⁾	Prior-use certificate of FMEDA Data	★
QT ⁽¹⁰⁾	Safety certificate to IEC61508	★
Special procedures		
P1 ⁽¹¹⁾	Hydrostatic testing with certificate	★
Example of options included with the model number: 2120 D 0A K 1 I1 A 0000 Q8		

- ECTFE copolymer coating is only available for a flanged Rosemount 2120 but excludes 1-in./DN25/25A flanges. Flanges are dual certified 316 and 316L Stainless Steel (1.4401 and 1.4404).
- Other process connections available upon request.
- Hand-polished for hygienic connections to better than 0.4 μm Ra such that there are no pits, folds, crevices or cracks discernible to the naked eye (i.e. no features larger than 75 micrometers based on resolving 1/60 degree at a distance of 250 mm).
- Includes the Technical Regulation Customs Union (EAC) ordinary location mark.
- See “[Product Certifications](#)” on page 13. E5 includes G5 requirements. G5 is for use in unclassified, safe area locations only.
- See “[Product Certifications](#)” on page 13. E6 includes G6 requirements. G6 is for use in unclassified, safe area locations only.
- Not available for hand polished wet side.
- Minimum length available for ³/₄-in. threaded connection is 3.8 in. (95 mm); for 1-in. threaded, it is 3.7 in. (94 mm); for flanged, it is 3.5 in. (89 mm); and for Tri Clamp, it is 4.1 in. (105 mm). Maximum length is 157.5 in. (4000 mm), except for ECTFE copolymer coating and hand-polished process where the maximum length is 59.1 in. (1500 mm) and 39.4 in. (1000 mm) respectively. Examples: Code E1181 is 118.1 inches. Code M3000 is 3000 millimeters.
- Only available for process-wetted parts.
- Not available for Direct Load switching electronics.
- Option limited to units with extended lengths up to 59.1-in. (1500 mm). Option is not available for ECTFE coating.

Safety Integrity Level (SIL) certification option

- The Rosemount 2120 is SIL2-certified and SIL3 capable for all electronics except the Direct Load option.
- The Rosemount 2120 has been independently certified to IEC 61508 as required by IEC 61511. Certification was conducted by Exida. If required, add “**QT**” to the end of the model code. For example, 2120 D 0A K E1 X A0000 **QT**. (Note that you can have one or more OPTIONS codes at the end).
- Visit EmersonProcess.com/Rosemount, and then select the “Safety” product quick link for additional information.

Overfill approval option

- The Rosemount 2120 has been TÜV-tested and approved for overfill protection according to the German DIBt/WHG regulations. This option is not selectable in the ordering information table. If required, add “R2259” to the end of the model code. For example, 2120 D 0A K E1 X A0000 **R2259**. (Note that you can have one or more OPTIONS codes at the end).

Spare Parts and Accessories

Table 2. Spare Parts and Accessories

Specification and selection of product materials, options, or components must be made by the purchaser of the equipment. See [page 9](#) for more information on Material Selection.

Spares and accessories ⁽¹⁾⁽²⁾		
02100-1000-0001	Seal for 1-in. BSPP (G1A). Material: Non-asbestos BS7531 grade X carbon fiber with rubber binder	★
02100-1040-0001	Seal for 3/4-in. BSPP (G3/4A). Material: Non-asbestos BS7531 grade X carbon fiber with rubber binder	★
02100-1010-0001	Hygienic adaptor boss 1-in. BSPP. Material: 316 SST fitting. FPM/FKM O-ring	★
02100-1020-0001	2-in. (51 mm) Tri Clamp kit (vessel fitting, clamp ring, and seal). Material: 316 SST, NBR Nitrile	★
02100-1030-0001	Telescopic test magnet	★
02120-2000-0001 ⁽³⁾	1 1/2-in. BSPP adjustable 316 SST clamp gland for 1-in. extended lengths. Silicone (Si) rubber seal	★
02120-2000-0002 ⁽³⁾	1 1/2-in. NPT adjustable 316 SST clamp gland for 1-in. extended lengths. Silicone (Si) rubber seal	★
02120-7000-0001 ⁽⁴⁾	Replacement Cassette: Direct load switching (2 Wire) (Red)	★
02120-7000-0002 ⁽⁴⁾	Replacement Cassette: PNP/PLC, 20 to 60 Vdc (Yellow)	★
02120-7000-0003 ⁽⁴⁾	Replacement Cassette: NAMUR (Light Blue)	★
02120-7000-0004 ⁽⁴⁾	Replacement Cassette: Relay (DPCO), standard version (Green)	★
02120-7000-0005 ⁽⁴⁾	Replacement Cassette: 8/16 mA output (Dark Blue)	★
02120-7000-0007 ⁽⁴⁾	Replacement Cassette: Relay (DPCO), 9...30 Vdc (12 Vdc nominal) version (Green)	★
02100-1060-0001 ⁽⁵⁾	Quick Release kit (contains 2-in. Tri Clamp, seal, and quick release device for 2-in. NPT process connection)	

1. Check the Electronic Type and Product Certification sections in [Table 1 on page 4](#) for availability conditions.
2. Intrinsically Safe (IS) approved cassettes can only be replaced with the same type of IS cassette. Non-IS cassette types can be interchanged with other non-IS cassettes, but the new label must be fitted and the original part number transferred to the new label.
3. The adjustable clamp gland is not explosion-proof.
4. This replacement cassette is for versions of the Rosemount 2120 shipped since June 2013.
5. The Quick Release kit is a set of accessories requiring a Rosemount 2120 with the 2-in. Tri Clamp option and an existing 2-in. NPT process connection on the vessel. For additional information, see Rosemount 2120 Quick Release kit – Quick Start Guide (document number 00825-0200-4030). Contact an Emerson™ Process Management representative for the current availability of the kit.

Specifications

General

Product

Rosemount 2120 Vibrating Fork Liquid Level Switch

Measuring principle

Vibrating fork technology

Applications

Most liquids including coating liquids, aerated liquids, and slurries.

Mechanical

Housing / Enclosure

Table 3. Housing / Enclosure Specifications

Housing code	A	D	X	Y	S	T
Housing material	Nylon PA66 30%GF		Al alloy ASTM B85 A360.0		316C12 SST	
Rotational	Yes		No		No	
Housing paint	Not applicable		Polyurethane paint		Not applicable	
LED window	Nylon PA12		None		None	
Conduit entry	M20	1/2-in. ANPT	M20	3/4-in. ANPT	M20	3/4-in. ANPT
Ingress protection	IP66/67 to EN60529		IP66/67 to EN60529, NEMA 4X		IP66/67 to EN60529, NEMA 4X	

Connections

Threaded, hygienic, and flanged process connections.

See “Process connection size / type” on page 4 for a full list.

Extended lengths

The maximum extended length is 157.5 in. (4000 mm) except for ECTFE copolymer coating and hand-polished process connection options which have a maximum length of 59.1 in. (1500 mm) and 39.4 in. (1000 mm) respectively.

Table 4. Minimum Extended Lengths

Process connection	Minimum extended length
3/4-in. threaded	3.8 in. (95 mm)
1-in. threaded	3.7 in. (94 mm)
Flanged	3.5 in. (89 mm)
Tri Clamp	4.1 in. (105 mm)

Dimensional drawings

See “Dimensional Drawings” on page 15.

Material selection

Emerson provides a variety of Rosemount product with various product options and configurations including materials of construction that can be expected to perform well in a wide range of applications. The Rosemount product information presented is intended as a guide for the purchaser to make an appropriate selection for the application. It is the purchaser’s sole responsibility to make a careful analysis of all process parameters (such as all chemical components, temperature, pressure, flow rate, abrasives, contaminants, etc.), when specifying product, materials, options and components for the particular application.

Emerson Process Management is not in a position to evaluate or guarantee the compatibility of the process fluid or other process parameters with the product, options, configuration or materials of construction selected.

Process connection materials

316/316L stainless steel (1.4401/1.4404 dual certified).

Alloy C (UNS N10002) and Alloy C-276 (UNS N10276) – available for flanged, and BSPT and NPT threaded process connections (3/4- and 1-in. BSPT (R), and 3/4- and 1-in. NPT).

ECTFE co-polymer coated 316/316L Stainless Steel (1.4401/1.4404 dual certified) – only available for a flanged Rosemount 2120 but excludes 1-in./DN25/25A flanges.

Hand-polished to better than 0.4 µm option for hygienic connections.

Gasket material for 3/4- and 1-in. BSPP (G) is non-asbestos BS7531 Grade X carbon fiber with rubber binder.

Functional

Maximum operating altitude

6562 ft. (2000 m)

Maximum operating pressure

The final rating depends on the selected process connection.

- Threaded connection: see Figure 1 for operating pressures
Clamp glands 02120-2000-0001 and 02120-2000-0002 (page 8) limit the maximum pressure to 18.85 psig (1.3 bar g).
- Hygienic connection: 435 psig (30 bar g).

- Flanged connection:
See [Figure 1](#) or [Table 5](#) (whichever gives the lowest pressure).

Figure 1. Process Pressure

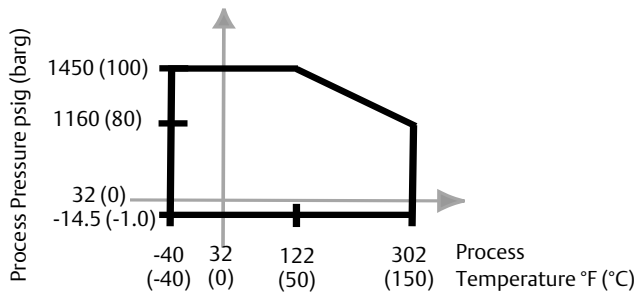


Table 5. Maximum Flange Pressure Rating

Standard	Class/Rating	SST flanges
ASME B16.5	Class 150	275 psig ⁽¹⁾
ASME B16.5	Class 300	720 psig ⁽¹⁾
ASME B16.5	Class 600	1440 psig ⁽¹⁾
EN1092-1	PN 10	10 barg ⁽²⁾
EN1092-1	PN 16	16 barg ⁽²⁾
EN1092-1	PN 25	25 barg ⁽²⁾
EN1092-1	PN 40	40 barg ⁽²⁾
EN1092-1	PN 63	63 barg ⁽²⁾
EN1092-1	PN 100	100 barg ⁽²⁾
JIS B2220	10K	14 barg ⁽³⁾
JIS B2220	20K	34 barg ⁽³⁾

1. At 100 °F (38 °C), the rating decreases with an increasing process temperature.
2. At 122 °F (50 °C), the rating decreases with an increasing process temperature.
3. At 248 °F (120 °C), the rating decreases with an increasing process temperature.

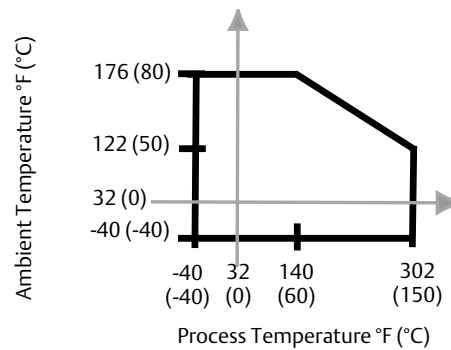
Minimum and maximum operating temperatures

See [Figure 2](#) for operating temperatures.

Clamp glands 02120-2000-0001 and 02120-2000-0002 ([page 8](#)) limit the maximum temperature to 257 °F (125 °C).

The ambient temperature for a 8/16 mA cassette is limited to 158 °F (70 °C) in dust applications.

Figure 2. Operating Temperatures



Liquid density requirement

Minimum of 37.5 lb/ft³ (600 kg/m³).

Liquid viscosity range

Up to 10000 cP (centiPose).

Solids content and coating

Maximum recommended diameter of solid particles in the liquid is 0.2 in. (5 mm).

For a coating product, avoid bridging of forks.

Switching delay

User selectable 0.3, 1, 3, 10, 30 seconds delay for dry-to-wet and wet-to-dry switching.

CIP (Clean In Place) and SIP (Steam In Place) cleaning

Withstands cleaning routines up to 275 °F (135 °C).

NACE

NACE compliance to MR0175 / ISO 15156 or MR0103, depending on the option code selected for the model number.

Safety integrity level

The Rosemount 2120 FMEDA is certified for SIL2, and is SIL3 capable, for all electronics except the Direct Load option.

Visit EmersonProcess.com/Rosemount, and then select the “Safety” product quick link for additional information.

Performance

Hysteresis (water)

±0.039-in. (±1 mm) nominal.

Switching point (water)

0.5 in. (13 mm) from tip (vertical) / from edge (horizontal) of fork (this will vary with different liquid densities).

Electrical

Switching mode

User selectable switching mode (Dry=on or Wet=on).

Protection

Polarity insensitive

– on Relay (except 12 Vdc version) and Direct Load electronics

Over-current protection

– on Direct Load and PNP/PLC electronics

Short-circuit protection

– on Direct Load and PNP/PLC electronics

Load-missing protection

– on Direct Load and PNP/PLC electronics

Surge protection (to IEC61326)

– available on all versions of the Rosemount 2120

Heartbeat LED

The Rosemount 2120 has a status-indicating ‘heartbeat’ LED, which can be seen at all times and from all angles through a lens in the cover (no lens in metal housings).

The LED flashes when the output is ‘off’ and is constantly lit when it is ‘on’. The LED gives a constant indication that the Rosemount 2120 is functioning correctly (different flash rates are used to indicate a product malfunction) and gives a local indication of the process state.

Magnetic test point

A magnetic test point is located on the side of the housing, allowing a functional test of the Rosemount 2120 and a system connected to it. By holding a magnet to the target, the output changes state for as long as the magnet is held there.

Terminal connection (wire diameter)

Minimum 26 AWG, Maximum 14 AWG (0.13 to 2.5 mm²).
Note national regulations.

Grounding

The Rosemount 2120 must always be grounded either through the terminals or using the external ground connection provided.

Conduit plugs/cable gland

Metal housing:

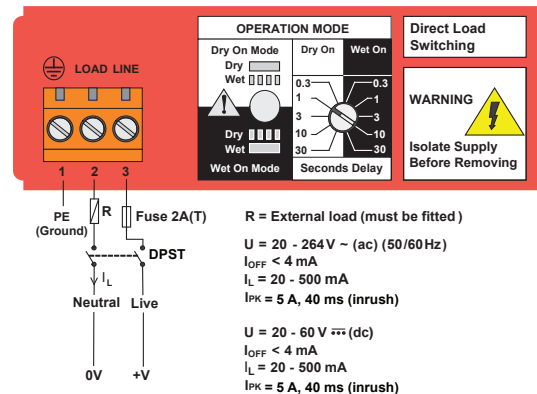
Conduit entries for explosion-proof areas are shipped with one Exd plug (loose in bag) and two dust caps fitted. Use suitably rated cable glands. Unused conduit entries must be sealed with a suitably rated blanking plug.

Glass-filled nylon housing with direct load, PNP/PLC and IS electronics are shipped with one PA66⁽¹⁾ cable gland and one blanking plug.

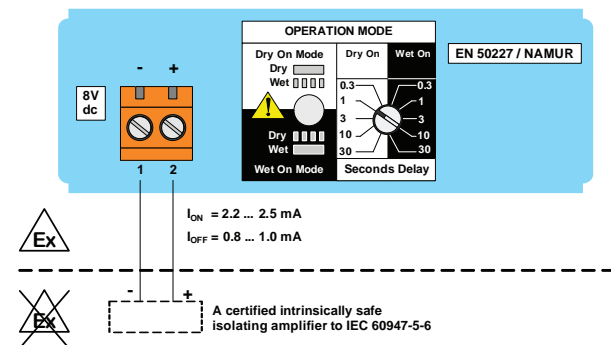
Glass-filled nylon housing with relay electronics are shipped with two PA66⁽¹⁾ cable glands.

Electrical connections

■ Direct load switching (mains two wire) cassette

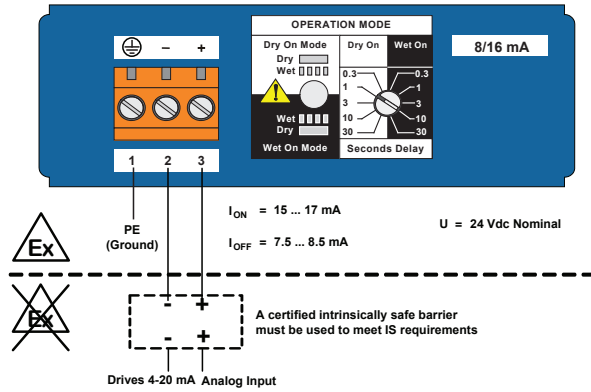


■ NAMUR (light blue) cassette

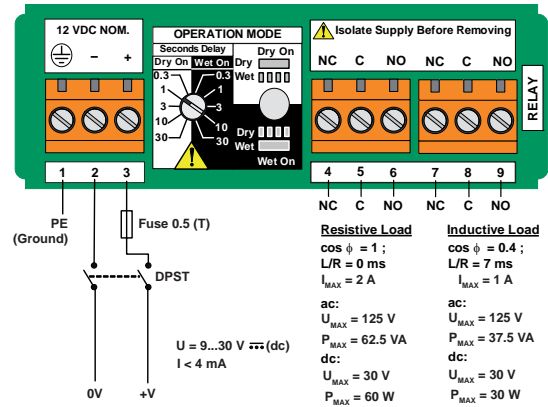


1. Cable diameter 0.2 to 0.3 in. (5 to 8 mm)

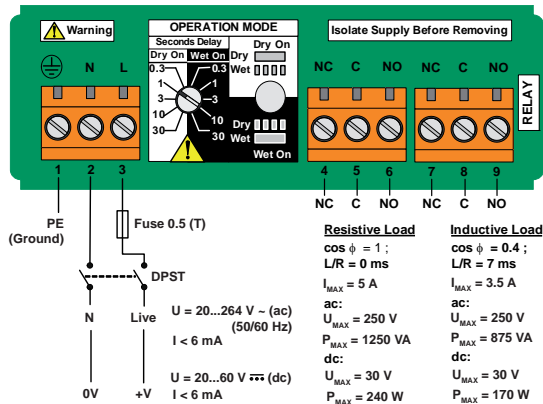
■ 8/16 mA (dark blue) cassette



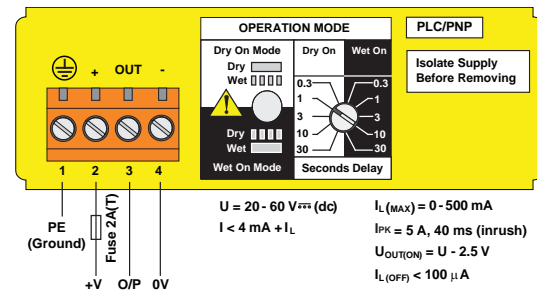
■ DPCO dual relay cassette (12 Vdc nominal version)



■ DPCO dual relay cassette (standard version)



■ Solid state PNP output for direct interface to a PLC



Note

The external DPST switch that is shown in the wiring diagrams is an optional local disconnect (customer supplied).

Product Certifications

European directive information

The EC declaration of conformity for all applicable European directives for this product can be found at EmersonProcess.com/Rosemount

ATEX directive

Complies with the ATEX directive.

Pressure Equipment Directive (PED)

The Rosemount 2120 is outside the scope of this directive.

Low Voltage Directive (LVD)

EN61010-1 Pollution degree 2, Category II (264 V maximum), Pollution degree 2, Category III (150 V maximum)

Electro Magnetic Compatibility (EMC) directive

EN61326 Emissions to Class B.
Immunity to industrial location requirements.

NAMUR NE21.

CE-mark

Complies with applicable directives (EMC, ATEX, and LVD).

NAMUR approval

NAMUR NE95 type test report is available upon request.
Complies with NAMUR NE21.

Overfill approval

Certificate: Z-65.11-522.
TÜV-tested and approved for overfill protection according to the German DIBt/WHG regulations. Certified under safety devices for tanks and piping related to water pollution control.

Marine approvals

ABS	American Bureau of Shipping
GL	Germanischer Lloyd
SRS	Russian Maritime Registered Shipping (RMRS)

Note

The requirements of CRN are met when a Rosemount 2120 CSA-approved vibrating fork level switch model is configured with 316/316L stainless steel (1.4401/1.4404) process-wetted parts and either NPT threaded or 2 to 8-in. ASME B16.5 flanged process connections.

Drinking water approval

Rosemount Measurement Limited, Slough, UK confirms that the wetted parts of the Rosemount type 2120 vibrating level switches are suitable and approved for use in potable water.

The wetted parts of the vibrating level switches executed in:

Stainless steel (option code D) and Alloy C / Alloy C-276 (option code C) with Flanged, NPT thread, BSPT(R) thread, or Tri Clamp process connections, are in accordance with the requirements of DVGW - Worksheet W270. The materials used are classified as toxicologically and microbiologically safe.

Ordinary location certification for FM

G5 Project ID: 3021776

The switch has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by FM, a nationally recognized testing laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA)

Ordinary location certification for CSA

G6 Certificate Number: 06 CSA 1805769

The switch has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by CSA, a nationally recognized testing laboratory as accredited by the Standards Council of Canada (SCC). Single process seal.

Safety Integrity Level (SIL) certification

The Rosemount 2120 is SIL2-certified, and is also SIL3 capable. It has been independently certified to IEC 61508 as required by IEC 61511. Certification was conducted by Exida. If required, add **"QT"** to the end of the model code. For example, 2120 D 0A K E1 X A0000 **QT**.

(This option is not available for the Direct Load electronics).

Canadian Registration Number

CRN 0F04227.2C

Hazardous locations certifications

Note

A certified isolating amplifier or barrier must be used for intrinsic safety.

North American approvals

Factory Mutual (FM) explosion-proof approval

- E5** Project ID: 3012658
Explosion-proof for Class I, Div. 1, Groups A, B, C, and D
Temperature Class: T6 (T_{amb} -40 to 75 °C)
Enclosure: Type 4X

Factory Mutual (FM)

intrinsically safe approval and non-incendive

- I5** Project ID: 3011456
Intrinsically Safe for Class I, Div. 1, Groups A, B, C, and D
Class I, Zone 0, AEx ia IIC
Non-incendive for Class I, Div. 2, Groups A, B, C, and D
Class I, Zone 2, IIC
Temperature Code: T5 (T_{amb} -40 to 80 °C, T_{proc} < 80 °C)
Control Drawing: 71097/1154 (with NAMUR electronics)
Control Drawing: 71097/1314 (with 8/16 mA electronics)

Canadian approvals

Canadian Standards Association (CSA) explosion-proof

- E6** Project ID: 1786345
Explosion-proof for Class I, Div. 1, Groups A, B, C, and D
Temperature Class: T6 (T_{amb} -40 to 75 °C)
Enclosure: Type 4X
Single process seal


Canadian Standards Association (CSA)

intrinsically safe and non-incendive


- I6** Certificate Number: 06 CSA 1786345
Intrinsically Safe for Class I, Div. 1, Groups A, B, C, and D
Class 1, Zone 0, Ex ia IIC
Non-Incendive for Class I, Div. 2, Groups A, B, C, and D
Temperature Code: T5 (T_{amb} -40 to 80 °C, T_{proc} < 80 °C)
Control Drawing: 71097/1179 (with NAMUR electronics)
Control Drawing: 71097/1315 (with 8/16 mA electronics)
Single process seal

European approvals

ATEX flameproof and dust-proof approval

- E1** Certificate: Sira 05ATEX1129X
Flameproof and dust-proof:
ATEX Marking  II 1/2 GD
Ex db IIC T6...T2 Ga/Gb
Ex tb IIIC T85 °C...T265 °C Db

ATEX intrinsically safe approval

- I1** Certificate: Sira 05ATEX2130X
Intrinsic Safety for gas and dust environments:
ATEX Marking  II 1 GD
Ex ia IIC T5...T2 Ga
Ex ia IIIC T85 °C...T265 °C Da

International approvals

International Electrotechnical Commission (IEC) flameproof and dust-proof approval

- E7** Certificate: IECEx SIR 06.0051X
Flameproof and dust-proof:
Ex db IIC T6...T2 Ga/Gb
Ex tb IIIC T85 °C...T265 °C Db

International Electrotechnical Commission (IEC) intrinsically safe approval

- I7** Certificate: IECEx SIR 06.0070X
Intrinsically Safe for gas and dust environments:
Ex ia IIC T5...T2 Ga
Ex ia IIIC T85 °C...T265 °C Da

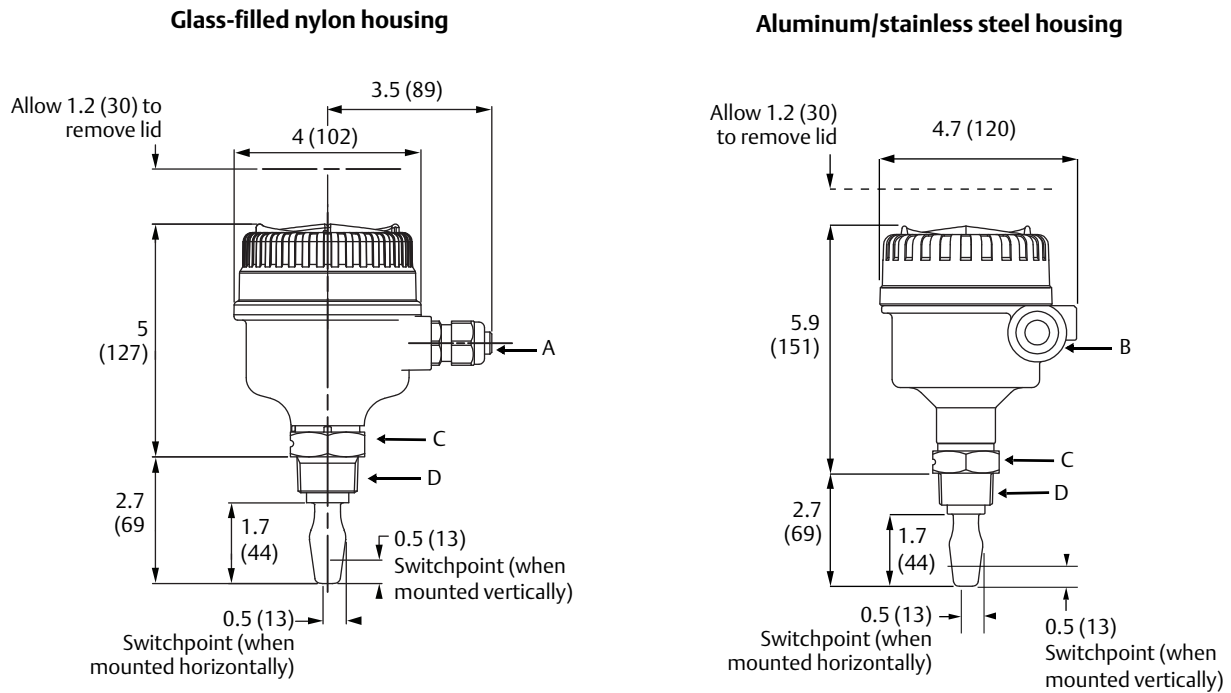
Technical Regulation Customs Union (EAC) approvals

- EM** Certificate: RU C-GB.ГБ06.B.00072
Flameproof:
1Exd IIC T6...T3 X
Ta (see table in the certificate)

- IM** Certificate: RU C-GB.ГБ06.B.00072
Intrinsic Safety:
0Exia IIC T5...T3 X
Ta (see table in the certificate)

Dimensional Drawings

Figure 3. 3/4- and 1-in. Threaded Mounting (Standard Length)



- A. Cable entry M20 x 1.5 or 1/2-in. ANPT
- B. Cable entry M20 x 1.5 or 3/4-in. ANPT

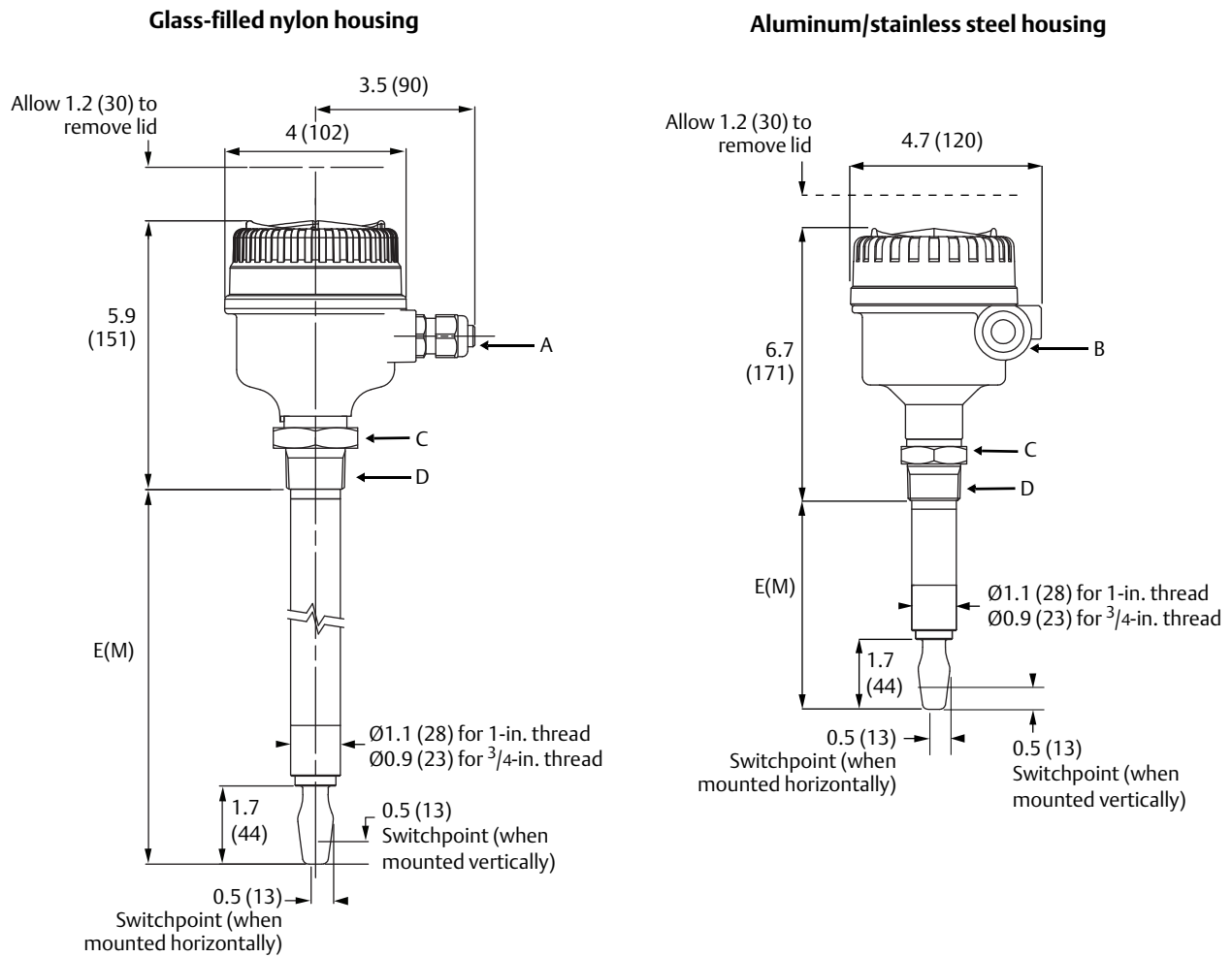
- C. 1.6 (40) A/F hexagon
- D. 3/4- or 1-in. thread

Dimensions are in inches (millimeters).

Note

For Hygienic Rosemount 2120 dimensions, see Type 1 drawing downloads on EmersonProcess.com/Rosemount.

Figure 4. 3/4- and 1-in. Thread Mounting (Extended Length)



- A. Cable entry M20 x 1.5 or 1/2-in. ANPT
- B. Cable entry M20 x 1.5 or 3/4-in. ANPT

- C. 1.6 (40) A/F hexagon
- D. 3/4- or 1-in. thread

Dimensions are in inches (millimeters).

Note

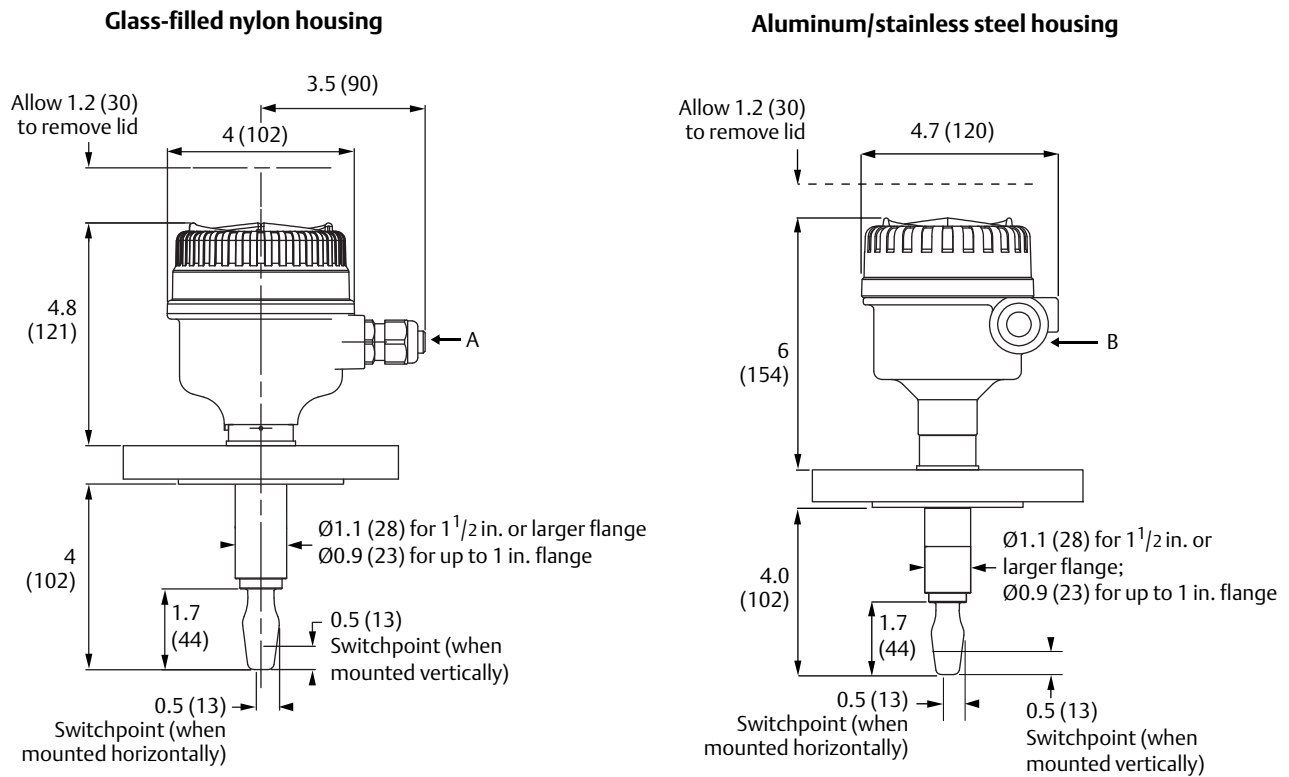
For Hygienic Rosemount 2120 dimensions, see Type 1 drawing downloads on EmersonProcess.com/Rosemount.

Table 6. Fork Length for 3/4- and 1-in. Threaded Rosemount 2120

Process connection	Standard length fork length code A	Minimum length fork length code E (M)	Maximum length fork length code E (M) ⁽¹⁾
3/4-in. Thread	1.7 in. (44 mm)	3.75 in. (95 mm)	157.5 in. (4000 mm)
1-in. Thread	1.7 in. (44 mm)	3.74 in. (94 mm)	157.5 in. (4000 mm)

1. Maximum extended length of fork with hand-polished option is 39.4 in. (1000 mm).

Figure 5. Flange Mounting (Standard Length)

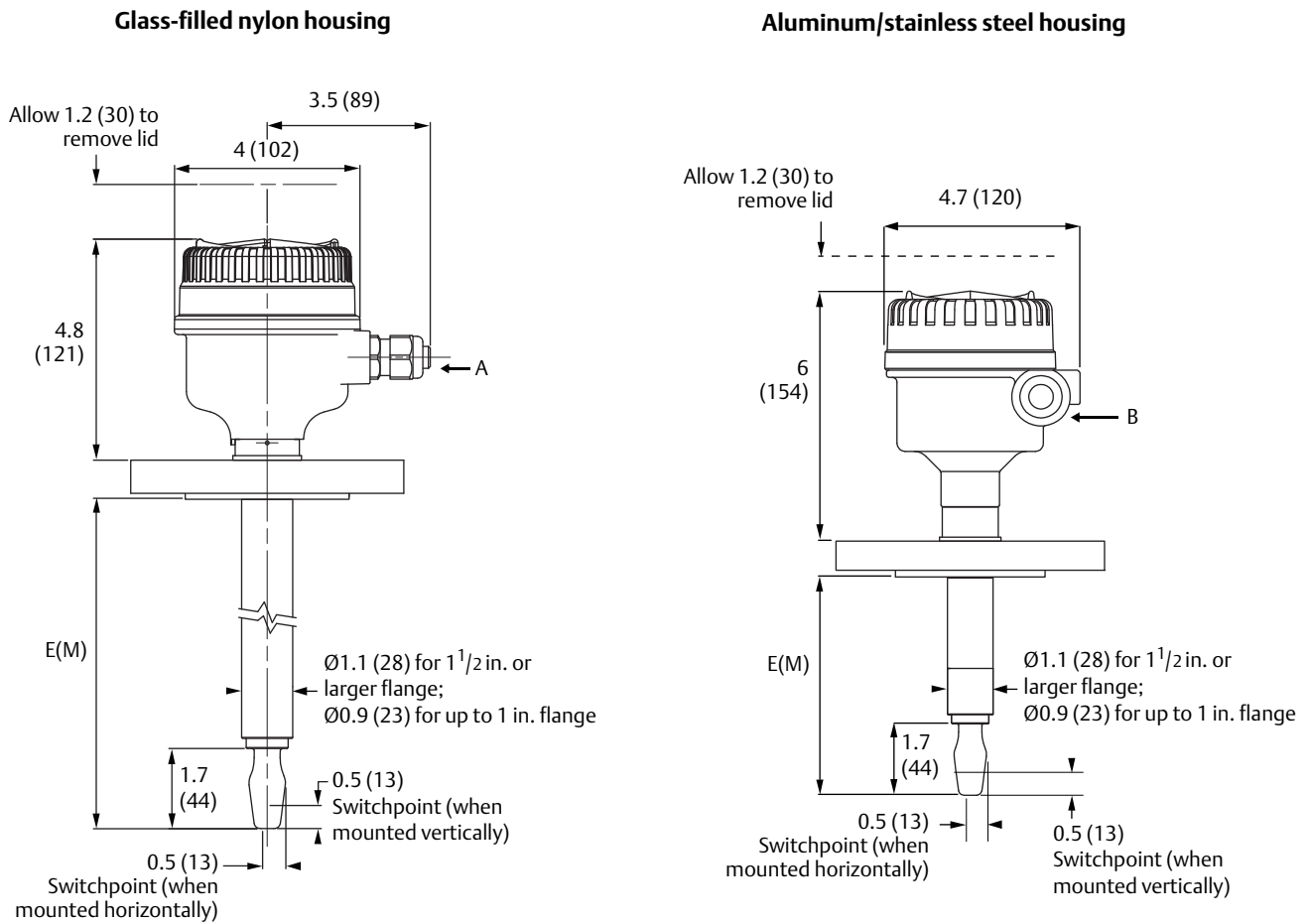


A. Cable entry M20 x 1.5 or 1/2-in. ANPT

B. Cable entry M20 x 1.5 or 3/4-in. ANPT

Dimensions are in inches (millimeters).

Figure 6. Flange Mounting (Extended Length)



A. Cable entry M20 x 1.5 or 1/2-in. ANPT
 B. Cable entry M20 x 1.5 or 3/4-in. ANPT

Dimensions are in inches (millimeters).

Table 7. Fork Length for Flanged Rosemount 2120

Process connection material	Standard length model code H	Minimum length model code E (M)	Maximum length model code E (M)
Stainless steel ⁽¹⁾	4 in. (102 mm)	3.5 in. (89 mm)	157.5 in. (4000 mm)
ECTFE co-polymer coated	4 in. (102 mm)	3.5 in. (89 mm)	59.1 in. (1500 mm)
Alloy C and Alloy C-276	4 in. (102 mm)	3.5 in. (89 mm)	157.5 in. (4000 mm)

1. Maximum extended length of fork with hand-polished option is 39.4 in. (1000 mm).

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Farris Engineering Products and Services



Process Pressure Relief Valves

Series 2600	ASME NB Certified for Air, Steam, and Water
Series 3800	ASME NB Certified for Air, Steam, and Water
Series 2700	ASME NB Certified for Air, Steam, and Water
Series 1890/1896M	ASME NB Certified for Air, Steam, and Water
Series 2850/2856	ASME NB Certified for Air and Steam

Steam Safety Valves

Series 4200	ASME NB Certified for Steam – Section I & VIII
Series 6400/6600	ASME NB Certified for Steam – Section I & VIII

Universal Test Stand

Tests Valves on Air and Water

SizeMaster™ Mark IV

Pressure Relief Valve Engineering Software
for Sizing and Selection

FAST Centers (Farris Authorized Service Team)

"Understanding what the Customer wants...making it happen!"

- Worldwide Network of Service Centers with Factory Trained Technicians
- Local Inventory with 24 hour a day / 7 day a week support
- Access to Worldwide Farris Inventory through the Web
- ASME/National Board approved Assembly & Test Facilities
- Application and Sizing & Selection Support

The following is a list of Farris approvals currently on record:

- ASME "V", "UV" and "NV" approvals
- National Board "NB" approval
- ISO 9001-2000
- US Coast Guard approval
- PED 97/23/EC (European Pressure Equipment Directive)
- ATEX 94/9/EC (European Potentially Explosive Atmospheres)
- Canadian TSSA Registration
- China Safety Quality License
- Russian GOSH-R and GGNT (Russian Certification and Permits)
- First Point Assessment Limited



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Series 2600

Pressure Relief Valves



This catalog covers Series 2600, 2600S and 2600L Pressure Relief Valves including the latest information available to assist you in the sizing and selection of the proper valves for your application.

Farris pressure relief valves have over a half century of proven performance providing automatic and positive protection against overpressure in thousands of industrial plants and facilities worldwide. Our earned reputation as “the First Line of Safety” is the result of countless Farris innovations combined with progressive engineering, sound design and high quality production.

Our headquarters and manufacturing facility located in Brecksville, Ohio, oversees the production of these superior valves at plants in the United States, Canada and the United Kingdom. Our associated facility in Australia is also equipped with precision machinery and controlled by rigid inspection and standards to produce quality pressure relief valves to meet your needs. The Brecksville facility is also responsible for research and development, engineering, manufacturing technology, and sales and marketing. We offer the services of our engineering sales representatives throughout the world as well as our Farris Authorized Service Teams (FAST Centers) and headquarters staff to extend you every possible customer service.

Guarantee

All products manufactured by Farris Engineering, a division of Curtiss-Wright Flow Control Corporation, are guaranteed free of defects in material and workmanship for a period of one year when used within the recommended range. When authorized, any defective product may be returned to the Factory, and if found defective, will be repaired or replaced free of charge, F.O.B. our Factory. No charge for labor or other expense incurred will be allowed as the liability of Farris Engineering is measured by the refund price of the defective product only.



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Farris pressure relief valves are designed to automatically protect your equipment against excessive overpressure. Every care is taken in the development, design and production of these valves to ensure complete dependability in performance. Our constant objective is to provide a superior valve that will assure ultimate protection at the lowest cost, both initially and throughout its service life.

What is the Farris Advantage?

- Easy sizing and selection of valves using Farris catalogs and/or SizeMaster™ Sizing and Selection software.
- A method of specification and ordering that is simple, accurate and complete.
- Accurate and timely shipments in accordance with our computerized inventories.
- Factory-trained engineering/sales staff to assist you in solving your pressure relief valve problems.
- Streamlined design to allow you maximum flexibility in the use and repair of your Farris pressure relief valves.
- Assurance of the utmost safety of your equipment when protected by a Farris valve.
- Maximum seat tightness in accordance with stringent inspection and testing.
- Complete repair and maintenance information that affords you repairs in your own maintenance shop.
- Maximum interchangeability of parts.
- Continuous availability of replacement parts at our plants and authorized service centers for immediate shipment to meet your emergency requirements.
- Long service life of a soundly-designed pressure relief valve made from materials suited to your service.
- Twenty-four hour/seven-day customer support is achieved via our FAST Centers and our Web-based CW Commerce Program accessible to all Farris Representatives.

Valve Selection

This catalog simplifies the sizing and selection of Series 2600 process pressure relief valves. The pressure relief valves are presented here in an easy-to-understand format. Unless otherwise stated, references made to the Code refer specifically to ASME Section VIII, Division 1.

Certified Capacity Code Compliance

The Series 2600 pressure relief valves have been carefully constructed and tested in accordance with the requirements of the ASME Pressure Vessel Code, Section VIII. Their capacity rating for the applicable fluids is certified by the National Board of Boiler and Pressure Vessel Inspectors.

Range of Service Application

Series 2600 pressure relief valves are designed to function equally well on air, gases and steam or in liquid service. For specific Code applications in liquid service, Farris 2600L relief valves offer superior performance. This catalog covers orifice ranges “D” through “Z”.

Nozzle Design

The Farris full nozzle pressure relief valve design (Fig 1) incorporates a nozzle shape to provide:

1. A high stable flow coefficient.
2. Greater strength to resist possible discharge piping strains.
3. Wrenching provisions on raised face nozzles where they will not interfere with the flow path.

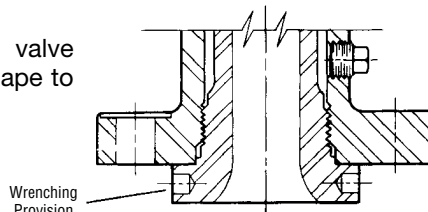


Figure No. 1

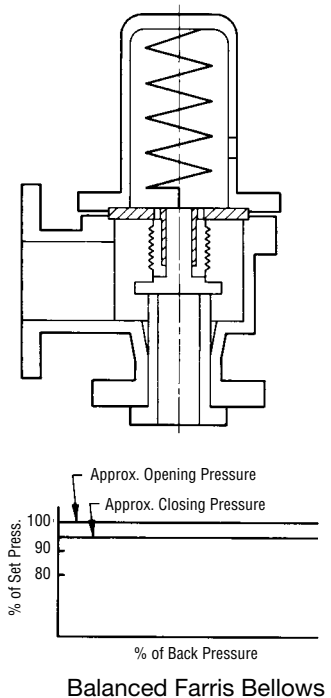
The superior design allows easy maintenance by simplifying nozzle removal and assembly.

Balanced Bellows Design

Both the Farris BalanSeal balanced bellows (Fig 2A) and the BalanSeal/Piston pressure relief valve provide consistent capacity, set pressure and blow down at elevated backpressure encountered when valves discharge into headers or where other devices produce variable backpressure in the relief manifold system. Nozzle can be removed from Body with the Blowdown Ring attached.

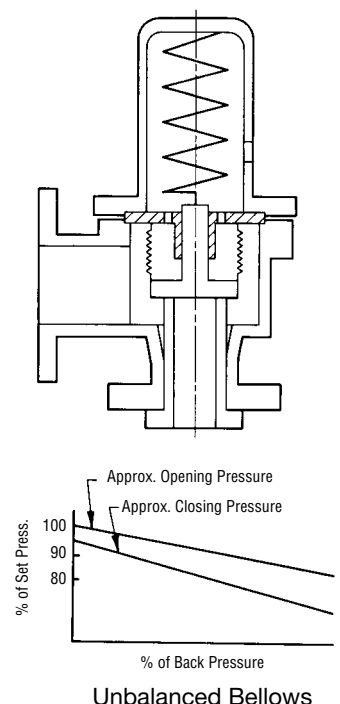
The Farris BalanSeal design permits simple conversion of conventional construction valves to BalanSeal balanced bellows construction by adding a bellows and bellows gasket for orifice sizes “F” through “T”.

The “D” and “E” orifices are available with balanced bellows through the class 600 inlet, with higher class valves available in an unbalanced bellows design (Fig 2B). The unbalanced bellows is used for corrosion isolation applications, and can also be used where constant backpressure is encountered. Spring setting compensation is made for constant backpressure applications.



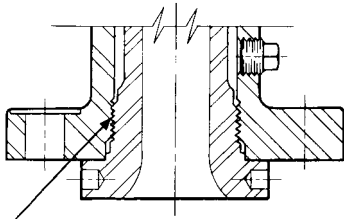
Balanced Farris Bellows

Figure No. 2A



Unbalanced Bellows

Figure No. 2B



Threaded connection of nozzle located in inlet flange to avoid distortion on the nozzle seating surface.

Figure No. 3

If connected to a closed system, specific care should be taken to keep piping strains away from the pressure relief valve under all conditions of process operation.

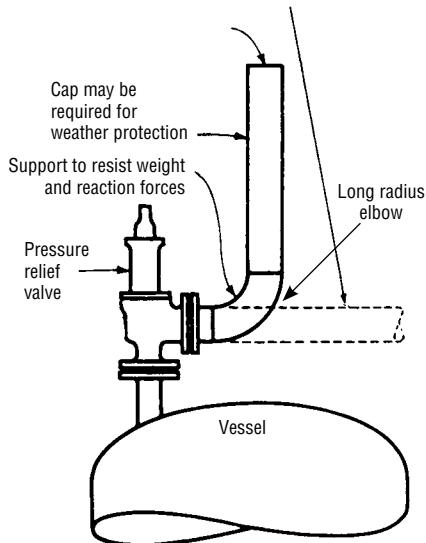


Figure No. 4

Resistance to Discharge Piping Strains

For most pressure relief valves, and particularly for those from which the discharge must be piped away to a remote location, it is almost impossible to keep piping strains away from the valve. The superior Farris pressure relief valve design incorporates several features which allow this valve to take a maximum amount of piping strain without hampering the functional characteristics of the valve or contributing to serious leakage.

1. The threaded connection between the valve nozzle and the valve inlet flange is located low in the flange so that any distortion which may take place at the inlet neck of the body is not transmitted to the valve nozzle. This eliminates the effect of the distortion on the nozzle seating surface and the subsequent serious leakage through the valve (Fig 3).
2. The accurate guiding in the Farris design, using the double universal ball joint construction above and below the sleeve guide, will allow the disc seat to align itself positively with the nozzle seat in cases where the discharge piping strains cannot be avoided and have forced the upper portion of the valve out of exact alignment (Fig 4 & 5).
3. The superior strength built into the body of the Farris pressure relief valve to resist these discharge piping strains materially reduces the deflection and distortion in the valve and reduces the leakage encountered, when at times discharge piping strains become excessive.

In spite of these features, however, it is advisable to minimize the discharge piping strain on any pressure relief valve. It is our recommendation that piping engineers eliminate these discharge piping strains as much as possible under all operating conditions. Additional information on allowable external loads is provided in the Farris Technical Recommendations publication.

Isolation of Bonnet Spring Chamber

The Farris pressure relief valve huddling chamber is engineered to extract the flow forces required to overcome the force of the spring as well as the forces resulting from the body and bonnet pressure when the valve is open. In other designs, the use of eductor tubes, venting the guide directly into the valve body, or other techniques are used in an attempt to keep the huddling chamber or body pressure away from the topside of the disc to obtain full lift and capacity. These designs may have undesirable effects on valve performance, life and maintenance. Special attention should be given in the following cases:

1. **High Temperature.** In Farris pressure relief valves on high temperature service, there is no induced or forced flow of the hot lading fluid into the bonnet spring chamber, so relaxation of the spring due to high temperature does not occur as rapidly as it does in other valve designs. As a result, blow down in the Farris valve is stabilized for longer flowing periods than in competitive designs.
2. **Corrosive Service.** In Farris pressure relief valves on corrosive service, there is no induced or forced flow of the corrosive lading fluid past the guiding surfaces during valve operation. This reduces the corrosive effect of the lading fluid on the guiding surfaces and valve spring, so lowering the frequency of galling and spring failure with the accompanying reduction of maintenance costs and unscheduled downtime.
3. **Dirty Service.** Where small foreign particles can be carried in the gas or vapor stream, there is no induced or forced flow in the Farris design carrying these small particles between the guiding surfaces. Galling of the guide surfaces, which frequently causes the valve to “hang” or “freeze” in either an open or closed position, is eliminated.

The Farris design avoids all these difficulties by discharging directly from the huddling chamber into the valve body without inducing flow past the guiding surfaces into the spring chamber or forcing flow past the guiding surfaces because of the large pressure drop between the huddling chamber and the valve body.

Integral Sleeve Guide

The Farris pressure relief valve design incorporates an integral sleeve guide (Fig 5), assuring continual positive alignment after the part has been manufactured, and including the same high corrosion resistant properties in the guide flange that are present in the sleeve portion of the guide. The sleeve guide is extended above the top of the guide flange, minimizing the possibility of corrosive or other foreign particles washing onto the guiding surfaces when the valve is relieving or when it is “breathing” as a result of atmospheric temperature changes. Openings are provided in the guide flange to allow these solid particles to leave the bonnet, preventing them from passing between the guiding surfaces and causing galling.

Tightness

In a spring loaded pressure relief valve, the force exerted by the system pressure under the valve disc approaches the opposing spring force on top of the valve disc as the system operating pressure nears the set pressure of the valve. Since the operating pressure of the system is often 90% of the valve set pressure, the differential force holding the seats together is quite small.

There are several factors which affect the tightness of the spring loaded pressure relief valve, including alignment, disc strength, thermal distortion, and preparation of seating surfaces. The Farris valve is engineered for exceptional tightness because of positive alignment, a high strength disc design, the elimination of thermal distortion and optimum seating surface finish.

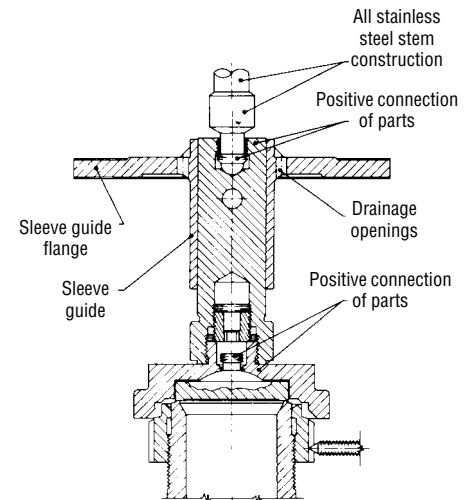
Positive Alignment. Using the double universal joint, 2½ to 1 guiding ratio, and self-aligning disc, positive alignment of internal parts is achieved. Misalignment is avoided, improving tightness and eliminating other undesirable effects such as long blow down.

High Strength Disc Design. In the Farris valve, the thickness of the self-aligning disc (Fig 6) is no greater than necessary; however, the same thickness is maintained for all catalog materials. For purposes of strength, the disc is strong enough in bending moment for all materials shown in the catalog. Valves constructed with hardened discs are exceptional in withstanding the effects of impact, an advantage where installation or process conditions may cause chatter.

Elimination of Thermal Distortion. In a pressure relief valve, especially on high or low temperature service, a single large disc, with its top surface exposed to atmospheric temperature when the valve is closed, has a temperature gradient between the surface contacted by the lading fluid and the surface contacted by the ambient temperature in the valve body or bonnet. This temperature gradient induces thermal stresses in a heavy disc that can cause deformation of the seating surfaces and consequent leakage of the valve.

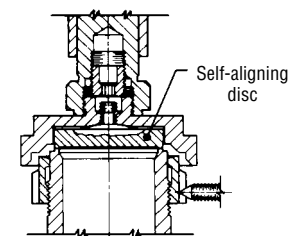
The Farris self-aligning disc is essentially encased in a disc holder with contact at only one central point, so that the conduction or convection of heat around the disc is quite low. As a result, the thermal stresses at the seating surface practically disappear. This gives further assurance of tightness over the range of temperatures used in various operations.

Optimum Seating Surface Finish. Seat surfaces are machine lapped and polished to produce flatness (as measured with optical flats) that deviates less than eleven millionths of an inch from a true plane, with a surface finish of five micro inches or less. Regardless of the seating surfaces, maximum tightness will not be achieved unless positive alignment and elimination of thermal distortion are integral design features of the valve.



Integral Sleeve Guide

Figure No. 5



High Strength Disc

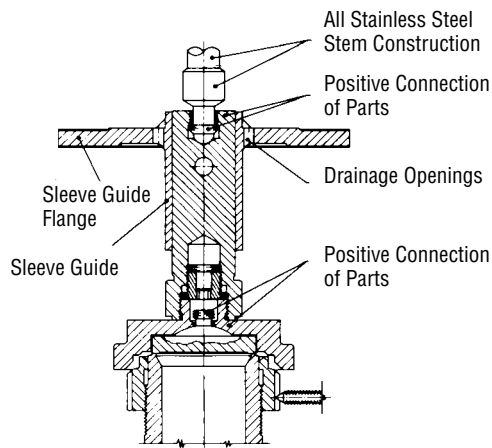
Figure No. 6

All Stainless Steel Stem Construction

The Farris pressure relief valve design features an all stainless steel stem. This construction cost-effectively eliminates dangerous sticking due to galvanic corrosion at the upper guiding point in the spring adjusting screw. The careful design of this upper bearing also ensures proper alignment and optimum freedom from galling and erratic popping.

Positive Connection of Parts

The Farris design incorporates a positive connection between the valve stem and the stem retainer as well as between the disc and disc holder (Fig 7). These connections are made with a male threaded head which threads into a portion of a female socket through which it drops free into an undercut chamber to make bearing contact on a spherical surface. This allows complete freedom of action for alignment purposes while retaining the positive connection of the threads. It also eliminates the need to use snap ring connections which, in some cases, are not sufficiently positive during valve operations and may be inadvertently left out during maintenance.



Positive Connection of Parts

Figure No. 7

The Farris two-piece design of disc holder and stem retainer features a positive locking device called the disc holder lock screw. Any attempt to disassemble these parts causes the lock screw to lock tighter, unless first disengaged. The lock screw provides a positive lock between these two parts that makes them equivalent to a single part but without the associated disadvantages. The two-piece assembly allows conversion to bellows construction at a minimal investment. The two-piece design also allows the stem retainer to be constructed of less corrosion-resistant material than the disc holder, when a bellows is installed to isolate the moving parts. When maintenance requires parts replacement, the entire assembly will not need replacement if only one piece is damaged.

Convertibility of Design

The Farris pressure relief valve is available as a conventional valve and as a BalanSeal (balanced bellows) valve. The conversion of this valve from conventional to BalanSeal, or vice versa, requires only the addition or removal of the balanced bellows and bellows gasket in the valve, and the coincidental removal or replacement of a pipe plug in the valve bonnet vent. No other parts are required and all other parts are completely interchangeable. This unique feature is offered in orifices "F" through "T".

In addition, the bonnet of the valve is constructed so that all valves can be equipped with a plain screwed cap, bolted cap, an open lever or packed lifting lever without changing any other valve parts or fully disassembling the valve.

Body and Bonnet of Equal Materials

Although the Farris pressure relief valve does not induce circulation of the lading fluid through the bonnet, the bonnet and the valve body are made of the same high quality steel. It is important that both the body and bonnet be made of materials suitable for the service in which the valve will be used, especially in the case of high temperature services.

Steam Jacketing for Better Heat Transfer

In modern process plants, it is necessary to keep some valves and lines warm at all times to avoid solidification of the lading fluid and to guarantee the safety of equipment. Farris offers a steam jacket (Fig 8) to substantially increase the rate of heat transfer into the valve and, at the same time, simplify the problem of removing or dismantling the valve for maintenance. This design offers a separate two-piece jacket that installs on a standard valve body. See details on page 71.

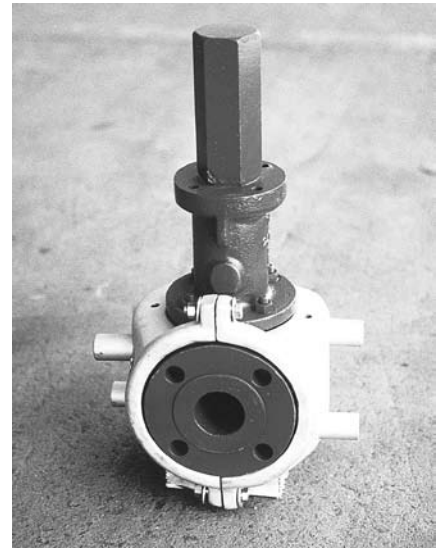
Simple, Accurate Adjustments

The single Blow Down Ring construction of the Farris pressure relief valve allows simple shop or field setting, something not possible with multiple ring valve types.

In most process plants, it is not possible or economical to test the pressure relief valve in place on the process equipment, so the valve is tested while mounted on a maintenance shop test stand where the pressure and volume for testing are often limited. With the Farris design, the single Blow Down Ring is adjusted in the maintenance shop so that the set pressure point can be observed. After the set pressure is established, the Blow Down Ring is adjusted to a lower empirically predetermined or field established position depending on set pressure, size and lading fluid (Figs 9A, 9B). Blow Down Ring settings and test equipment recommendations are detailed in maintenance manuals published by Farris Engineering.

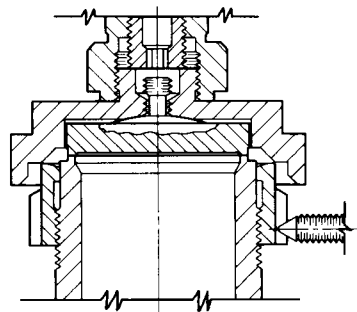
Interchangeability of Parts

In the Farris pressure relief valve design, maximum interchangeability of parts is maintained in order to reduce the number of spare parts needed and keep spare parts inventories to a minimum.



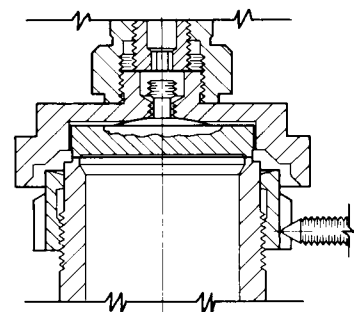
Steam Jacketed Body

Figure No. 8



Blow Down Ring Adjustment
For Set Pressure Test

Figure No. 9A



Blow Down Ring Adjustment
For Service Operation – Vapors

Figure No. 9B

Standard Flanged Connections

1. All steel raised face flanges are supplied with a serrated spiral finish with 45 to 55 grooves per inch and a finish between 125 and 160 AARH.
2. All ring joint flanged facings are supplied for octagonal or oval gaskets.
3. Facings other than raised face or large male can be supplied at additional cost.
4. Flange ratings that conform to ANSI B16.5 are indicated on each Orifice Selection Table. Heavier outlet flanges can be supplied at additional cost. For flange dimensions, see ANSI Dimension Table, page 77.
5. Drilling of all flanges always straddles the valve center line.

Valve Trim

Trim is a term that generally refers to internal parts of a pressure relief valve. Unless noted, valve trim in a Farris pressure relief valve specifically includes the nozzle and disc only. Standard bills of materials for all 2600 Series valves are located on pages 12 and 13. For low temperature and corrosive service materials, see pages 17 through 21. If other than standard trim or metallurgy is required, this must be specified.

Differential Between Operating and Set Pressure

For best performance in process applications, we recommend pressure relief valves be set to open at a minimum of 10% or 25 psig above the operating pressure. A suitable margin above the operating pressure should be provided in order to prevent any unintended operation of the pressure relief valve. Refer to ASME Section VIII Pressure Vessel Code, Appendix M, Paragraph M-10, Pressure Differentials for Pressure Relief Valves as well as to Farris Technical Recommendations for complete information.

In the case of pump and compressor discharge lines, a greater differential is recommended if possible, since pulsations within the system can result in faulty valve operation. Consequently, the pressure relief valve should be set as high above the discharge line pressure as possible.

Set Pressure Compensation for Temperature

An increase in temperature causes a reduction of valve set pressure as a result of the direct effect of temperature on the spring and expansion of body and bonnet which reduces spring loading. Since pressure relief valves are invariably tested at atmospheric temperature, it is customary to adjust

the set pressure at ambient conditions to compensate for higher operating temperatures as indicated in the following table.

All Service Fluids

Operating Temperature	% Increase in Set Pressure At Atmospheric Temperature
-450° F to 300° F	None
301° F to 600° F	1%
601° F to 900° F	2%
901° F to 1200° F	3%

Steam service valves are tested on steam by the manufacturer and require no additional temperature compensation. Where the set pressure is above the production steam test facility limits, Section VIII steam valves may be tested on air. When steam valves are tested on air, compensation shown in the All Service Fluids Table should be used.

Low Pressure Settings

Low set pressure limits are indicated in the following table. These limits apply to both metal-to-metal and O-ring seat construction. Low pressure settings may be governed by valve design and performance and/or Code application limits. Pressure vessels having operating pressures not exceeding 15 psig are not considered within the scope of the ASME Code, Section VIII. Accordingly, pressure relief valve requirements for such applications are governed by other Codes and Standards that should be consulted.

The sizing equations for compressible fluids provided herein are valid for sonic flow conditions and should not be used to size pressure relief valves for applications in which subsonic (below 15 psig) flow conditions may exist. Low pressure applications can be reviewed by the Factory and special valves provided to meet those requirements.

Valve Series	Construction	Low Set Pressure Limit (psig)
2600 2600S 2600L	Conventional	15
2600 2600S 2600L 2600 Bal/Piston	BalanSeal BalanSeal/Piston	15*

*Low set pressure limit for "D" and "E" orifice BalanSeal (balanced bellows) valves are 50 psig and 25 psig respectively.

SAFETY VALVE – an automatic pressure relieving device actuated by the static pressure upstream of the valve, and characterized by rapid full opening or pop action. Used for steam, gas or vapor service.

RELIEF VALVE – an automatic pressure relieving device actuated by the static pressure upstream of the valve, which opens in proportion to the increase in pressure over the opening pressure.

SAFETY RELIEF VALVE – an automatic pressure actuated relieving device suitable for use as either a safety or relief valve, depending on the application.

PRESSURE RELIEF VALVE – a pressure relief device designed to re-close and prevent the further flow of fluid after normal conditions have been restored.

SET PRESSURE – in pounds per square inch gage, the inlet pressure at which the pressure relief valve is adjusted to open under service conditions. In a safety or safety relief valve in gas, vapor or steam service, the set pressure is the inlet pressure at which the valve pops under service conditions. In a relief or safety relief valve in liquid service, the set pressure is the inlet pressure at which the first steady steam flows from the valve perpendicular to the outlet.

DIFFERENTIAL SET PRESSURE – the pressure differential, in pounds per square inch between the set pressure and the constant superimposed back pressure. It is applicable only when a conventional type safety relief valve is being used in service against a constant superimposed back pressure.

COLD DIFFERENTIAL TEST PRESSURE – in pounds per square inch gage is the inlet static pressure at which the pressure relief valve is adjusted to open on the test stand. This pressure includes the corrections for service conditions of back pressure or temperature, or both.

OPERATING PRESSURE – the pressure, in pounds per square inch gage to which the vessel is usually subjected in service. A vessel is usually designed for a maximum allowable working pressure, in pounds per square inch gage, which will provide a suitable margin above the operating pressure in order to prevent any undesirable operation of the relief device. It is suggested that this margin be as great as possible consistent with economical vessel and other equipment design, system operation and the performance characteristics of the pressure relieving device.

MAXIMUM ALLOWABLE WORKING PRESSURE – the maximum gage pressure permissible in the top of a completed vessel in its operating position for a designated temperature. This pressure is based on calculations for each element in a vessel using nominal thicknesses, exclusive of allowances for corrosion and thicknesses required for loadings other than pressure. It is the basis for the pressure setting of the pressure relieving devices protecting the vessel. The design pressure may be used in place of maximum allowable working pressure in cases where calculations are not made to determine the value of the latter.

OVERPRESSURE – a pressure increase over the set pressure of a pressure relief valve, usually expressed as a percentage of the set pressure.

ACCUMULATION – the pressure increase over the maximum allowable working pressure of the vessel during discharge through the pressure relief valve, expressed as a percent of that pressure or in pounds per square inch.

BLOW DOWN – the difference between actual popping pressure of a pressure relief valve and actual reseating pressure, expressed as a percentage of set pressure or in pressure units.

LIFT – the actual travel of the disc away from closed position when a valve is relieving.

BACK PRESSURE – the static pressure existing at the outlet of a pressure relief device due to pressure in the discharge system.

CONSTANT BACK PRESSURE – back pressure that does not change appreciably under any condition of operation whether the pressure relief valve is closed or open.

VARIABLE BACK PRESSURE – refer to the discussion on BalanSeal valves on page 85.

BUILT-UP BACK PRESSURE – pressure existing at the outlet of a pressure relief device occasioned by the flow through that particular device into a discharge system.

SUPERIMPOSED BACK PRESSURE – the static pressure existing at the outlet of a pressure relief device at the time the device is required to operate. It is the result of pressure in the discharge system from other sources.

Prefix

(if applicable)

H
Designates high pressure versions. Used for "Q", "R", & "T" orifices only.

26

Series Number

Designates Series 2600 cast steel flanged pressure relief valves

D

Orifice Areas

Orifice Letter	Area, Sq. In.		Area, Sq. mm*	
	API	Actual	API	Actual
D	0.110	0.150	71	97
E	0.196	0.225	126	145
F	0.307	0.371	198	239
G	0.503	0.559	325	361
H	0.785	0.873	506	563
J	1.287	1.430	830	923
K	1.838	2.042	1186	1317
L	2.853	3.170	1841	2045
M	3.60	4.000	2323	2581
N	4.34	4.822	2800	3111
P	6.38	7.087	4116	4572
Q	11.05	12.27	7129	7916
R	16.0	17.78	10323	11471
T	26.0	28.94	16774	18671
U	—	31.5	—	203.2
W	—	63.62	—	410.2
W2	—	104.0	—	670.8
X	—	113.1	—	729.5
Y	—	143.1	—	923.0
Z	—	176.7	—	1139.7

Note: The "U" through "Z" orifices are not API Standard Sizes.
* "U" through "Z" metric areas in square centimeters.

A

Construction

- A** Conventional construction
- B** BalanSeal construction
- C** Conventional with O-ring seat pressure seal
- D** BalanSeal with O-ring seat pressure seal
- E** BalanSeal with auxiliary balancing piston
- F** BalanSeal with auxiliary balancing piston and O-ring seat pressure seal
- T** Teflon seat, conventional
- U** Teflon seat, BalanSeal

1

Temperatures & Materials

Designation	Inlet Temperature Range °F	Material	
		Body & Bonnet	Spring
1	-20 to 800	Carbon Steel	Chrome Alloy
2**	451 to 800	Carbon Steel	Chrome Alloy
3	801 to 1000	Chrome Moly Steel	High Temp. Alloy
4*	1001 to 1200	—	—
5*	1201 to 1500	—	—
1	-21 to -75	Use "S3" Trim Options	
1	-76 to -450	Use "S4" Trim Options	

* Temperature ranges 4 and 5 are beyond the scope of this catalog. Consult the Factory.
** Temperature range 2 is no longer used as the standard range valve handles temperatures to 800°F.

Our type numbering system simplifies the selection and specifying of Farris pressure relief valves because the digits that comprise a specific type number have a distinct significance. The digits describe the basic valve series, orifice, seat and internal construction, inlet temperature range, body, bonnet and spring material, inlet flange class and Code liquid design.

Ordering Information

To process your order properly and promptly, please specify the following:

1. Quantity*
2. Inlet and outlet size
3. Farris type number*
4. Inlet and outlet flange class and facing
5. Materials of construction, if other than standard
6. O-ring seat pressure seal material, if required
7. Set pressure*
8. Maximum inlet temperature*
9. Allowable overpressure*
10. Fluid and fluid state*
11. Back pressure, superimposed constant and/or variable and built-up*
12. Required capacity*
13. Accessories
 - (a) Bolted cap, open or packed lever
 - (b) Test gag
 - (c) Remoter
14. Code requirements, if any

*As a customer service, we verify your selection and sizing. If you want this service, you must include this information.

Parts Replacement

Valves – If an exact replacement valve is required, then the valve type, size and serial number must be specified to ensure proper dimensions and material being supplied. If a specific valve is obsolete, a recommendation of the current equivalent will be made if possible.

Spare Parts – When ordering parts, use part names as listed in the bills of materials. Specify valve type, size and serial number. If the serial number is not available, the original Farris factory order number will help us supply the proper part and material.

Springs – Order as an assembly to include spring with upper and lower spring buttons. Specify valve type, size, serial number, set pressure and backpressure, if any.

Note: If valve modification or set pressure changes are required, consideration must be given to correct the nameplate and other data.

2	L	-	1	2	0	/S4
Inlet Class	Special Construction* (if applicable)		Inlet Facing	Cap Construction	Test Gag	Special Material

Designation	ANSI Nominal Inlet Flange Class
0	150
1	300 lightweight valve
2	300 heavyweight valve
3	600
4	900
5	1500
6	2500

- A- Expanded API sizes: air, steam and gas service
- B- Expanded API sizes: ASME liquid valve
- C- Expanded API sizes: ASME Code Section VIII exposed spring design
- D- Valve suitable for heat transfer service-vapor
- E- Valve suitable for heat transfer service-liquid
- F- Expanded API size valves suitable for heat transfer service-vapor
- G- Expanded API size valves suitable for heat transfer service-liquid
- L- ASME Code certified for liquid service only
- S- ASME Code Section VIII exposed spring design

* Letter suffixes for expanded API sizes where 2 1/2" inlet or outlet has been replaced.

- Special (Note 2) 0
- Raised Face, ANSI Std. (125 to 160 AARH) 1
- Large Female, ANSI Std. 2
- Small Male, ANSI Std. 3
- Small Female, ANSI Std. 4
- Large Tongue, ANSI Std. 5
- Large Groove, ANSI Std. 6
- Small Tongue, ANSI Std. 7
- Small Groove, ANSI Std. 8
- Ring Joint (octagonal), ANSI Std. 9
- 63-83 AARH Smooth Finish RF H
- Although not applicable to the Inlet facing only, the following first digit letters are also used:
 - 63 to 83 AARH (outlet only) J
 - 63 to 83 AARH (inlet & outlet) K

- Screwed Cap 2
- Bolted Cap 3
- Packed Lever 4
- Open Lever 7
- Remoter (with Packed Lever) 8

- Without Gag 0
- With Gag 1

See Materials for Corrosive Service Table below.

Materials for Corrosive Service

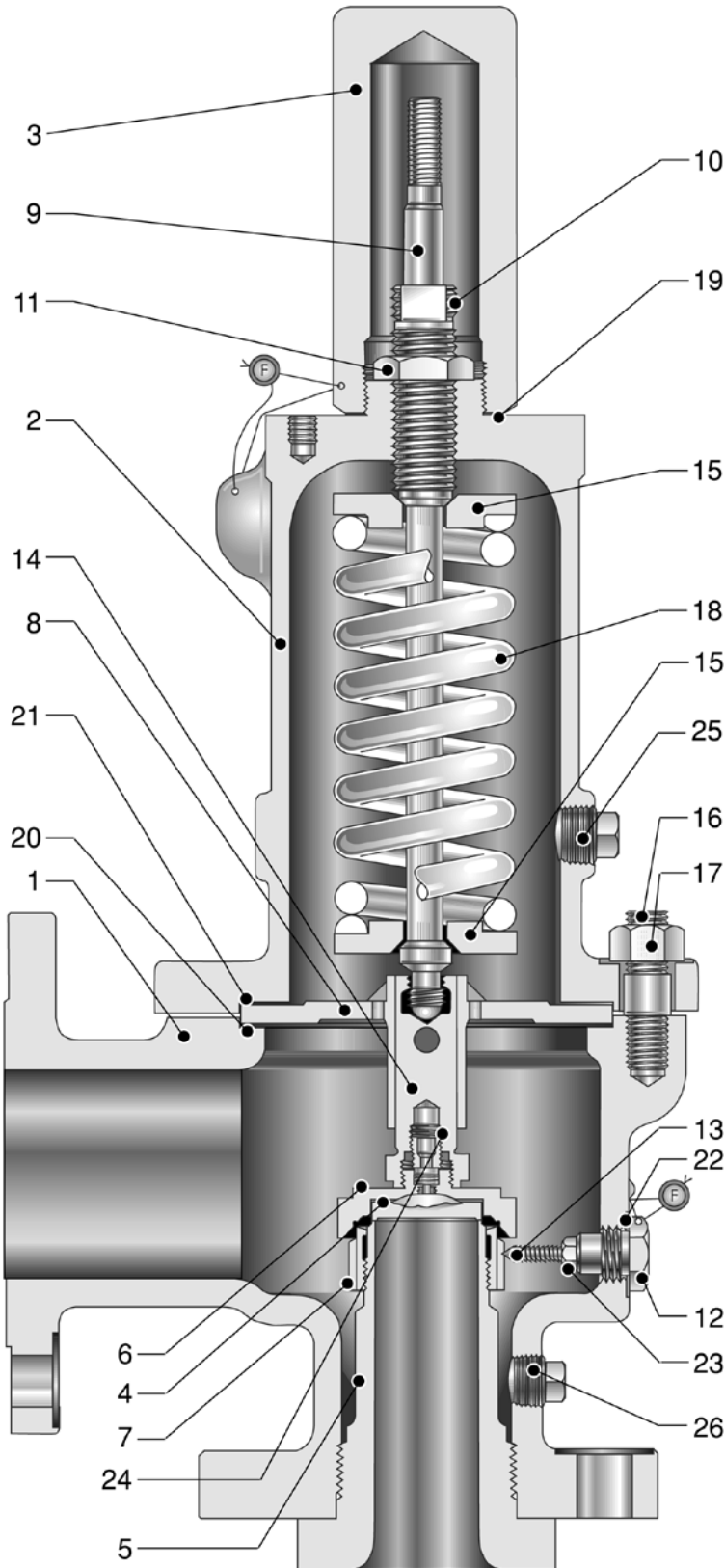
Designation	Special Material Description			
	Body Bonnet, Cap	Internal Parts		
		Nozzle & Disc	Other	Springs & Buttons
/S1	Standard	316	316*	316 buttons, Chrome Alloy or High Temperature Alloy Nickel Plated spring
/S3	316	316	316	316 buttons, Chrome Alloy or High Temperature Alloy Nickel Plated spring
S4	316	316	316	316
/H1	Standard	Hastelloy C	Standard	Standard
/H2	Standard	Hastelloy C	Hastelloy C & Monel	316 buttons, Chrome Alloy or High Temperature Alloy Nickel Plated spring
/H3	Hastelloy C	Hastelloy C	Hastelloy C	316 buttons, Chrome Alloy or High Temperature Alloy Nickel Plated spring
/H4	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
/M1	Standard	Monel	Standard	Standard
/M2	Standard	Monel	Monel	316 buttons, Chrome Alloy or High Temperature Alloy Nickel Plated spring
/M3	Monel	Monel	Monel	316 buttons, Chrome Alloy or High Temperature Alloy Nickel Plated spring
/M4	Monel	Monel	Monel	Inconel spring, Monel buttons
/N1	Carbon Steel (NACE)	316 (NACE)	316*	Standard ³
/N4	316 (NACE)	316 (NACE)	316*	316 ³

* Spring adjusting screw in standard material

General Notes:

1. Other special materials, such as 316L stainless steel and Alloy 20, as well as non-standard outlet flange classes are available upon request. In these instances, suffix code "SP" is used with a brief description of the special requirements.
2. Special inlet facings include, but are not limited to, socket or butt weld ends, lens joint and Grayloc® fittings. Grayloc is a registered trademark of Grayloc Products, a division of ABB Vetco Gray Inc.
3. The springs shown assumes bellows construction. For conventional construction, use Inconel X750.©

Built in conformance to ASME Code Section VIII, capacity certified by National Board (air, gas, steam⁶)



Bill of Materials—Conventional		
Item	Part Name	Material
1	Body	26()A10 thru 26()A16 SA-216 GR. WCB Carbon Steel
		26()A32 thru 26()A36 SA-217 GR. WC6, Alloy St. (1¼ CR-½ Moly)
2	Bonnet	26()A10 thru 26()A16 SA-216 GR. WCB Carbon Steel
		26()A32 thru 26()A36 SA-217 GR. WC6, Alloy St. (1¼ CR-½ Moly)
3	Cap. Plain Screwed	Carbon Steel
4	Disc	316 St. St.
5	Nozzle	316 St. St.
6	Disc Holder	316 St. St.
7	Blow Down Ring	316 St. St.
8	Sleeve Guide	316 St. St.
9	Stem	316 St. St.
10	Spring Adjusting Screw	Stainless Steel
11	Jam Nut (Spr. Adj. Screw)	316 St. St.
12	Lock Screw (B.D.R.)	316 St. St.
13	Lock Screw Stud	316 St. St.
14	Stem Retainer*	17-4-PH St. St.
15	Spring Button	Carbon St., Rust proofed or 316 St. St.
16	Body Stud	ASME SA-193 GR. B7 Alloy St.
17	Hex Nut (Body)	ASME SA-194 GR. 2H Alloy St.
18	Spring	26()A10 thru 26()A16 Chrome Alloy Rust Proofed
		26()A32 thru 26()A36 High Temperature Alloy Rust Proofed
19	Cap Gasket	316 St. St.
20	Body Gasket	316 St. St.
21	Bonnet Gasket	316 St. St.
22	Lock Screw Gasket	316 St. St.
23	Hex Nut (B.D.R.L.S.)	Stainless Steel
24	Lock Screw (D.H.)	Stainless Steel
25	Pipe Plug (Bonnet)	Steel
26	Pipe Plug (Body)	Steel

General Notes:

1. Parentheses in type number indicate orifice designation, as in 26FA10.
2. For corrosive and low temperature materials, see pages 17 through 21.
3. For open and packed lever materials and test gags, see accessories on pages 68 & 69.
4. For capacities, see pages 39-42 U.S. Units, 57-60 Metric Units.
5. For dimensions and weights, see pages 72-75.
6. Also suitable for liquid service where ASME Code Certification is not required. For ASME Code Certified liquid service, use the 2600L Series as illustrated on page 14.

*For 316 Stem Retainer add S1 suffix to Type #.

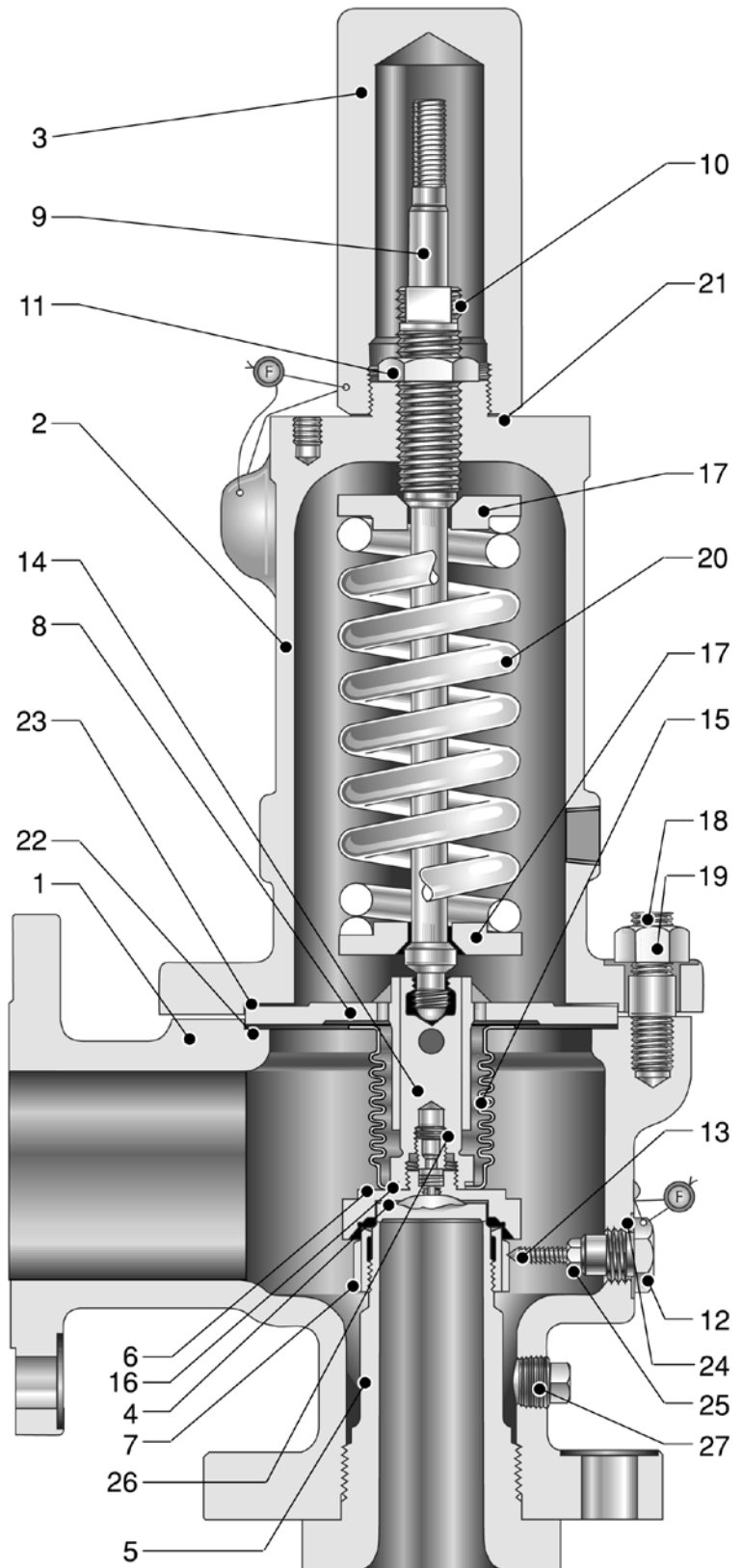
Built in conformance to ASME Code Section VIII, capacity certified by National Board (air, gas, steam[®])



Bill of Materials—BalanSeal			
Item	Part Name	Material	
1	Body	26()B10 thru 26()B16	SA-216 GR. WCB Carbon Steel
		26()B32 thru 26()B36	SA-217 GR. WC6, Alloy St. (1¼ CR-½ Moly)
2	Bonnet	26()B10 thru 26()B16	SA-216 GR. WCB Carbon Steel
		26()B32 thru 26()B36	SA-217 GR. WC6, Alloy St. (1¼ CR-½ Moly)
3	Cap. Plain Screwed	Carbon Steel	
4	Disc	316 St. St.	
5	Nozzle	316 St. St.	
6	Disc Holder	316 St. St.	
7	Blow Down Ring	316 St. St.	
8	Sleeve Guide	316 St. St.	
9	Stem	316 St. St.	
10	Spring Adjusting Screw	Stainless Steel	
11	Jam Nut (Spr. Adj. Screw)	316 St. St.	
12	Lock Screw (B.D.R.)	316 St. St.	
13	Lock Screw Stud	316 St. St.	
14	Stem Retainer	17-4-PH St. St.	
15	Bellows	Inconel Composite	
16	Bellows Gasket	Non-Asbestos	
17	Spring Button	Carbon St., Rust proofed or 316 St. St.	
18	Body Stud	ASME SA-193 GR. B7 Alloy St.	
19	Hex Nut (Body)	ASME SA-194 GR. 2H Alloy St.	
20	Spring	26()B16 thru 26()B26	Chrome Alloy Rust Proofed
		26()B32 thru 26()B36	High Temperature Alloy Rust Proofed
21	Cap Gasket	316 St. St.	
22	Body Gasket	316 St. St.	
23	Bonnet Gasket	316 St. St.	
24	Lock Screw Gasket	316 St. St.	
25	Hex Nut (B.D.R.L.S.)	Stainless Steel	
26	Lock Screw (D.H.)	Stainless Steel	
27	Pipe Plug (Body)	Steel	

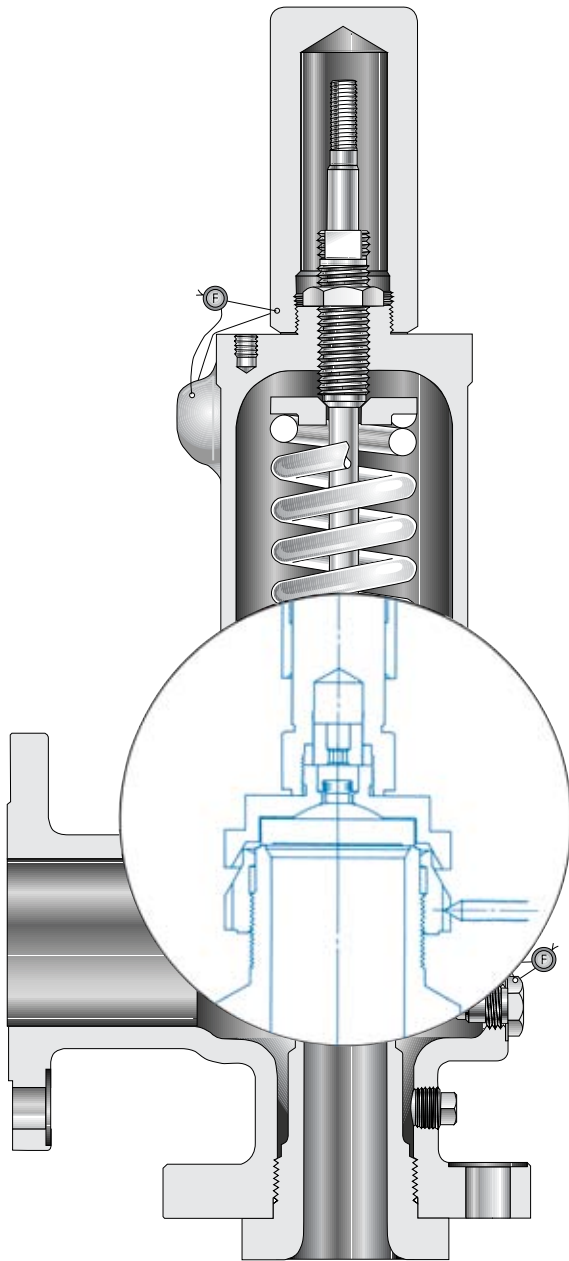
General Notes:

1. Parentheses in type number indicate orifice designation, as in 26FB10.
2. For corrosive and low temperature materials, see pages 17 through 21.
3. For open and packed lever materials and test gags, see accessories on pages 68 & 69.
4. For capacities, see pages 39-42 U.S. Units, 57-60 Metric Units.
5. For dimensions and weights, see pages 72-75.
6. Also suitable for liquid service where ASME Code Certification is not required. For ASME Code Certified liquid service, use the 2600L Series as illustrated on page 14.





Built in conformance to ASME Code Section VIII, capacity certified by National Board



The 2600L Series liquid relief valves are for use on ASME Section VIII Code applications and offer a superior valve with greater capacity at 10% overpressure than the traditional 2600 Series.

The 2600L Series complements a full line of pressure relief valves in orifices “D” through “T” to meet the ASME Code requirements for incompressible fluid services. The Code stamped construction requires liquid relief valves that have been capacity certified on water at 10% overpressure to carry the ASME UV and National Board NB symbols.

For compressible fluid services, the standard 2600 Series should be used. Liquid service applications that do not require the use of Code stamped liquid relief valves can still be satisfied with the standard 2600 series line. In most cases the standard 2600 should only be used in liquid service where an existing installation pipe size / orifice combination does not match the 2600L design.

The 2600L Series is also certified under ASME Code Section VIII for use in air, gas, steam, and vapor services. It may be used in those applications or where two phase or flashing fluid service is anticipated. The 2600L is certified as a fixed blow down design whether used in compressible or non-compressible services.

The type number is differentiated from the existing 2600 Series design by adding the letter “L” as a suffix. The letter “L” is used to specify all liquid trim type numbers and always appears in the seventh position of the type number, just before the three-digit option code for inlet facing/cap construction/test gag. Example: 26GA10L-120.

Optional trim material classes and other accessories are available, as with the 2600 Series, with the exceptions of the H2600. All types within the 2600L Series follow the size, pressure-temperature ratings, and center-to-face dimensions of the 2600 Series (API Std. 526).

Traditional Farris convertibility between conventional and bellows is maintained, as is the interchangeability of parts.

The 2600S Series safety valves with exposed springs represent an enhancement of the standard 2600 Series and are designed to offer improved performance in steam service. They are built in conformance to Section VIII of the ASME Code and have capacities certified at 10% overpressure by the National Board of Boiler and Pressure Vessel Inspectors. Series 2600S is available in the same "D" through "Z" orifices and flange classes as the standard 2600 Series, and have the same center-to-face dimensions (API Std. 526).

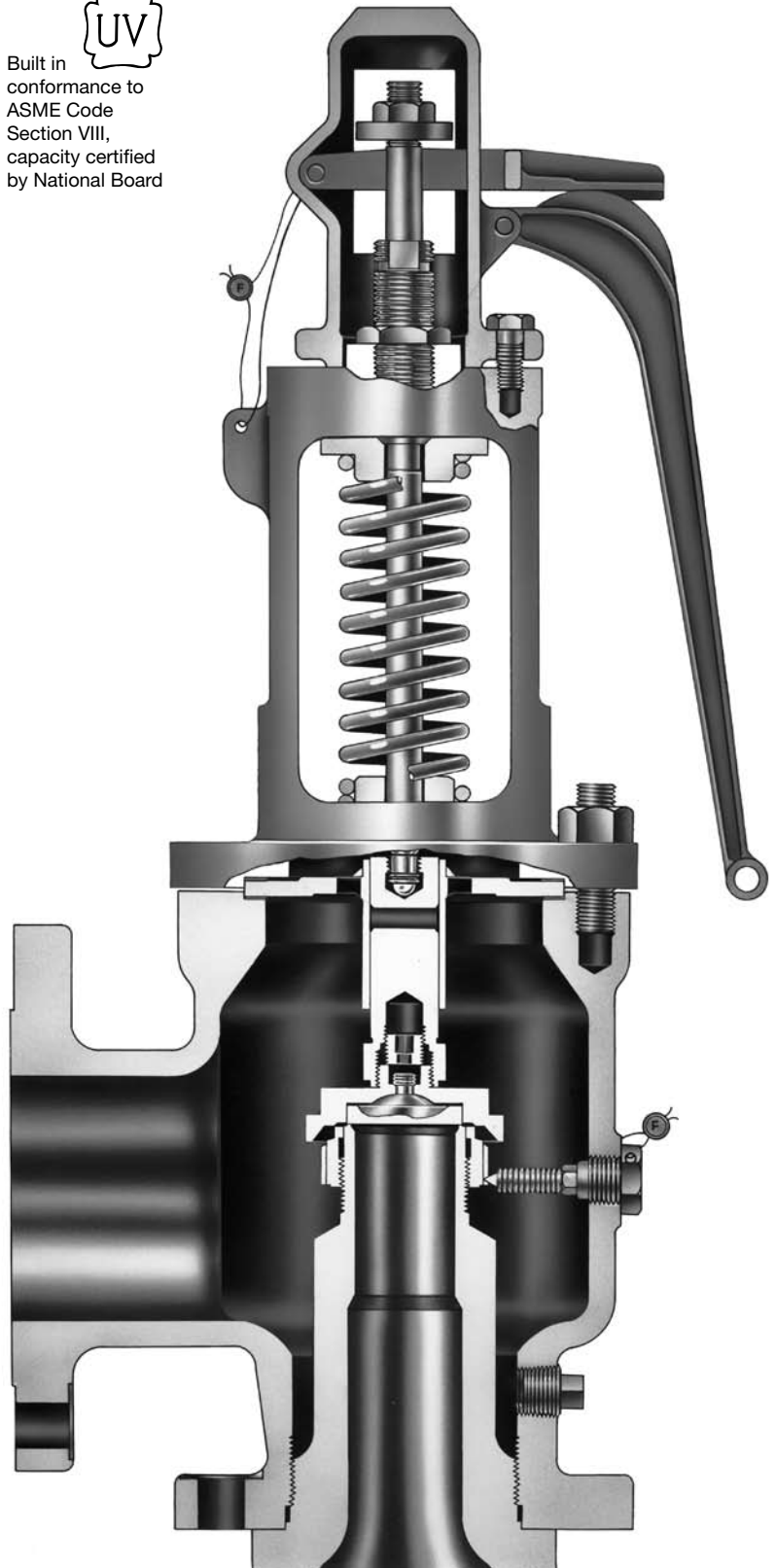
In steam service, you can encounter galling of the guiding surfaces. To minimize this problem, the guide and stem retainer are made from different materials: 316 stainless steel for the guide and hardened stainless steel for the stem retainer. Since the open bonnet is made from a standard 2600 Series bonnet, all other parts are identical to the 2600 Series to provide maximum interchangeability of parts and to reduce inventory costs.

An open lifting lever, required by ASME Code for steam and air service, is standard with the 2600S Series. Chrome alloy springs are used to 1000° F. They can also be used on air service or on other clean gases. Most other 2600 Series options can be supplied, including O-ring seats and bellows. For weather protection of the spring, use the standard 2600 vapor service valve with open lever.

The type number is differentiated from the 2600 Series by the addition of the suffix letter "S" in the seventh digit of the type number. Example: 26JA10S-170.



Built in conformance to ASME Code Section VIII, capacity certified by National Board



Balanced Bellows with Auxiliary Balancing Piston

Under back pressure conditions, rupture of the bellows can cause an increase in set pressure of the pressure relief valve. Consistent with safety, Farris Engineering offers a BalanSeal/piston design to compensate for a broken or ruptured bellows. The valve features a piston guide that has an inside diameter equal to the average diameter of the bellows convolutions.

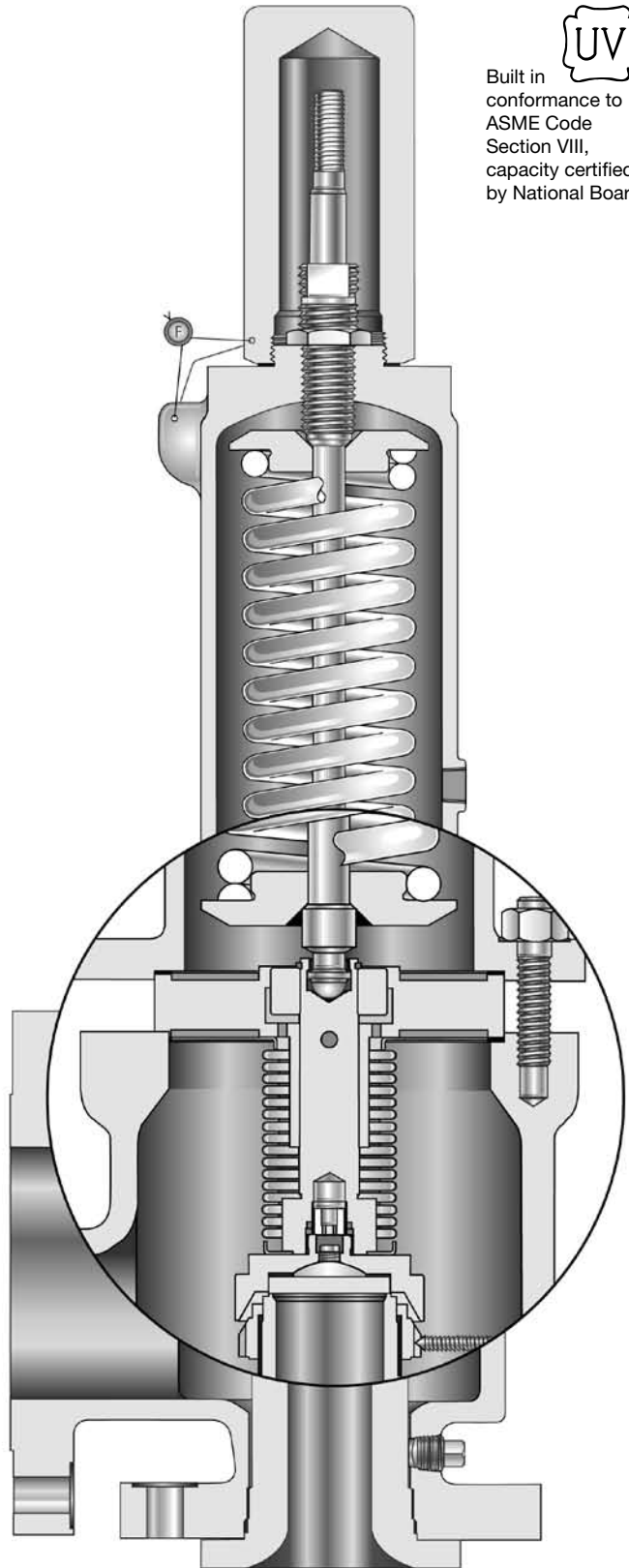
If the bellows fails, the effect of the back pressure is nullified by the use of the piston. Since there is a slight diametrical clearance between the piston and the guide, a small amount of lading fluid is permitted to pass through the bonnet vent, indicating a bellows rupture. Although the valve will continue to function as a Farris bellows pressure relief valve, the damaged bellows should be replaced to avoid further product loss.

When the proper orifice and corresponding letter designation have been determined, refer to the selection charts and choose the conventional pressure and temperature required. Sizes, set pressure, back pressure, temperature ratings and capacity data are the same as the BalanSeal construction.

To convert the conventional valve type number to the catalog number for balanced bellows valve with auxiliary balancing piston, insert the letter "E" in place of "A". Example: 26FA12-120 conventional valve becomes 26FE12-120.



Built in conformance to ASME Code Section VIII, capacity certified by National Board

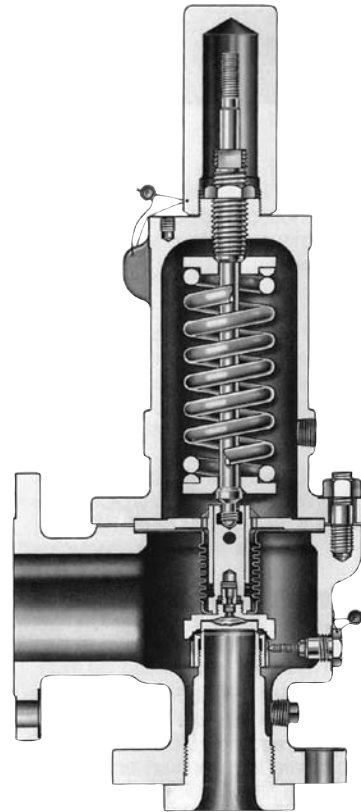


The inherent features of engineering design in the Farris nozzle pressure relief valve make it ideal for heat transfer fluid service. Heat transfer fluids form solid on relief to atmosphere and exhibit non-lubricating qualities. Consequently the valve requires the ultimate in tightness and perfect guiding beyond that of a valve used in other services.

The Farris design includes a 2½-to-1 guiding ratio, self-aligning, flat, easily replaceable disc and double universal joint for exact alignment. These valves have been proven in thousands of installations and are accepted as the industry standard for heat transfer fluid service.

For additional protection against deposit build-up on the guiding surfaces, a BalanSeal bellows can be provided to isolate internal working parts.

All heat transfer fluid service valves receive particular attention in the Farris assembly and testing departments. Special lapping, gasketing and sealing compounds are used to assure maximum tightness for this hard-to-hold service.



Built in conformance to ASME Code Section VIII, capacity certified by National Board

Materials for Corrosive and Low Temperature Service

Standard materials of construction for corrosive service and low temperature service are listed on pages 18-21. Our selection of these materials is a result of many years of research in metallurgy and, while not all-inclusive, covers the most frequently used construction materials. In the case of a special application that requires materials not listed in this catalog, consult the Farris Factory.

Note that Farris Engineering cannot guarantee valve service life, as there are many factors that can affect the life of any material and that are beyond our control.

Corrosive Service. A pressure relief valve is not expected to operate frequently; therefore, standard materials should prove satisfactory. Where severe corrosive conditions exist, the nozzle and disc, which are always exposed to the lading fluid, are available in more corrosive-resistant materials such as Monel (/M1) and Hastelloy C (/H1).

Where specific applications require complete internals to be more corrosion resistant due to frequent valve operation and where parts beyond the nozzle and disc are exposed to corrosive lading fluid, complete internals and the complete valve are available in 316, Monel and Hastelloy (/S3, /S4, /N1, /N4, /M2, /M3, /M4, /H2, /H3, /H4).

Low Temperature Service. For low temperature applications, Farris offers S3 and S4 trim categories, depending on the degree of sub-zero temperatures involved. Materials cover special metallurgy to maintain adequate impact resistance on all stressed parts at sub-zero temperatures.

Standard Material for Corrosive Service 316 St. St. ⁶



Part Name	S3 COMPLETE VALVE EXCEPT SPRING ASSEMBLY		S4 COMPLETE VALVE	
	-75°F TO 800°F		-450°F TO 450°F (Note 3)	
	Conventional	BalanSeal	Conventional	BalanSeal
Body	SA-351 Gr. CF8M St. St. (316 St. St.)	SA-351 Gr. CF8M St. St. (316 St. St.)	SA-351 Gr. CF8M St. St. (316 St. St.)	SA-351 Gr. CF8M St. St. (316 St. St.)
Bonnet	SA-351 Gr. CF8M St. St. (316 St. St.)	SA-351 Gr. CF8M St. St. (316 St. St.)	SA-351 Gr. CF8M St. St. (316 St. St.)	SA-351 Gr. CF8M St. St. (316 St. St.)
Cap, Plain Screwed	316 St. St.	316 St. St.	316 St. St.	316 St. St.
Disc	—	—	—	—
Nozzle	—	—	—	—
Disc Holder	—	—	—	—
Blow Down Ring	—	—	—	—
Sleeve Guide	—	—	—	—
Stem	—	—	—	—
Spring Adj. Screw	316 St. St.	316 St. St.	316 St. St.	316 St. St.
Jam Nut (Spr. Adj. Scr.)	—	—	—	—
Blow Down Ring Lock Screw	—	—	—	—
Lock Screw Stud	—	—	—	—
Stem Retainer	316 St. St.	316 St. St.	316 St. St.	316 St. St.
Bellows	None	—	None	—
Bellows Gasket	None	Teflon Composite	None	Teflon Composite
Spring Button	316 St. St.	316 St. St.	316 St. St.	316 St. St.
Body Stud	ASTM A193 Gr. B8M St. St.	ASTM A193 Gr. B8M St. St.	ASTM A193 Gr. B8M St. St.	ASTM A193 Gr. B8M St. St.
Body Hex Nut	ASTM A194 Gr. 8M St. St.	ASTM A194 Gr. 8M St. St.	ASTM A194 Gr. 8M St. St.	ASTM A194 Gr. 8M St. St.
Spring	Chrome Alloy, Nickel Plated	Chrome Alloy, Nickel Plated	316 St. St.	316 St. St.
Cap Gasket	—	—	—	—
Bonnet Gasket	—	—	—	—
Body Gasket	—	—	—	—
Lock Screw Gasket	—	—	—	—
Hex. Nut (Lock Screw)	—	—	—	—
Disc Holder Lock Screw	—	—	—	—
Pipe Plug (Bonnet)	316 St. St.	None	316 St. St.	None
Pipe Plug (Body)	316 St. St.	316 St. St.	316 St. St.	316 St. St.

General Notes:

- Any part denoted with a dash is standard material.
- Maximum set pressures for S1 trim are equal to the carbon steel valves in the selection tables.
- Maximum set and back pressures for the S3 and S4 trim are equal to the 316 stainless valve limits shown on pages 24-37, 43-56, 79 and 80.
- To designate valves with 316 stainless construction, add the appropriate suffix to the type number. Example: 26FA10-120 becomes 26FA10-120/S4.
- For open and packed lever materials, see page 68.
- Specify S1 trim to select a valve with a 316 St. St. stem retainer and standard carbon steel body and bonnet.



Standard Material for Corrosive Service Monel

PART NAME	M1 NOZZLE & DISC		M2 INTERNAL PARTS EXCEPT SPRING ASSEMBLY		M3 COMPLETE VALVE EXCEPT SPRING ASSEMBLY		M4 COMPLETE VALVE	
	-20°F TO 800°F (Note 2)		-20°F TO 800°F (Note 2)		-75°F TO 800°F (Note 3)		-325°F TO 900°F (Note 3)	
	Convent'l	BalanSeal	Convent'l	BalanSeal	Convent'l	BalanSeal	Convent'l	BalanSeal
Body	—	—	—	—	Monel	Monel	Monel	Monel
Bonnet	—	—	—	—	Monel	Monel	Monel	Monel
Cap, Plain Screwed	—	—	—	—	Monel	Monel	Monel	Monel
Disc	Monel	Monel	Monel	Monel	Monel	Monel	Monel	Monel
Nozzle	Monel	Monel	Monel	Monel	Monel	Monel	Monel	Monel
Disc Holder	—	—	Monel	Monel	Monel	Monel	Monel	Monel
Blow Down Ring	—	—	Monel	Monel	Monel	Monel	Monel	Monel
Sleeve Guide	—	—	Monel	—	Monel	Monel	Monel	Monel
Stem	—	—	Monel	—	Monel	Monel	Monel	Monel
Spring Adj. Screw	—	—	Monel	—	Monel	Monel	Monel	Monel
Jam Nut (Spring Adj. Screw)	—	—	Monel	—	Monel	Monel	Monel	Monel
Blow Down Ring Lock Screw	—	—	Monel	Monel	Monel	Monel	Monel	Monel
Lock Screw Stud	—	—	Monel	Monel	Monel	Monel	Monel	Monel
Stem Retainer	—	—	Monel	Monel	Monel	Monel	Monel	Monel
Bellows	None	—	None	Monel	None	Monel	None	Monel
Bellows Gasket	None	—	None	Teflon Composite	None	Teflon Composite	None	Teflon Composite
Spring Button	—	—	316 St. St.	—	316 St. St.	316 St. St.	Monel	Monel
Body Stud	—	—	—	—	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Body Hex Nut	—	—	—	—	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Spring	—	—	Chrome Alloy Nickel Plated	—	Chrome Alloy Nickel Plated	Chrome Alloy Nickel Plated	Inconel X	Inconel X
Cap Gasket	—	—	Monel	—	Monel	Monel	Monel	Monel
Bonnet Gasket	—	—	Monel	—	Monel	Monel	Monel	Monel
Body Gasket	—	—	Monel	Monel	Monel	Monel	Monel	Monel
Lock Screw Gasket	—	—	Monel	Monel	Monel	Monel	Monel	Monel
Hex Nut (Lock Screw)	—	—	Monel	Monel	Monel	Monel	Monel	Monel
Disc Holder Lock Screw	—	—	Monel	Monel	Monel	Monel	Monel	Monel
Pipe Plug (Bonnet)	—	None	—	None	Monel	None	Monel	None
Pipe Plug (Body)	—	—	—	—	Monel	Monel	Monel	Monel

General Notes:

- Any part denoted with a dash is standard material.
- Maximum set pressures for M1 and M2 trim are equal to the Monel flange limits as shown on page 83. Consult the factory for higher pressures.
- Maximum set and back pressures for the M3 and M4 trim are equal to the Monel valve limits as shown on page 83.
- To designate valves with Monel construction, add the appropriate suffix to the type number. Example: 26FA10-120 becomes 26FA10-120/M1.
- For open and packed lever materials, see page 68.
- Monel, Inconel and Inconel X are registered trademarks of Inco Alloys International. We reserve the right to substitute comparable materials from other manufacturers.

Standard Material for Corrosive Service Hastelloy C



PART NAME	H1 NOZZLE & DISC		H2 INTERNAL PARTS EXCEPT SPRING ASSEMBLY		H3 COMPLETE VALVE EXCEPT SPRING ASSEMBLY		H4 COMPLETE VALVE	
	-20°F TO 500°F (Note 2)		-20°F TO 500°F (Note 2)		-75°F TO 500°F (Note 3)		-325°F TO 500°F (Note 3)	
	Convent'l	BalanSeal	Convent'l	BalanSeal	Convent'l	BalanSeal	Convent'l	BalanSeal
Body	—	—	—	—	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Bonnet	—	—	—	—	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Cap, Plain Screwed	—	—	—	—	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Disc	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Nozzle	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Disc Holder	—	—	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Blow Down Ring	—	—	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Sleeve Guide	—	—	Hastelloy C	—	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Stem	—	—	Monel	—	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Spring Adj. Screw	—	—	Monel	—	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Jam Nut (Spring Adj. Screw)	—	—	Monel	—	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Blowdown Ring Lock Screw	—	—	Monel	Monel	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Lock Screw Stud	—	—	Monel	Monel	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Stem Retainer	—	—	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Bellows (See Note 5)	None	—	None	Inconel Composite Teflon Coated	None	Inconel Composite Teflon Coated	None	Inconel Composite Teflon Coated
Bellows Gasket	None	—	None	Teflon Composite	None	Teflon Composite	None	Teflon Composite
Spring Button	—	—	316 St. St.	—	316 St. St.	316 St. St.	Hastelloy C	Hastelloy C
Body Stud	—	—	—	—	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Body Hex Nut	—	—	—	—	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Spring	—	—	Chrome Alloy Nickel Plated	—	Chrome Alloy Nickel Plated	Chrome Alloy Nickel Plated	Hastelloy C	Hastelloy C
Cap Gasket	—	—	Monel	—	Teflon Composite	Teflon Composite	Teflon Composite	Teflon Composite
Bonnet Gasket	—	—	Monel	—	Teflon Composite	Teflon Composite	Teflon Composite	Teflon Composite
Body Gasket	—	—	Monel	Monel	Teflon Composite	Teflon Composite	Teflon Composite	Teflon Composite
Lock Screw Gasket	—	—	Monel	Monel	Teflon Composite	Teflon Composite	Teflon Composite	Teflon Composite
Hex Nut (Lock Screw)	—	—	Monel	Monel	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Disc Holder Lock Screw	—	—	Monel	Monel	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C
Pipe Plug (Bonnet)	—	None	—	None	Hastelloy C	None	Hastelloy C	None
Pipe Plug (Body)	—	—	—	—	Hastelloy C	Hastelloy C	Hastelloy C	Hastelloy C

General Notes:

- Any part denoted with a dash is standard material.
- Maximum set pressures for H1 and H2 trim are equal to the carbon steel valves in the Selection Tables.
- Maximum set and back pressures for the H3 and H4 trim are equal to the Hastelloy C valve limits shown on pages 81 and 82.
- To designate valves with Hastelloy C construction, add the appropriate suffix to the type number. Example: 26FA10-120 becomes 26FA10-120/H1.
- For open and packed lever materials, see page 68.
- Hastelloy and Hastelloy C are registered trademarks of Haynes International. We reserve the right to substitute comparable materials from other manufacturers.



Pressure Relief Valves for Sour Gas Service NACE MR0103 and MR0175/ISO 15156

NACE International (formerly The National Association of Corrosion Engineers) publishes two standards covering the use of equipment in environments containing H₂S (Hydrogen Sulfide). The standards are: MR0103, Standard Material Requirements – Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments; and MR0175/ISO 15156, Petroleum and natural gas industries – Materials for use in H₂S-containing Environments in oil and gas production.

The material requirements of the NACE Standards have resulted in various constructions. 2600 Series valves constructed of standard carbon steel (SA216 Grade WCB) and 316 stainless steel (SA351 Grade CF8M or SA479 Type 316) will be dual certified to NACE MR0103 and NACE MR0175/ISO 15156. For non-standard materials,

Farris Engineering will have to review the materials on a case-by-case basis to determine NACE compliance.

The customer must decide whether his application requires a valve in compliance with NACE standards. Farris Engineering is responsible for supplying materials in compliance with the applicable NACE specification. As part of the order requirement, Farris will verify that material hardness values are in compliance with the NACE standard on the body, bonnet, nozzle and disc as applicable. Additionally, we will offer bolting and springs (for conventional and pilot operated valves only) in compliance with NACE specifications.

To specify a valve with materials compliant to NACE specifications, add the suffix /N1 or /N4 to the standard type number. Example: 26LB12-120/N1.

Part Name	N1 Suffix		N4 Suffix	
	Conventional	Bellows	Conventional	Bellows
Body	SA216 Gr. WCB (NACE)	SA216 Gr. WCB (NACE)	SA351 Gr. CF8M (NACE)	SA351 Gr. CF8M (NACE)
Bonnet	SA216 Gr. WCB (NACE)	SA216 Gr. WCB (NACE)	SA351 Gr. CF8M (NACE)	SA351 Gr. CF8M (NACE)
Cap, Plain Screwed	—	—	—	—
Disc	316 Stainless Steel (NACE)	316 Stainless Steel (NACE)	316 Stainless Steel (NACE)	316 Stainless Steel (NACE)
Nozzle	316 Stainless Steel (NACE)	316 Stainless Steel (NACE)	316 Stainless Steel (NACE)	316 Stainless Steel (NACE)
Disc Holder	—	—	—	—
Blow Down Ring	—	—	—	—
Sleeve Guide	—	—	—	—
Stem	—	—	—	—
Spring Adj. Screw	—	—	—	316 SS
Jam Nut (Spr. Adj. Scr.)	—	—	—	—
Blow Down Ring	—	—	—	—
Lock Screw	—	—	—	—
Lock Screw Stud	—	—	—	—
Stem Retainer	316 Stainless Steel	316 Stainless Steel	316 Stainless Steel	316 Stainless Steel
Bellows	—	—	—	—
Bellows Gasket	—	—	—	—
Spring Button	—	—	—	—
Body Stud	ASME SA-193 Gr. B7M Alloy Steel	ASME SA-193 Gr. B7M Alloy Steel	ASME SA-193 Gr. B8MA Stainless Steel	ASME SA-193 Gr. B8MA Stainless Steel
Body Hex Nut	ASME SA-194 Gr. 2HM Alloy Steel	ASME SA-194 Gr. 2HM Alloy Steel	ASME SA-194 Gr. 8MA Stainless Steel	ASME SA-194 Gr. 8MA Stainless Steel
Spring	Inconel	—	Inconel	316 SS
Cap Gasket	—	—	—	—
Bonnet Gasket	—	—	—	—
Body Gasket	—	—	—	—
Lock Screw Gasket	—	—	—	—
Hex. Nut (Lock Screw)	—	—	—	—
Disc Holder Lock Screw	—	—	—	—
Pipe Plug (Bonnet)	None	—	None	—
Pipe Plug (Body)	—	—	—	—

Notes:

1. Any part denoted with a dash is standard material.
2. For open and packed lever materials, see page 68.
3. For a valve with complete Inconel bellows, use "N1/SP" type number suffix. Example: 26JB10-120/N1/SP
4. For a valve in complete stainless steel, add "N4" to suffix. Example: 26HB10-120/N4. For optional complete Inconel bellows, add "N4/SP". Example: 26HB10-120/N4/SP.

Farris O-Ring Seat Pressure Seal for Conventional or BalanSeal



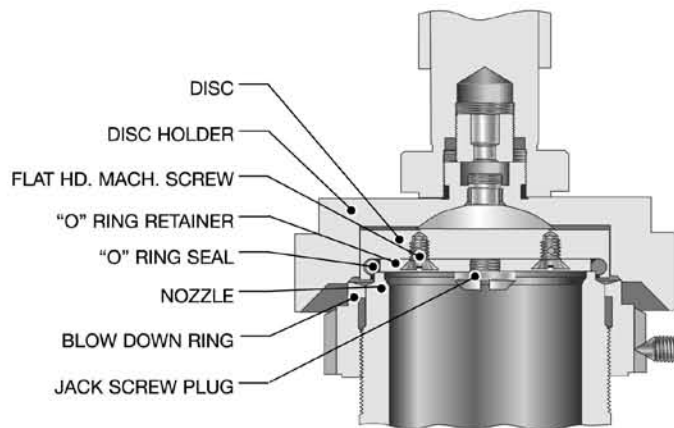
The O-ring seat pressure seal minimizes leakage and costly product loss as well as reduces downtime and maintenance on troublesome applications such as:

- Operation too close to set pressure
- Light, hard-to-hold fluids
- Entrained foreign particles and solids
- Vibratory applications
- Corrosive fluids
- Nozzle icing conditions
- Discharge piping strains

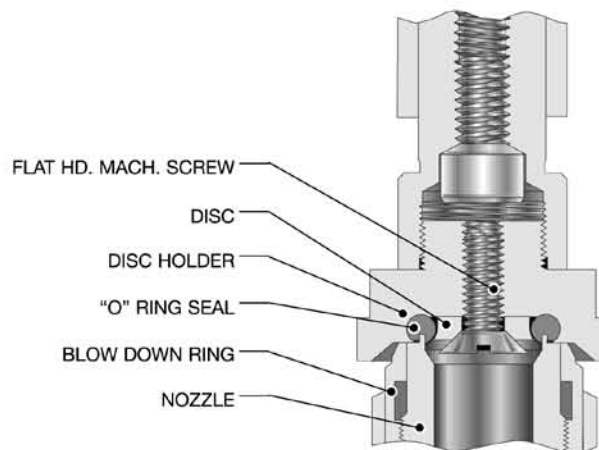
Recognizing the need for a resilient seat in a pressure relief valve for extreme tightness, Farris Engineering first produced an O-ring seat in early 1950. The O-ring design received and continues to receive phenomenal acceptance and use because it makes possible complete tightness at pressures much closer to valve set pressure. This tightness is not possible with the standard metal-to-metal seat.

The present Farris O-ring seat seal permits set pressure as high as 1500 psig. Equally important, the spring load is carried solely by the metal-to-metal portion of the seat with the O-ring becoming a pressure seal within its recessed chamber, assuring maximum tightness.

The O-ring seat seal option is available for the 2600/2600L/2600S Series of flanged pressure relief valves in the conventional, BalanSeal, and BalanSeal/piston constructions. Refer to the Selection Tables on pages 24 through 37. Substitute a "C" for the fourth digit "A" in the type number for the conventional valve, a "D" for the fourth digit "B" in the type number for a BalanSeal valve, and an "F" for the fourth digit in the type number for the BalanSeal/piston construction when an O-ring seat seal is required. Valves with Teflon seat seals are available on application.



2600 L Through T Orifice O-Ring Details



2600 D Through K Orifice O-Ring Details

The same type number changes apply to the 2600L Series. Examples:

- 26FA10 becomes 26FC10 (conventional).
- 26FB10 becomes 26FD10 (BalanSeal).
- 26FA10L becomes 26FC10L (conventional-liquid service).
- 26FE10L becomes 26FF10L (BalanSeal/piston-liquid service).

The set pressure limits of the conventional, BalanSeal, and BalanSeal/piston valves covered in the Selection Tables are the same for the O-ring design in all type numbers and orifices with the class 150, 300, and 600 inlet flanges. Above class 600 inlet flanges, 1500 psig is the limit for the O-ring design, not the conventional limit shown in the Selection Charts and Tables. Refer to the O-Ring Material Selection Chart on page 23 for temperature and pressure ratings of the various elastomeric O-ring materials available.



Why use an O-ring seat pressure seal?

In the normal operation of a pressure relief valve, the disc must lift off the nozzle very slightly to simmer, allowing pressure build-up within the secondary orifice (huddling chamber), causing the valve to pop fully open. Simmering occurs many times in the process industries where, as a result of process changes, minor upsets, etc., operating pressure fluctuates higher than normal, causing pressure relief valves to simmer but not fully open. This can cause serious misalignment in the valve, and after the pressure drops, the valve will very often continue to leak below the normal operating pressure. The leaking can be overcome by actually popping the valve, but sometimes this is not possible. Use of a Farris O-ring seat pressure seal will always correct this problem.

Frequently operating pressures are too close to valve set pressures. As the operating pressure nears the set pressure, seat loading is diminished, reducing the force that affects tightness. The Farris O-ring seat pressure seal ensures that tightness is achieved at relatively higher operating pressures, much more so than with metal-to-metal or other soft seat pressure relief valves.

On light, hard-to-hold fluids such as hydrogen, helium, light hydrocarbon, anhydrous ammonia, and others, metal-to-metal seats are often penetrated, causing leakage problems. The Farris O-ring seat pressure seal overcomes leakage on these hard-to-hold fluids.

In applications where heavy vibrations occur such as barges, tankers, pumps, and compressors, leakage of metal-to-metal seats develops. This occurs because, as the set pressure nears, the spring force is equalized and the vibration reduces the effect of seat loading, causing leakage. The Farris O-ring seat pressure seal maintains tightness because the spring force is not a factor in the tightness of the O-ring design.

Where occasional minute foreign particles are carried in the flowing medium, metal-to-metal seats are usually marred or scratched when the valve is blowing. This creates leakage problems after the valve closes. The Farris O-ring seat pressure seal absorbs the impact of these particles without damage, and eliminates disc separation from the mating metal seating surface on the nozzle as the valve closes. This reduces the incidence

of leakage on most process units. When necessary, simply replace the Farris O-ring to maintain tightness.

Due to corrosion, metal-to-metal seats can eventually leak. With the proper selection of the Farris O-ring seat pressure seal, tightness can be improved and maintained.

Nozzle icing results from the refrigerant effect of the flowing media when a valve relieves. Ice actually forms on the seat, causing leakage. The Farris O-ring seat pressure seal reduces this type of leakage.

“O” RING MATERIAL SELECTION TABLE

Material	Temperature Range °F	D to K Orifice		L to T Orifice	
		Set Pressure (psig)	Durometer (Shore A)	Set Pressure (psig)	Durometer (Shore A)
Viton ⁴	-20 to 450	15 to 100	50	15 to 150	50
	-20 to 450	101 to 650	75	150 to 450	75
	-20 to 125	650 to 950	75	450 to 750	75
	125 to 450		90		90
	-20 to 450	950 to 1500	90	750 to 1500	90
Ethylene Propylene	0 to 350	15 to 100	50	15 to 150	50
	0 to 350	101 to 650	70	150 to 450	70
	0 to 125	650 to 950	70	450 to 750	70
	125 to 350		80		80
	0 to 350	950 to 1500	80	750 to 1500	80
Buna N	0 to 200	15 to 100	50	15 to 100	50
	0 to 200	101 to 650	70	100 to 450	70
	0 to 125	650 to 950	70	150 to 750	70
	125 to 200		90		90
	0 to 200	950 to 1500	90	750 to 1500	90
Silicone	-150 to 450	15 to 100	50	15 to 100	50
	-150 to 0	101 to 600	50	100 to 200	50
	0 to 450		70		70
	-150 to 450	600 to 850	70	200 to 450	70
	-150 to 125	850 to 1100	70	450 to 750	70
	125 to 450		80		80
	-150 to 450	1100 to 1500	80	750 to 1500	80
Kalrez ⁴	-20 to 550	15 to 200	65	15 to 150	65
	-20 to 550	201 to 650	80	150 to 450	80
	-20 to 200	650 to 950	80	450 to 750	80
	200 to 550		90		90
	-20 to 550	950 to 1500	90	750 to 1500	90
Neoprene	-45 to 300	50 to 750	70	50 to 750	70
	-45 to 300	751 to 1500	80	751 to 1500	80

General Notes:

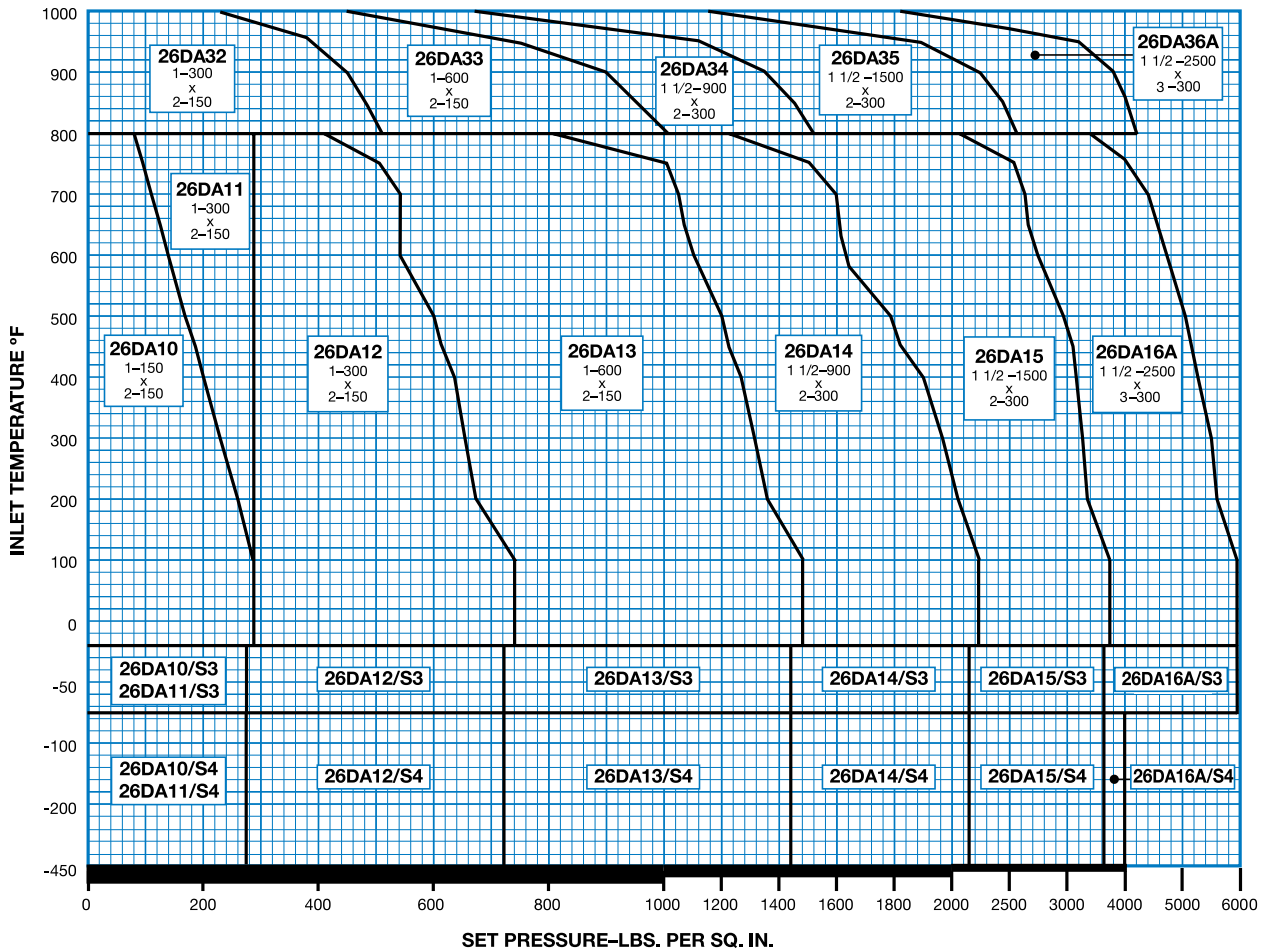
- Standard seat tightness for “O” ring valves is no bubbles at 90% of set pressure for both conventional and bellows valves. At set pressures of 50 psig and below, leakage test shall be made at 5 psig below set pressure.
- Ethylene Propylene is acceptable for steam service up to 350°F.
- Teflon seat seals available on an application basis. Consult the factory.
- Viton and Kalrez are registered trademarks of E. I. DuPont. We reserve the right to substitute comparable materials from other manufacturers.
- Teflon seat seals are available on application. Consult the factory.

D Orifice

API Area: 0.110 sq. in.
Actual Area: 0.150 sq. in.

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, PSIG						BACK PRESSURE LIMIT PSIG @ 100°F		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-450°F -76°F	-75°F -21°F	-20°F 100°F	450°F	800°F	1000°F	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26DA10	26DB10	1 x 2	150#	150#	—	—	285	185	80	—	285	230	CARBON STEEL	CHROME ALLOY	-20°F to 800°F
26DA11	26DB11	1 x 2	300#	150#	—	—	285	285	285	—	285	230			
26DA12	26DB12	1 x 2	300#	150#	—	—	740	615	410	—	285	230			
26DA13	26DB13	1 x 2	600#	150#	—	—	1480	1235	825	—	285	230			
26DA14	—	1 1/2 x 2	900#	300#	—	—	2220	1845	1235	—	600	500			
26DA15	—	1 1/2 x 2	1500#	300#	—	—	3705	3080	2060	—	600	500			
26DA16A	—	1 1/2 x 3	2500#	300#	—	—	6000	5135	3430	—	740	500	CHROME MOLY STEEL	HIGH TEMP. ALLOY	801°F to 1000°F
26DA32	26DB32	1 x 2	300#	150#	—	—	—	—	510	225	285	230			
26DA33	26DB33	1 x 2	600#	150#	—	—	—	—	1015	445	285	230			
26DA34	—	1 1/2 x 2	900#	300#	—	—	—	—	1525	670	600	500			
26DA35	—	1 1/2 x 2	1500#	300#	—	—	—	—	2540	1115	600	500			
26DA36A	—	1 1/2 x 3	2500#	300#	—	—	—	—	4230	1860	740	500			
26DA10/S3	26DB10/S3	1 x 2	150#	150#	—	275	—	—	—	—	275	230	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-21°F to -75°F
26DA11/S3	26DB11/S3	1 x 2	300#	150#	—	275	—	—	—	—	275	230			
26DA12/S3	26DB12/S3	1 x 2	300#	150#	—	720	—	—	—	—	275	230			
26DA13/S3	26DB13/S3	1 x 2	600#	150#	—	1440	—	—	—	—	275	230			
26DA14/S3	—	1 1/2 x 2	900#	300#	—	2160	—	—	—	—	600	500			
26DA15/S3	—	1 1/2 x 2	1500#	300#	—	3600	—	—	—	—	600	500			
26DA16A/S3	—	1 1/2 x 3	2500#	300#	—	6000	—	—	—	—	720	500	316 ST. ST.	316 ST. ST.	-76°F to -450°F
26DA10/S4	26DB10/S4	1 x 2	150#	150#	275	—	—	—	—	—	275	230			
26DA11/S4	26DB11/S4	1 x 2	300#	150#	275	—	—	—	—	—	275	230			
26DA12/S4	26DB12/S4	1 x 2	300#	150#	720	—	—	—	—	—	275	230			
26DA13/S4	26DB13/S4	1 x 2	600#	150#	1440	—	—	—	—	—	275	230			
26DA14/S4	—	1 1/2 x 2	900#	300#	2160	—	—	—	—	—	600	500			
26DA15/S4	—	1 1/2 x 2	1500#	300#	3600	—	—	—	—	—	600	500			
26DA16A/S4	—	1 1/2 x 3	2500#	300#	4000	—	—	—	—	—	720	500			

Selection Chart



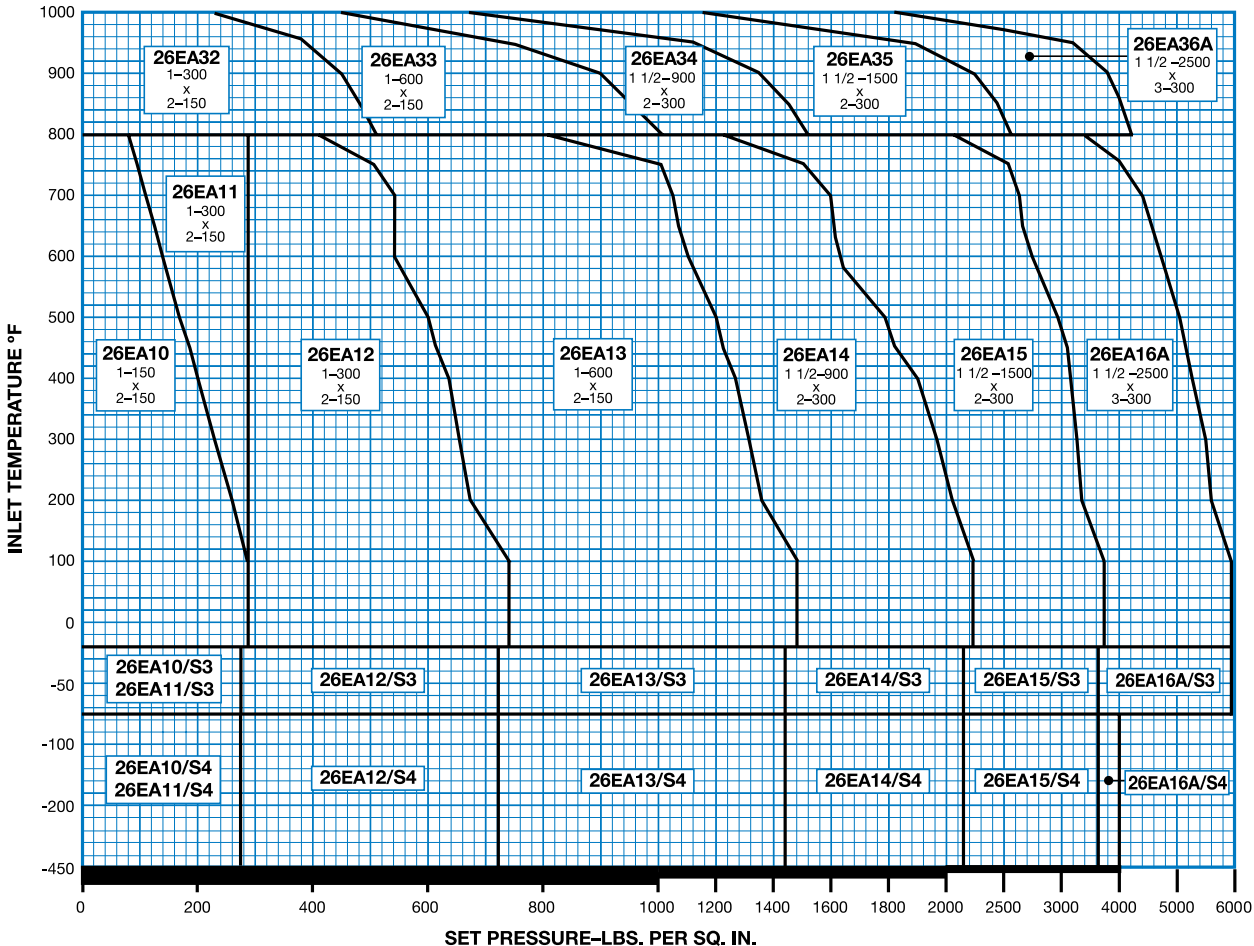
General Notes:

1. The type numbers shown on the Selection Chart indicate conventional valves. For BalanSeal, O-ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
2. Outlet pressure for temperatures above 100° F should not exceed the rating in ANSI B16.5.
3. For applications above 1000° F, consult the Farris Factory.

E Orifice

API Area: 0.196 sq. in.
Actual Area: 0.225 sq. in.

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, PSIG						BACK PRESSURE LIMIT PSIG @ 100°F		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-450°F -76°F	-75°F -21°F	-20°F 100°F	450°F	800°F	1000°F	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26EA10	26EB10	1 x 2	150#	150#	—	—	285	185	80	—	285	230	CARBON STEEL	CHROME ALLOY	-20°F to 800°F
26EA11	26EB11	1 x 2	300#	150#	—	—	285	285	285	—	285	230			
26EA12	26EB12	1 x 2	300#	150#	—	—	740	615	410	—	285	230			
26EA13	26EB13	1 x 2	600#	150#	—	—	1480	1235	825	—	285	230			
26EA14	—	1 1/2 x 2	900#	300#	—	—	2220	1845	1235	—	600	500			
26EA15	—	1 1/2 x 2	1500#	300#	—	—	3705	3080	2060	—	600	500			
26EA16A	—	1 1/2 x 3	2500#	300#	—	—	6000	5135	3430	—	740	500			
26EA32	26EB32	1 x 2	300#	150#	—	—	—	—	510	225	285	230	CHROME MOLY STEEL	HIGH TEMP. ALLOY	801°F to 1000°F
26EA33	26EB33	1 x 2	600#	150#	—	—	—	—	1015	445	285	230			
26EA34	—	1 1/2 x 2	900#	300#	—	—	—	—	1525	670	600	500			
26EA35	—	1 1/2 x 2	1500#	300#	—	—	—	—	2540	1115	600	500			
26EA36A	—	1 1/2 x 3	2500#	300#	—	—	—	—	4230	1860	740	500			
26EA10/S3	26EB10/S3	1 x 2	150#	150#	—	275	—	—	—	—	275	230	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-21°F to -75°F
26EA11/S3	26EB11/S3	1 x 2	300#	150#	—	275	—	—	—	—	275	230			
26EA12/S3	26EB12/S3	1 x 2	300#	150#	—	720	—	—	—	—	275	230			
26EA13/S3	26EB13/S3	1 x 2	600#	150#	—	1440	—	—	—	—	275	230			
26EA14/S3	—	1 1/2 x 2	900#	300#	—	2160	—	—	—	—	600	500			
26EA15/S3	—	1 1/2 x 2	1500#	300#	—	3600	—	—	—	—	600	500			
26EA16A/S3	—	1 1/2 x 3	2500#	300#	—	6000	—	—	—	—	720	500			
26EA10/S4	26EB10/S4	1 x 2	150#	150#	275	—	—	—	—	—	275	230			
26EA11/S4	26EB11/S4	1 x 2	300#	150#	275	—	—	—	—	—	275	230	316 ST. ST.	316 ST. ST.	-76°F to -450°F
26EA12/S4	26EB12/S4	1 x 2	300#	150#	720	—	—	—	—	—	275	230			
26EA13/S4	26EB13/S4	1 x 2	600#	150#	1440	—	—	—	—	—	275	230			
26EA14/S4	—	1 1/2 x 2	900#	300#	2160	—	—	—	—	—	600	500			
26EA15/S4	—	1 1/2 x 2	1500#	300#	3600	—	—	—	—	—	600	500			
26EA16A/S4	—	1 1/2 x 3	2500#	300#	4000	—	—	—	—	—	720	500			



Selection Chart

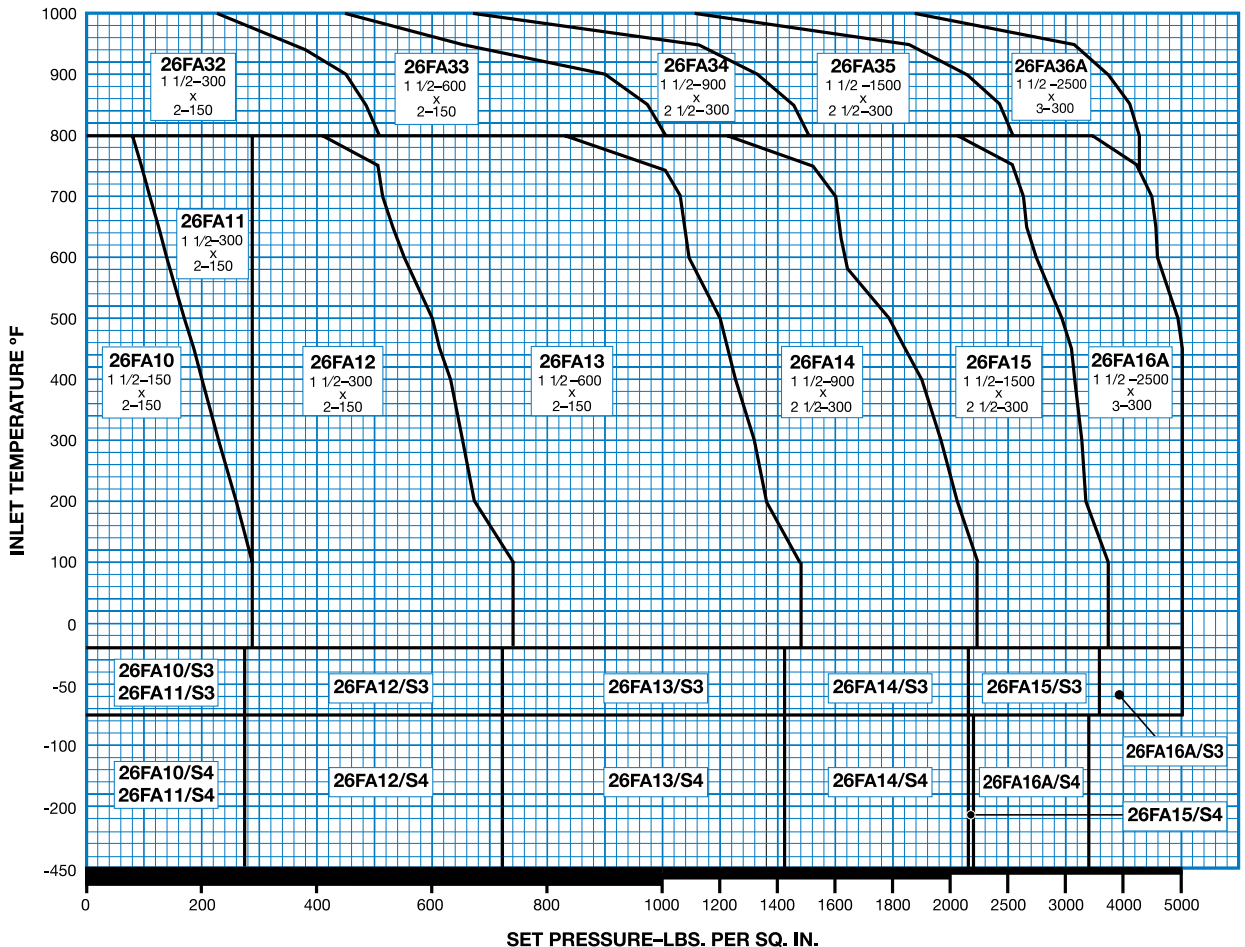
- General Notes:**
- The type numbers shown on the Selection Chart indicate conventional valves. For BalanSeal, O-ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
 - Outlet pressure for temperatures above 100° F should not exceed the rating in ANSI B16.5.
 - For applications above 1000° F, consult the Farris Factory.

F Orifice

API Area: 0.307 sq. in.
Actual Area: 0.371 sq. in.

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, PSIG						BACK PRESSURE LIMIT PSIG @ 100°F		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-450°F -76°F	-75°F -21°F	-20°F 100°F	450°F	800°F	1000°F	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26FA10	26FB10	1 1/2 x 2	150#	150#	—	—	285	185	80	—	285	230	CARBON STEEL	CHROME ALLOY	-20°F to 800°F
26FA11	26FB11	1 1/2 x 2	300#	150#	—	—	285	285	285	—	285	230			
26FA12	26FB12	1 1/2 x 2	300#	150#	—	—	740	615	410	—	285	230			
26FA13	26FB13	1 1/2 x 2	600#	150#	—	—	1480	1235	825	—	285	230			
26FA14A	26FB14A	1 1/2 x 3	900#	300#	—	—	2220	1845	1235	—	740	500			
26FA15A	26FB15A	1 1/2 x 3	1500#	300#	—	—	3705	3080	2060	—	740	500			
26FA16A	26FB16A	1 1/2 x 3	2500#	300#	—	—	5000	5000	3430	—	740	500			
26FA32	26FB32	1 1/2 x 2	300#	150#	—	—	—	—	510	225	285	230	CHROME MOLY STEEL	HIGH TEMP. ALLOY	801°F to 1000°F
26FA33	26FB33	1 1/2 x 2	600#	150#	—	—	—	—	1015	445	285	230			
26FA34A	26FB34A	1 1/2 x 3	900#	300#	—	—	—	—	1525	670	740	500			
26FA35A	26FB35A	1 1/2 x 3	1500#	300#	—	—	—	—	2540	1115	740	500			
26FA36A	26FB36A	1 1/2 x 3	2500#	300#	—	—	—	—	4230	1860	740	500			
26FA10/S3	26FB10/S3	1 1/2 x 2	150#	150#	—	275	—	—	—	—	275	230			
26FA11/S3	26FB11/S3	1 1/2 x 2	300#	150#	—	275	—	—	—	—	275	230			
26FA12/S3	26FB12/S3	1 1/2 x 2	300#	150#	—	720	—	—	—	—	275	230			
26FA13/S3	26FB13/S3	1 1/2 x 2	600#	150#	—	1440	—	—	—	—	275	230			
26FA14A/S3	26FB14A/S3	1 1/2 x 3	900#	300#	—	2160	—	—	—	—	720	500			
26FA15A/S3	26FB15A/S3	1 1/2 x 3	1500#	300#	—	3600	—	—	—	—	720	500			
26FA16A/S3	26FB16A/S3	1 1/2 x 3	2500#	300#	—	5000	—	—	—	—	720	500			
26FA10/S4	26FB10/S4	1 1/2 x 2	150#	150#	275	—	—	—	—	—	275	230	316 ST. ST.	316 ST. ST.	-76°F to -450°F
26FA11/S4	26FB11/S4	1 1/2 x 2	300#	150#	275	—	—	—	—	—	275	230			
26FA12/S4	26FB12/S4	1 1/2 x 2	300#	150#	720	—	—	—	—	—	275	230			
26FA13/S4	26FB13/S4	1 1/2 x 2	600#	150#	1440	—	—	—	—	—	275	230			
26FA14A/S4	26FB14A/S4	1 1/2 x 3	900#	300#	2160	—	—	—	—	—	720	500			
26FA15A/S4	26FB15A/S4	1 1/2 x 3	1500#	300#	2200	—	—	—	—	—	720	500			
26FA16A/S4	26FB16A/S4	1 1/2 x 3	2500#	300#	3400	—	—	—	—	—	720	500			

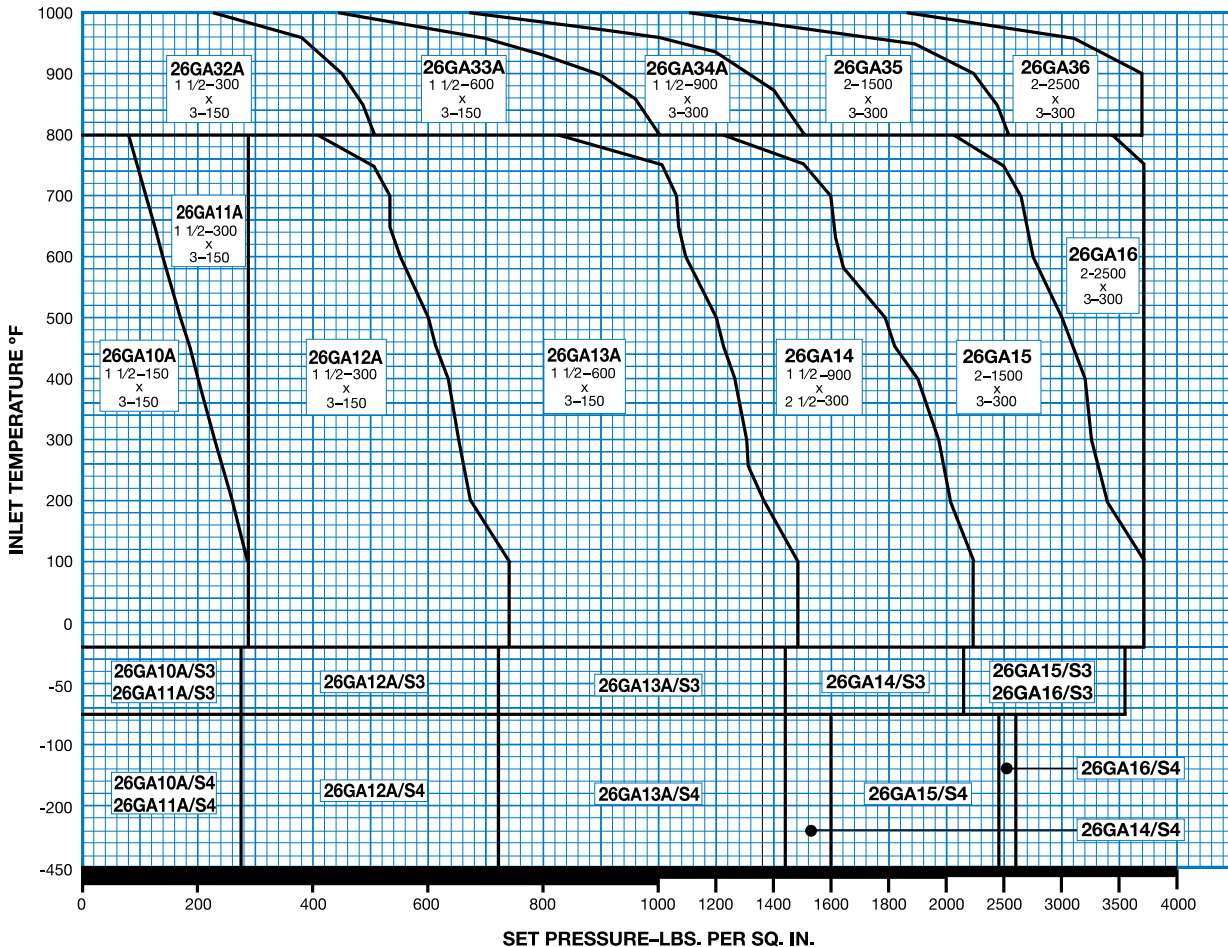
Selection Chart



G Orifice

API Area: 0.503 sq. in.
Actual Area: 0.559 sq. in.

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, PSIG						BACK PRESSURE LIMIT PSIG @ 100°F		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-450°F -76°F	-75°F -21°F	-20°F 100°F	450°F	800°F	1000°F	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26GA10A	26GB10A	1 1/2 x 3	150#	150#	—	—	285	185	80	—	285	230	CARBON STEEL	CHROME ALLOY	-20°F to 800°F
26GA11A	26GB11A	1 1/2 x 3	300#	150#	—	—	285	285	285	—	285	230			
26GA12A	26GB12A	1 1/2 x 3	300#	150#	—	—	740	615	410	—	285	230			
26GA13A	26GB13A	1 1/2 x 3	600#	150#	—	—	1480	1235	825	—	285	230			
26GA14A	26GB14A	1 1/2 x 3	900#	300#	—	—	2220	1845	1235	—	740	470			
26GA15	26GB15	2 x 3	1500#	300#	—	—	3705	3080	2060	—	740	470			
26GA16	26GB16	2 x 3	2500#	300#	—	—	3705	3705	3430	—	740	470			
26GA32A	26GB32A	1 1/2 x 3	300#	150#	—	—	—	—	510	225	285	230	CHROME MOLY STEEL	HIGH TEMP. ALLOY	801°F to 1000°F
26GA33A	26GB33A	1 1/2 x 3	600#	150#	—	—	—	—	1015	445	285	230			
26GA34A	26GB34A	1 1/2 x 3	900#	300#	—	—	—	—	1525	670	740	470			
26GA35	26GB35	2 x 3	1500#	300#	—	—	—	—	2540	1115	740	470			
26GA36	26GB36	2 x 3	2500#	300#	—	—	—	—	3705	1860	740	470			
26GA10A/S3	26GB10A/S3	1 1/2 x 3	150#	150#	—	275	—	—	—	—	275	230	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-21°F to -75°F
26GA11A/S3	26GB11A/S3	1 1/2 x 3	300#	150#	—	275	—	—	—	—	275	230			
26GA12A/S3	26GB12A/S3	1 1/2 x 3	300#	150#	—	720	—	—	—	—	275	230			
26GA13A/S3	26GB13A/S3	1 1/2 x 3	600#	150#	—	1440	—	—	—	—	275	230			
26GA14A/S3	26GB14A/S3	1 1/2 x 3	900#	300#	—	2160	—	—	—	—	720	470			
26GA15/S3	26GB15/S3	2 x 3	1500#	300#	—	3600	—	—	—	—	720	470			
26GA16/S3	26GB16/S3	2 x 3	2500#	300#	—	3600	—	—	—	—	720	470			
26GA10A/S4	26GB10A/S4	1 1/2 x 3	150#	150#	275	—	—	—	—	—	275	230	316 ST. ST.	316 ST. ST.	-76°F to -450°F
26GA11A/S4	26GB11A/S4	1 1/2 x 3	300#	150#	275	—	—	—	—	—	275	230			
26GA12A/S4	26GB12A/S4	1 1/2 x 3	300#	150#	720	—	—	—	—	—	275	230			
26GA13A/S4	26GB13A/S4	1 1/2 x 3	600#	150#	1440	—	—	—	—	—	275	230			
26GA14A/S4	26GB14A/S4	1 1/2 x 3	900#	300#	1600	—	—	—	—	—	600	470			
26GA15/S4	26GB15/S4	2 x 3	1500#	300#	2450	—	—	—	—	—	600	470			
26GA16/S4	26GB16/S4	2 x 3	2500#	300#	2600	—	—	—	—	—	720	470			



Selection Chart

- General Notes:**
- The type numbers shown on the Selection Chart indicate conventional valves. For BalanSeal, O-ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
 - Outlet pressure for temperatures above 100° F should not exceed the rating in ANSI B16.5.
 - For applications above 1000° F, consult the Farris Factory.

H Orifice

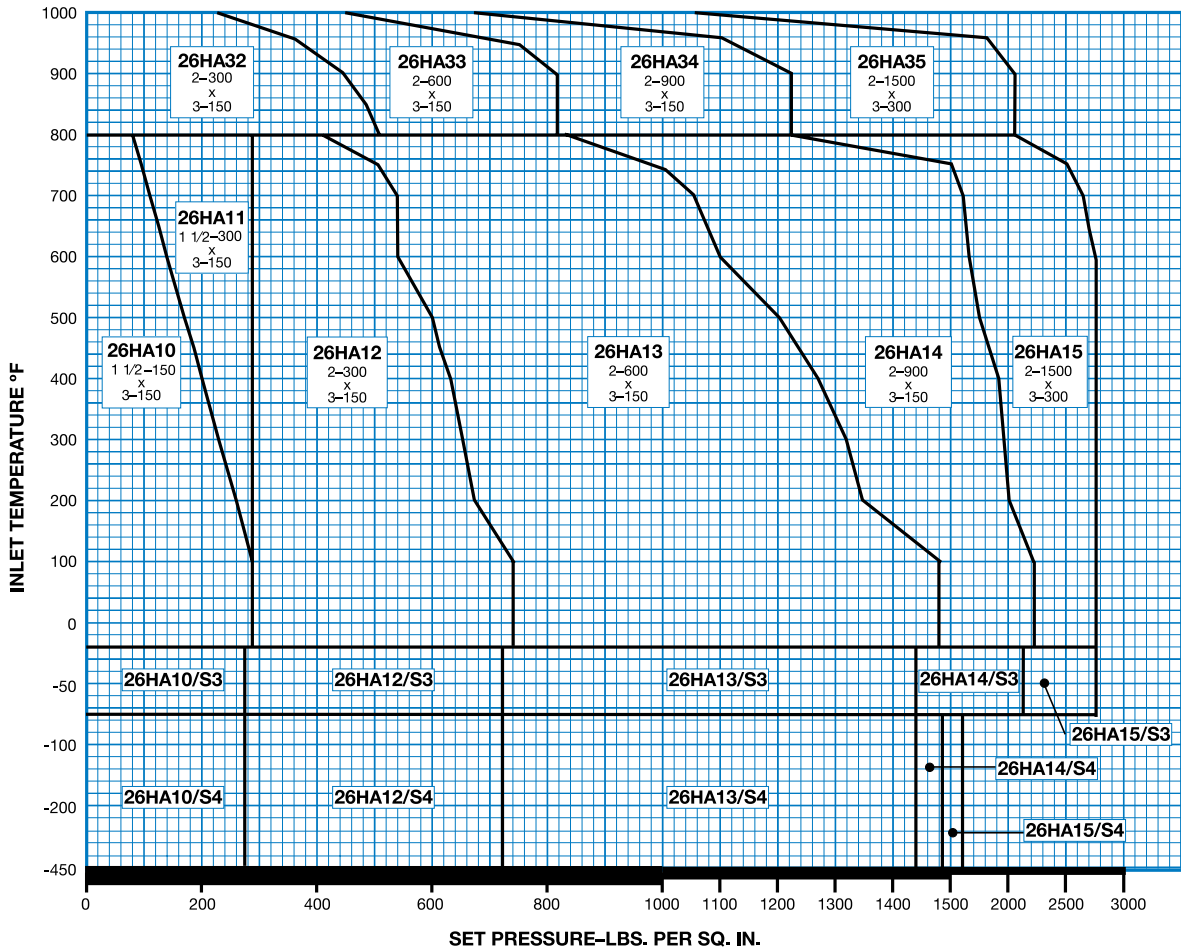
API Area: 0.785 sq. in.
Actual Area: 0.873 sq. in.

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, PSIG						BACK PRESSURE LIMIT PSIG @ 100°F		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-450°F -76°F	-75°F -21°F	-20°F 100°F	450°F	800°F	1000°F	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26HA10	26HB10	1 1/2 x 3	150#	150#	—	—	285	185	80	—	285	230	CARBON STEEL	CHROME ALLOY	-20°F ^F to 800°F
26HA11	26HB11	1 1/2 x 3	300#	150#	—	—	285	285	285	—	285	230			
26HA12	26HB12	2 x 3	300#	150#	—	—	740	615	410	—	285	230			
26HA13	26HB13	2 x 3	600#	150#	—	—	1480	1235	825	—	285	230			
26HA14	26HB14	2 x 3	900#	150#	—	—	2220	1845	1235	—	285	230			
26HA15	26HB15	2 x 3	1500#	300#	—	—	2750	2750	2060	—	740	415			
26HA32	26HB32	2 x 3	300#	150#	—	—	—	—	510	225	285	230	CHROME MOLY STEEL	HIGH TEMP. ALLOY	801°F ^F to 1000°F
26HA33	26HB33	2 x 3	600#	150#	—	—	—	—	815	445	285	230			
26HA34	26HB34	2 x 3	900#	150#	—	—	—	—	1225	670	285	230			
26HA35	26HB35	2 x 3	1500#	300#	—	—	—	—	2040	1115	740	415			
26HA10/S3	26HB10/S3	1 1/2 x 3	150#	150#	—	275	—	—	—	—	275	230			
26HA11/S3	26HB11/S3	1 1/2 x 3	300#	150#	—	275	—	—	—	—	275	230			
26HA12/S3	26HB12/S3	2 x 3	300#	150#	—	720	—	—	—	—	275	230			
26HA13/S3	26HB13/S3	2 x 3	600#	150#	—	1440	—	—	—	—	275	230			
26HA14/S3	26HB14/S3	2 x 3	900#	150#	—	2160	—	—	—	—	275	230			
26HA15/S3	26HB15/S3	2 x 3	1500#	300#	—	2750	—	—	—	—	720	415			
26HA10/S4	26HB10/S4	1 1/2 x 3	150#	150#	275	—	—	—	—	—	275	230	316 ST. ST.	316 ST. ST.	-76°F ^F to -450°F
26HA11/S4	26HB11/S4	1 1/2 x 3	300#	150#	275	—	—	—	—	—	275	230			
26HA12/S4	26HB12/S4	2 x 3	300#	150#	720	—	—	—	—	—	275	230			
26HA13/S4	26HB13/S4	2 x 3	600#	150#	1440	—	—	—	—	—	275	230			
26HA14/S4	26HB14/S4	2 x 3	900#	150#	1485	—	—	—	—	—	275	230			
26HA15/S4	26HB15/S4	2 x 3	1500#	300#	1600	—	—	—	—	—	720	415			

Selection Chart

General Notes:

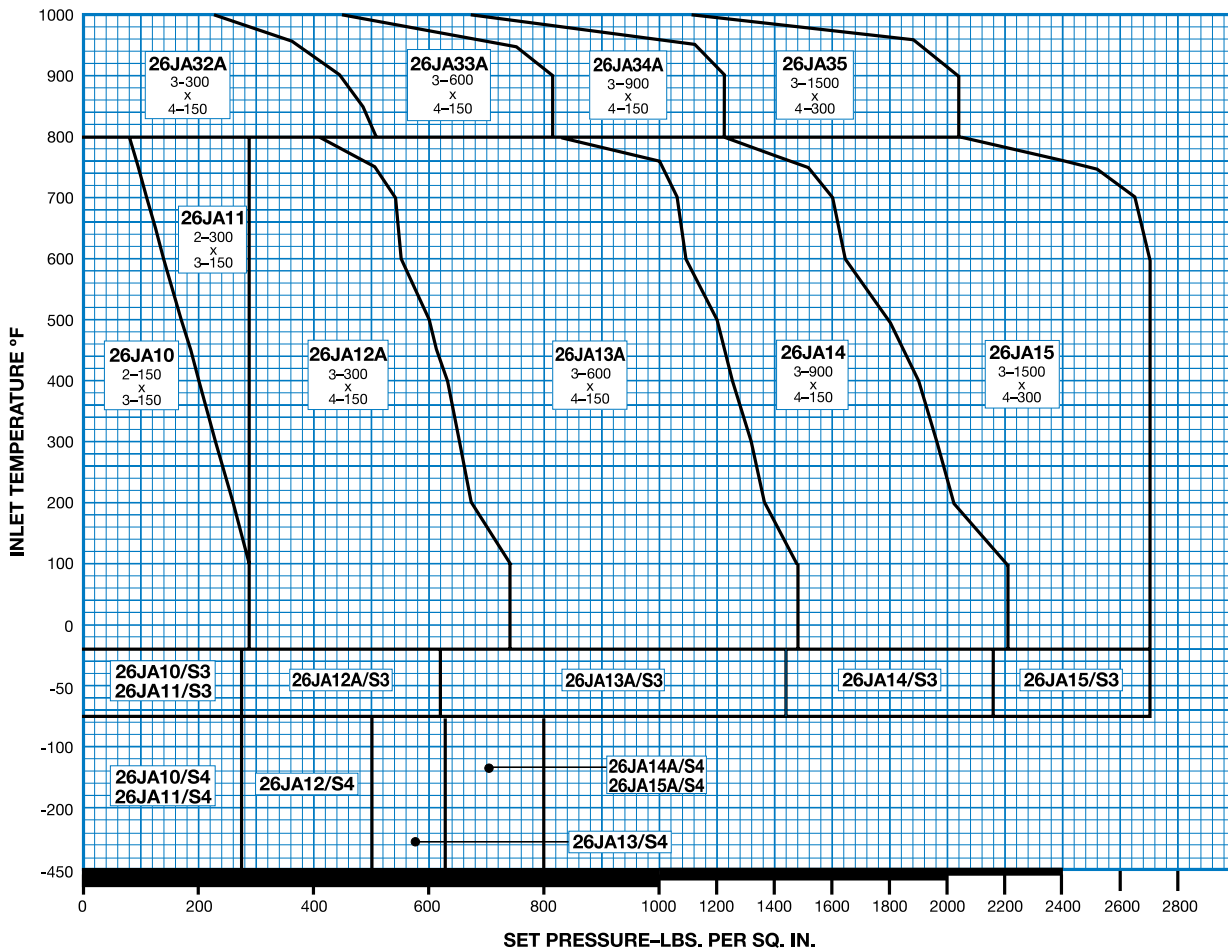
- The type numbers shown on the Selection Chart indicate conventional valves. For BalanSeal, O-ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
- Outlet pressure for temperatures above 100° F should not exceed the rating in ANSI B16.5.
- For applications above 1000° F, consult the Farris Factory.



J Orifice

API Area: 1.287 sq. in.
Actual Area: 1.430 sq. in.

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, PSIG						BACK PRESSURE LIMIT PSIG @ 100°F		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-450°F -76°F	-75°F -21°F	-20°F 100°F	450°F	800°F	1000°F	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26JA10	26JB10	2 x 3	150#	150#	—	—	285	185	80	—	285	230	CARBON STEEL	CHROME ALLOY	-20°F to 800°F
26JA11	26JB11	2 x 3	300#	150#	—	—	285	285	285	—	285	230			
26JA12A	26JB12A	3 x 4	300#	150#	—	—	740	615	410	—	285	230			
26JA13A	26JB13A	3 x 4	600#	150#	—	—	1480	1235	825	—	285	230			
26JA14	26JB14	3 x 4	900#	150#	—	—	2220	1845	1235	—	285	230			
26JA15	26JB15	3 x 4	1500#	300#	—	—	2700	2700	2060	—	600	230			
26JA32A	26JB32A	3 x 4	300#	150#	—	—	—	—	510	225	285	230	CHROME MOLY STEEL	HIGH TEMP. ALLOY	801°F to 1000°F
26JA33A	26JB33A	3 x 4	600#	150#	—	—	—	—	815	445	285	230			
26JA34A	26JB34A	3 x 4	900#	150#	—	—	—	—	1225	670	285	230			
26JA35	26JB35	3 x 4	1500#	300#	—	—	—	—	2040	1115	600	230			
26JA10/S3	26JB10/S3	2 x 3	150#	150#	—	275	—	—	—	—	275	230	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-21°F to -75°F
26JA11/S3	26JB11/S3	2 x 3	300#	150#	—	275	—	—	—	—	275	230			
26JA12A/S3	26JB12A/S3	3 x 4	300#	150#	—	720	—	—	—	—	275	230			
26JA13A/S3	26JB13A/S3	3 x 4	600#	150#	—	1440	—	—	—	—	275	230			
26JA14/S3	26JB14/S3	3 x 4	900#	150#	—	2160	—	—	—	—	275	230			
26JA15/S3	26JB15/S3	3 x 4	1500#	300#	—	2700	—	—	—	—	600	230			
26JA10/S4	26JB10/S4	2 x 3	150#	150#	275	—	—	—	—	—	275	230	316 ST. ST.	316 ST. ST.	-76°F to -450°F
26JA11/S4	26JB11/S4	2 x 3	300#	150#	275	—	—	—	—	—	275	230			
26JA12A/S4	26JB12A/S4	3 x 4	300#	150#	500	—	—	—	—	—	275	230			
26JA13A/S4	26JB13A/S4	3 x 4	600#	150#	625	—	—	—	—	—	275	230			
26JA14/S4	26JB14/S4	3 x 4	900#	150#	800	—	—	—	—	—	275	230			
26JA15/S4	26JB15/S4	3 x 4	1500#	300#	800	—	—	—	—	—	600	230			



Selection Chart

- General Notes:**
- The type numbers shown on the Selection Chart indicate conventional valves. For BalanSeal, O-ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
 - Outlet pressure for temperatures above 100° F should not exceed the rating in ANSI B16.5.
 - For applications above 1000° F, consult the Farris Factory.

K Orifice

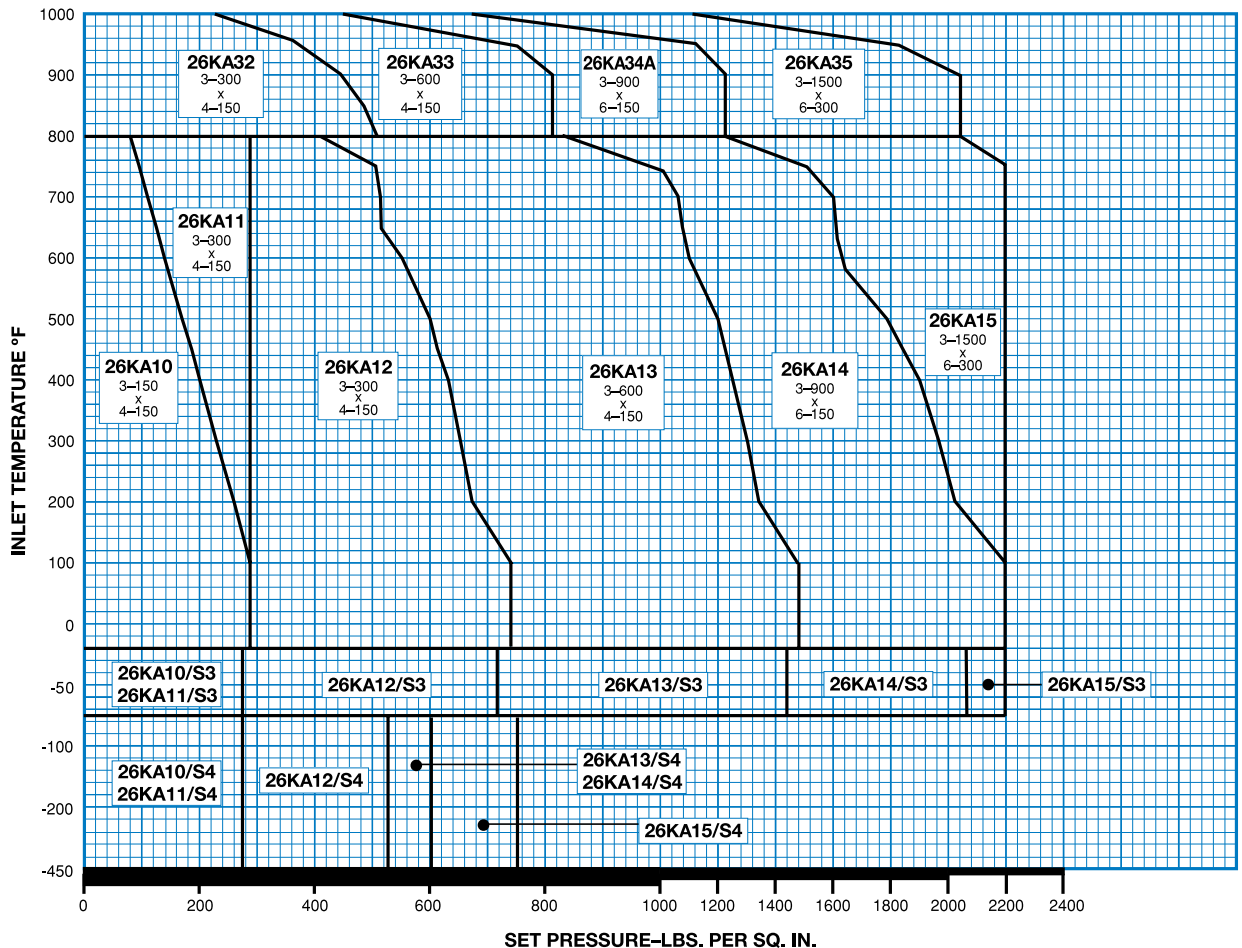
API Area: 1.838 sq. in.
Actual Area: 2.042 sq. in.

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, PSIG						BACK PRESSURE LIMIT PSIG @ 100°F		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-450°F -76°F	-75°F -21°F	-20°F 100°F	450°F	800°F	1000°F	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26KA10	26KB10	3 x 4	150#	150#	—	—	285	185	80	—	285	150	CARBON STEEL	CHROME ALLOY	-20°F to 800°F
26KA11	26KB11	3 x 4	300#	150#	—	—	285	285	285	—	285	150			
26KA12	26KB12	3 x 4	300#	150#	—	—	740	615	410	—	285	150			
26KA13	26KB13	3 x 4	600#	150#	—	—	1480	1235	825	—	285	200			
26KA14	26KB14	3 x 6	900#	150#	—	—	2220	1845	1235	—	285	200			
26KA15	26KB15	3 x 6	1500#	300#	—	—	2220	2220	2060	—	600	200			
26KA32	26KB32	3 x 4	300#	150#	—	—	—	—	510	225	285	150	CHROME MOLY STEEL	HIGH TEMP. ALLOY	801°F to 1000°F
26KA33	26KB33	3 x 4	600#	150#	—	—	—	—	815	445	285	200			
26KA34A	26KB34A	3 x 6	900#	150#	—	—	—	—	1225	670	285	200			
26KA35	26KB35	3 x 6	1500#	300#	—	—	—	—	2040	1115	600	200			
26KA10/S3	26KB10/S3	3 x 4	150#	150#	—	275	—	—	—	—	275	150	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-21°F to -75°F
26KA11/S3	26KB11/S3	3 x 4	300#	150#	—	275	—	—	—	—	275	150			
26KA12/S3	26KB12/S3	3 x 4	300#	150#	—	720	—	—	—	—	275	150			
26KA13/S3	26KB13/S3	3 x 4	600#	150#	—	1440	—	—	—	—	275	200			
26KA14/S3	26KB14/S3	3 x 6	900#	150#	—	2160	—	—	—	—	275	200			
26KA15/S3	26KB15/S3	3 x 6	1500#	300#	—	2220	—	—	—	—	600	200			
26KA10/S4	26KB10/S4	3 x 4	150#	150#	275	—	—	—	—	—	275	150	316 ST. ST.	316 ST. ST.	-76°F to -450°F
26KA11/S4	26KB11/S4	3 x 4	300#	150#	275	—	—	—	—	—	275	150			
26KA12/S4	26KB12/S4	3 x 4	300#	150#	525	—	—	—	—	—	275	150			
26KA13/S4	26KB13/S4	3 x 4	600#	150#	600	—	—	—	—	—	275	200			
26KA14/S4	26KB14/S4	3 x 6	900#	150#	600	—	—	—	—	—	275	200			
26KA15/S4	26KB15/S4	3 x 6	1500#	300#	750	—	—	—	—	—	600	200			

Selection Chart

General Notes:

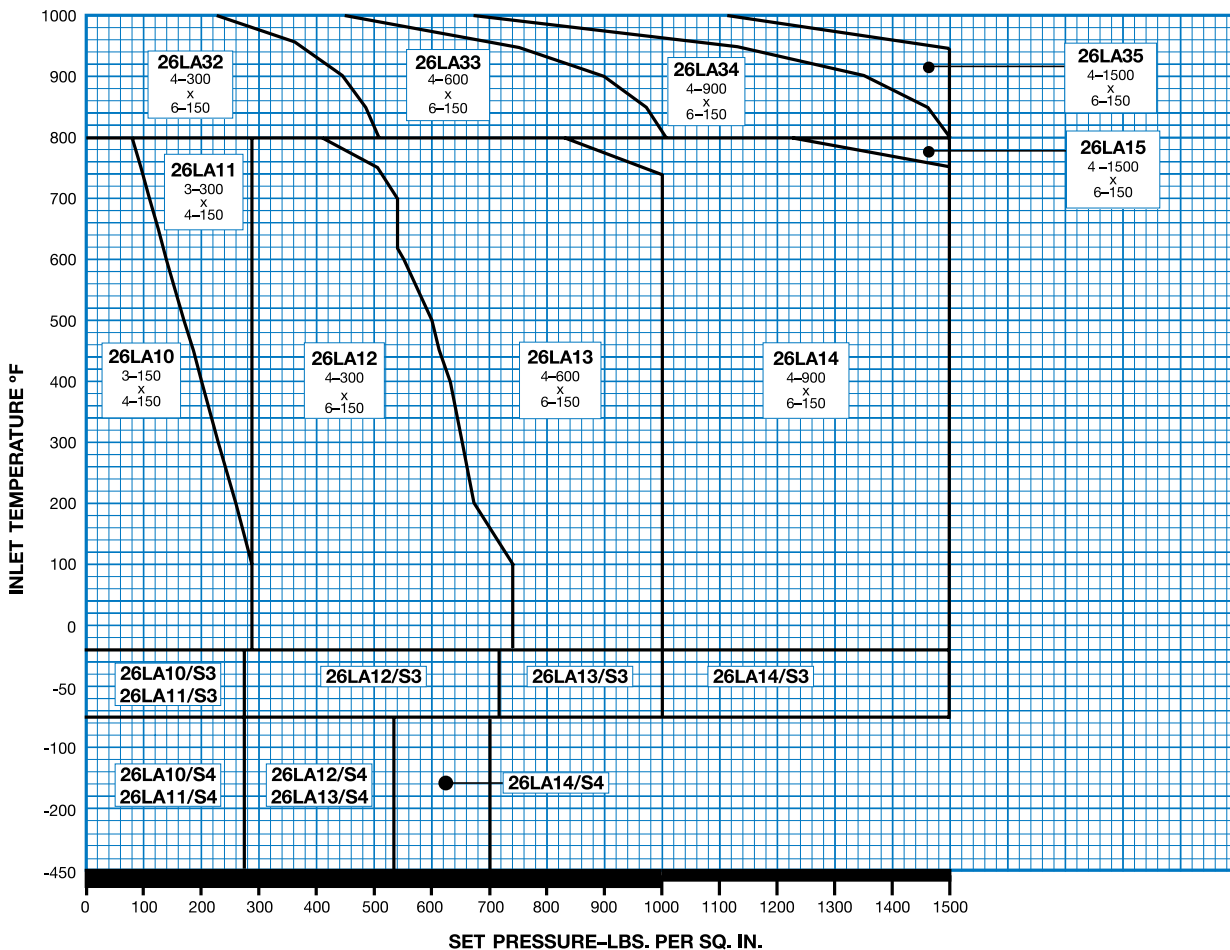
- The type numbers shown on the Selection Chart indicate conventional valves. For BalanSeal, O-ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
- Outlet pressure for temperatures above 100° F should not exceed the rating in ANSI B16.5.
- For applications above 1000° F, consult the Farris Factory.



L Orifice

API Area: 2.853 sq. in.
Actual Area: 3.170 sq. in.

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, PSIG						BACK PRESSURE LIMIT PSIG @ 100°F		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-450°F -76°F	-75°F -21°F	-20°F 100°F	450°F	800°F	1000°F	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26LA10	26LB10	3 x 4	150#	150#	—	—	285	185	80	—	285	100	CARBON STEEL	CHROME ALLOY	-20°F to 800°F
26LA11	26LB11	3 x 4	300#	150#	—	—	285	285	285	—	285	100			
26LA12	26LB12	4 x 6	300#	150#	—	—	740	615	410	—	285	170			
26LA13	26LB13	4 x 6	600#	150#	—	—	1000	1000	825	—	285	170			
26LA14	26LB14	4 x 6	900#	150#	—	—	1500	1500	1235	—	285	170			
26LA15	26LB15	4 x 6	1500#	150#	—	—	1500	1500	1500	—	285	170			
26LA32	26LB32	4 x 6	300#	150#	—	—	—	—	510	225	285	170	CHROME MOLY STEEL	HIGH TEMP. ALLOY	801°F to 1000°F
26LA33	26LB33	4 x 6	600#	150#	—	—	—	—	1000	445	285	170			
26LA34	26LB34	4 x 6	900#	150#	—	—	—	—	1500	670	285	170			
26LA35	26LB35	4 x 6	1500#	150#	—	—	—	—	1500	1115	285	170			
26LA10/S3	26LB10/S3	3 x 4	150#	150#	—	275	—	—	—	—	275	100	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-21°F to -75°F
26LA11/S3	26LB11/S3	3 x 4	300#	150#	—	275	—	—	—	—	275	100			
26LA12/S3	26LB12/S3	4 x 6	300#	150#	—	720	—	—	—	—	275	170			
26LA13/S3	26LB13/S3	4 x 6	600#	150#	—	1000	—	—	—	—	275	170			
26LA14/S3	26LB14/S3	4 x 6	900#	150#	—	1500	—	—	—	—	275	170			
26LA10/S4	26LB10/S4	3 x 4	150#	150#	275	—	—	—	—	—	275	170	316 ST. ST.	316 ST. ST.	-76°F to -450°F
26LA11/S4	26LB11/S4	3 x 4	300#	150#	275	—	—	—	—	—	275	170			
26LA12/S4	26LB12/S4	4 x 6	300#	150#	535	—	—	—	—	—	275	170			
26LA13/S4	26LB13/S4	4 x 6	600#	150#	535	—	—	—	—	—	275	170			
26LA14/S4	26LB14/S4	4 x 6	900#	150#	700	—	—	—	—	—	275	170			



Selection Chart

General Notes:

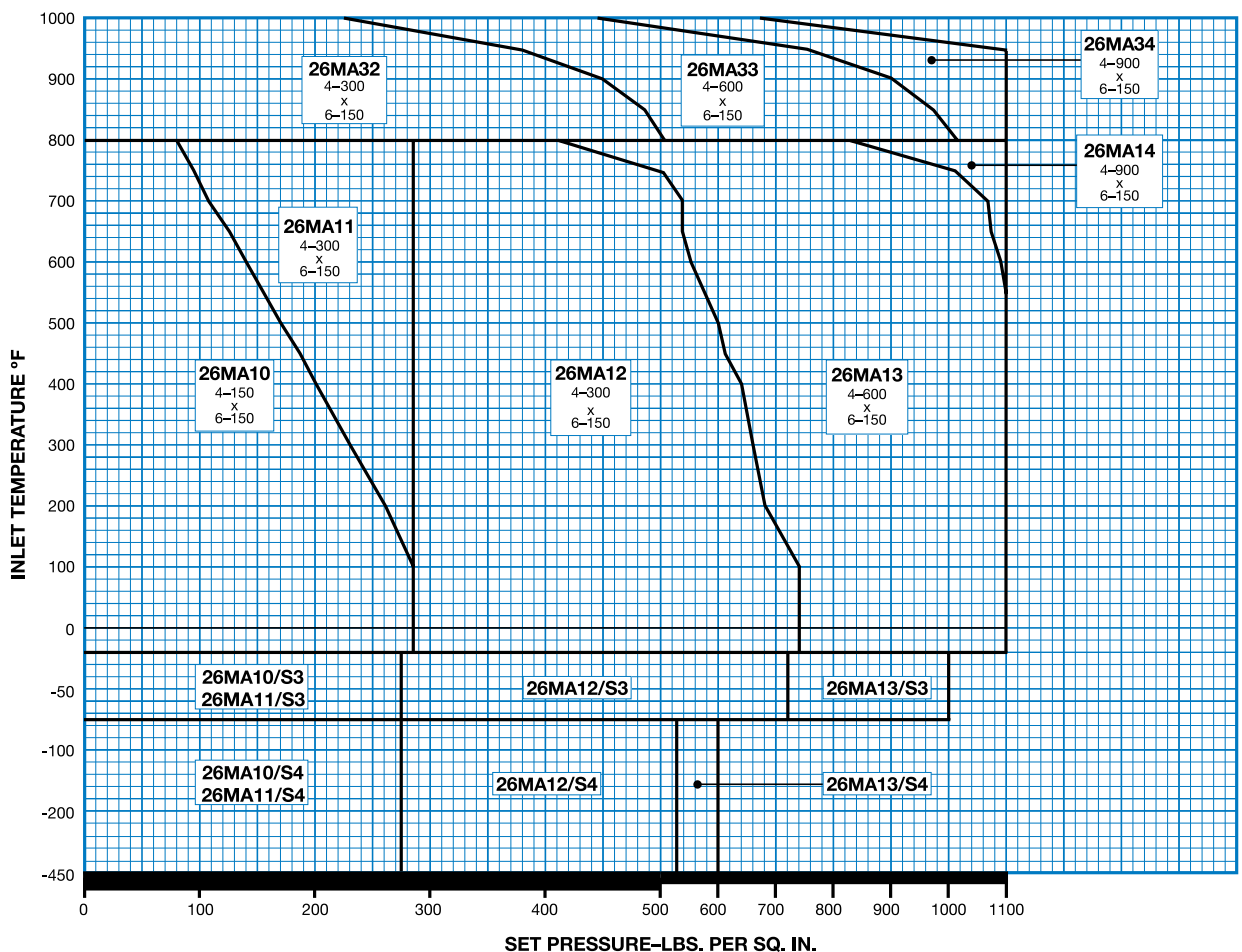
- The type numbers shown on the Selection Chart indicate conventional valves. For BalanSeal, O-ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
- Outlet pressure for temperatures above 100° F should not exceed the rating in ANSI B16.5.
- For applications above 1000° F, consult the Farris Factory.

M Orifice

API Area: 3.60 sq. in.
Actual Area: 4.000 sq. in.

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, PSIG						BACK PRESSURE LIMIT PSIG @ 100°F		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-450°F -76°F	-75°F -21°F	-20°F 100°F	450°F	800°F	1000°F	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26MA10	26MB10	4 x 6	150#	150#	—	—	285	185	80	—	285	80	CARBON STEEL	CHROME ALLOY	-20°F to 800°F
26MA11	26MB11	4 x 6	300#	150#	—	—	285	285	285	—	285	80			
26MA12	26MB12	4 x 6	300#	150#	—	—	740	615	410	—	285	160			
26MA13	26MB13	4 x 6	600#	150#	—	—	1100	1100	825	—	285	160			
26MA14	26MB14	4 x 6	900#	150#	—	—	1100	1100	1100	—	285	160			
26MA32	26MB32	4 x 6	300#	150#	—	—	—	—	510	225	285	160	CHROME MOLY STEEL	HIGH TEMP. ALLOY	801°F to 1000°F
26MA33	26MB33	4 x 6	600#	150#	—	—	—	—	1015	445	285	160			
26MA34	26MB34	4 x 6	900#	150#	—	—	—	—	1100	670	285	160			
26MA10/S3	26MB10/S3	4 x 6	150#	150#	—	275	—	—	—	—	275	80	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-21°F to -75°F
26MA11/S3	26MB11/S3	4 x 6	300#	150#	—	275	—	—	—	—	275	80			
26MA12/S3	26MB12/S3	4 x 6	300#	150#	—	720	—	—	—	—	275	160			
26MA13/S3	26MB13/S3	4 x 6	600#	150#	—	1000	—	—	—	—	275	160			
26MA10/S4	26MB10/S4	4 x 6	150#	150#	275	—	—	—	—	—	275	80	316 ST. ST.	316 ST. ST.	-76°F to -450°F
26MA11/S4	26MB11/S4	4 x 6	300#	150#	275	—	—	—	—	—	275	80			
26MA12/S4	26MB12/S4	4 x 6	300#	150#	525	—	—	—	—	—	275	160			
26MA13/S4	26MB13/S4	4 x 6	600#	150#	600	—	—	—	—	—	275	160			

Selection Chart



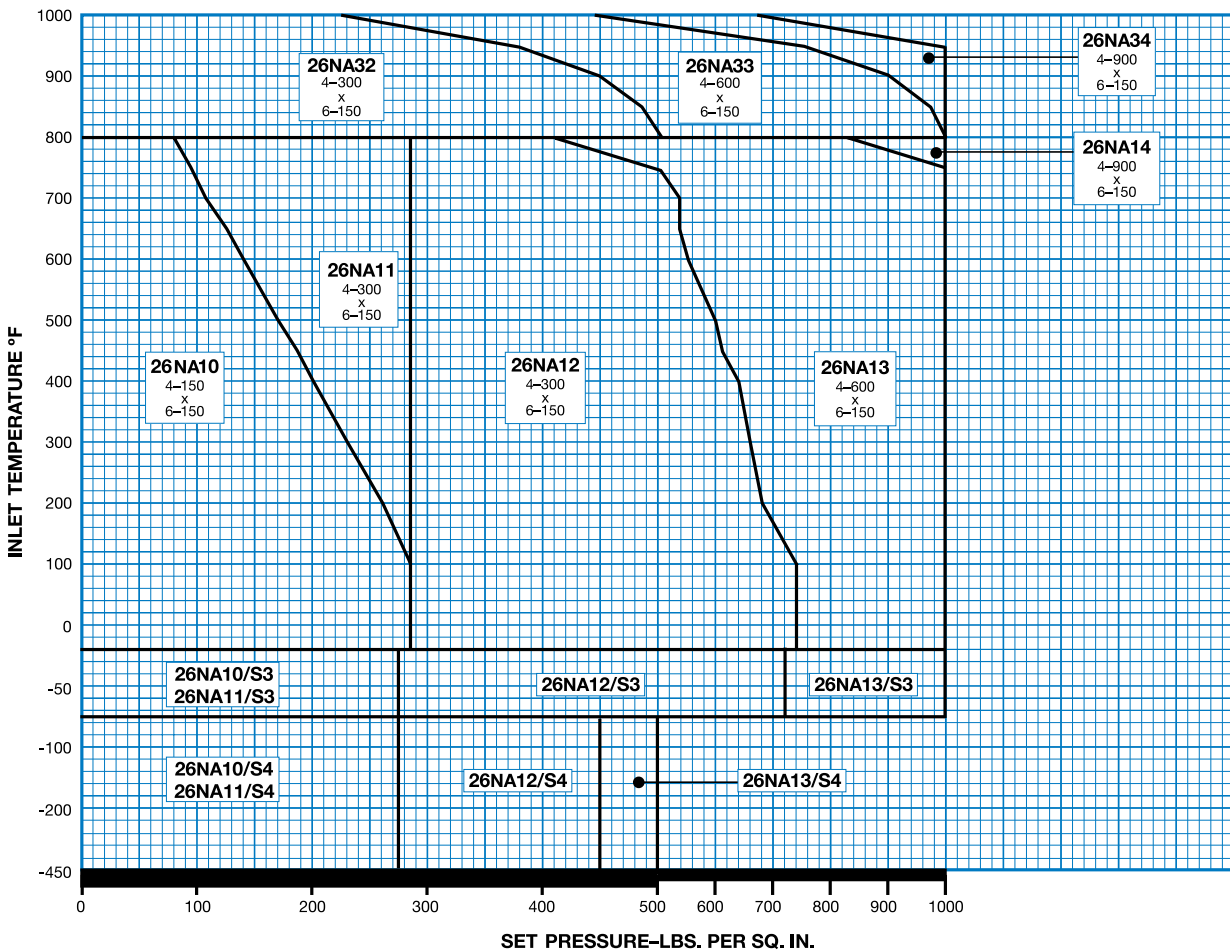
General Notes:

- The type numbers shown on the Selection Chart indicate conventional valves. For BalanSeal, O-ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
- Outlet pressure for temperatures above 100° F should not exceed the rating in ANSI B16.5.
- For applications above 1000° F, consult the Farris Factory.

N Orifice

API Area: 4.34 sq. in.
Actual Area: 4.822 sq. in.

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, PSIG						BACK PRESSURE LIMIT PSIG @ 100°F		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-450°F -76°F	-75°F -21°F	-20°F 100°F	450°F	800°F	1000°F	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26NA10	26NB10	4 x 6	150#	150#	—	—	285	185	80	—	285	80	CARBON STEEL	CHROME ALLOY	-20°F to 800°F
26NA11	26NB11	4 x 6	300#	150#	—	—	285	285	285	—	285	80			
26NA12	26NB12	4 x 6	300#	150#	—	—	740	615	410	—	285	160			
26NA13	26NB13	4 x 6	600#	150#	—	—	1000	1000	825	—	285	160			
26NA14	26NB14	4 x 6	900#	150#	—	—	1000	1000	1000	—	285	160			
26NA32	26NB32	4 x 6	300#	150#	—	—	—	—	510	225	285	160	CHROME MOLY STEEL	HIGH TEMP. ALLOY	801°F to 1000°F
26NA33	26NB33	4 x 6	600#	150#	—	—	—	—	1000	445	285	160			
26NA34	26NB34	4 x 6	900#	150#	—	—	—	—	1000	670	285	160			
26NA10/S3	26NB10/S3	4 x 6	150#	150#	—	275	—	—	—	—	275	80	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-21°F to -75°F
26NA11/S3	26NB11/S3	4 x 6	300#	150#	—	275	—	—	—	—	275	80			
26NA12/S3	26NB12/S3	4 x 6	300#	150#	—	720	—	—	—	—	275	160			
26NA13/S3	26NB13/S3	4 x 6	600#	150#	—	1000	—	—	—	—	275	160			
26NA10/S4	26NB10/S4	4 x 6	150#	150#	275	—	—	—	—	—	275	80	316 ST. ST.	316 ST. ST.	-76°F to -450°F
26NA11/S4	26NB11/S4	4 x 6	300#	150#	275	—	—	—	—	—	275	80			
26NA12/S4	26NB12/S4	4 x 6	300#	150#	450	—	—	—	—	—	275	160			
26NA13/S4	26NB13/S4	4 x 6	600#	150#	500	—	—	—	—	—	275	160			



Selection Chart

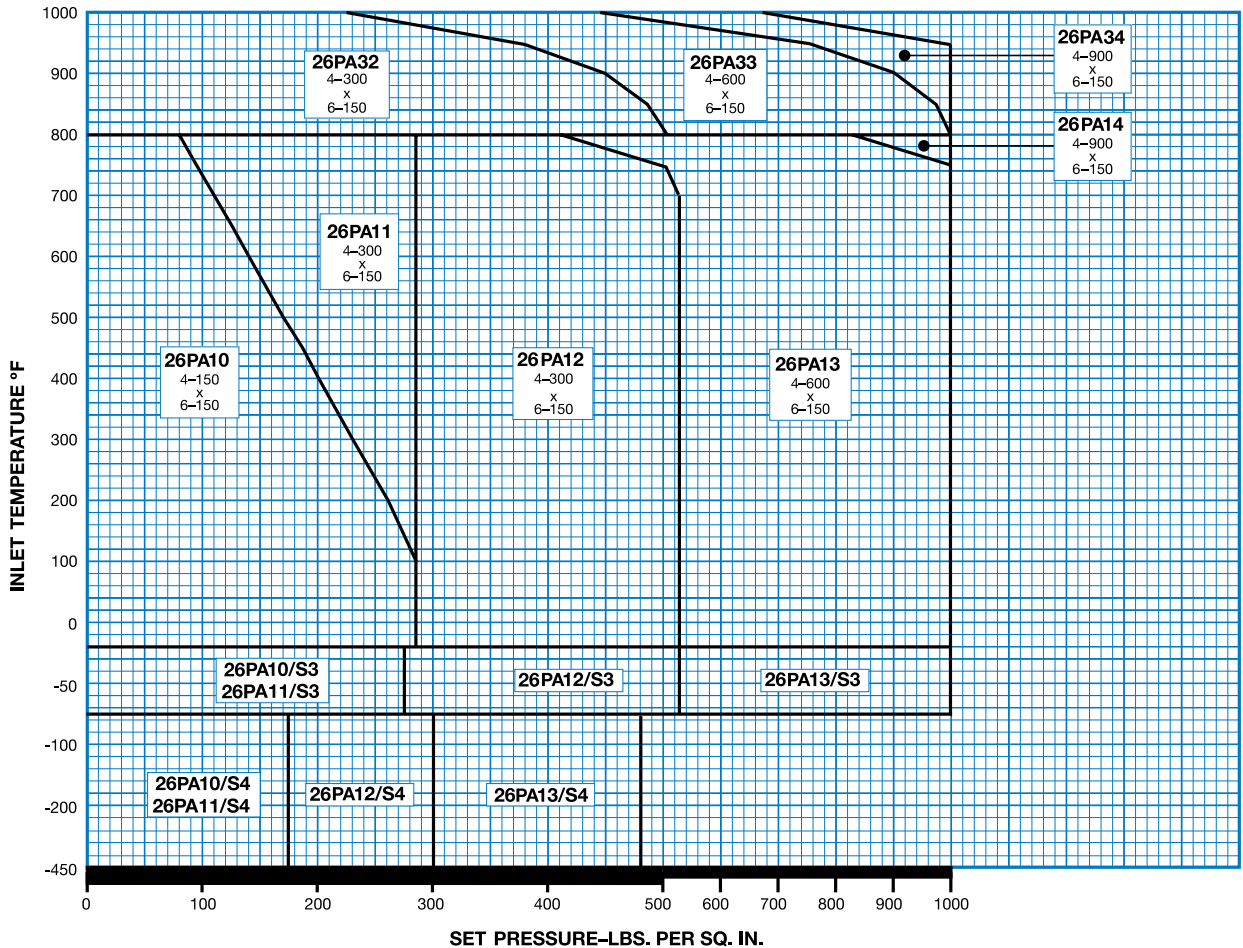
- General Notes:**
- The type numbers shown on the Selection Chart indicate conventional valves. For BalanSeal, O-ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
 - Outlet pressure for temperatures above 100° F should not exceed the rating in ANSI B16.5.
 - For applications above 1000° F, consult the Farris Factory.

P Orifice

API Area: 6.38 sq. in.
Actual Area: 7.087 sq. in.

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, PSIG						BACK PRESSURE LIMIT PSIG @ 100°F		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-450°F -76°F	-75°F -21°F	-20°F 100°F	450°F	800°F	1000°F	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26PA10	26PB10	4 x 6	150#	150#	—	—	285	185	80	—	285	80	CARBON STEEL	CHROME ALLOY	-20°F to 800°F
26PA11	26PB11	4 x 6	300#	150#	—	—	285	285	285	—	285	80			
26PA12	26PB12	4 x 6	300#	150#	—	—	525	525	410	—	285	150			
26PA13	26PB13	4 x 6	600#	150#	—	—	1000	1000	825	—	285	150			
26PA14	26PB14	4 x 6	900#	150#	—	—	1000	1000	1000	—	285	150			
26PA32	26PB32	4 x 6	300#	150#	—	—	—	—	510	225	285	150	CHROME MOLY STEEL	HIGH TEMP. ALLOY	801°F to 1000°F
26PA33	26PB33	4 x 6	600#	150#	—	—	—	—	1000	445	285	150	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-21°F to -75°F
26PA34	26PB34	4 x 6	900#	150#	—	—	—	—	1000	670	285	150			
26PA10/S3	26PB10/S3	4 x 6	150#	150#	—	275	—	—	—	—	275	80			
26PA11/S3	26PB11/S3	4 x 6	300#	150#	—	275	—	—	—	—	275	80	316 ST. ST.	316 ST. ST.	-76°F to -450°F
26PA12/S3	26PB12/S3	4 x 6	300#	150#	—	720	—	—	—	—	275	150			
26PA13/S3	26PB13/S3	4 x 6	600#	150#	—	1000	—	—	—	—	275	150			
26PA10/S4	26PB10/S4	4 x 6	150#	150#	175	—	—	—	—	—	175	80	316 ST. ST.	316 ST. ST.	-76°F to -450°F
26PA11/S4	26PB11/S4	4 x 6	300#	150#	175	—	—	—	—	—	175	80			
26PA12/S4	26PB12/S4	4 x 6	300#	150#	300	—	—	—	—	—	275	150			
26PA13/S4	26PB13/S4	4 x 6	600#	150#	480	—	—	—	—	—	275	150			

Selection Chart



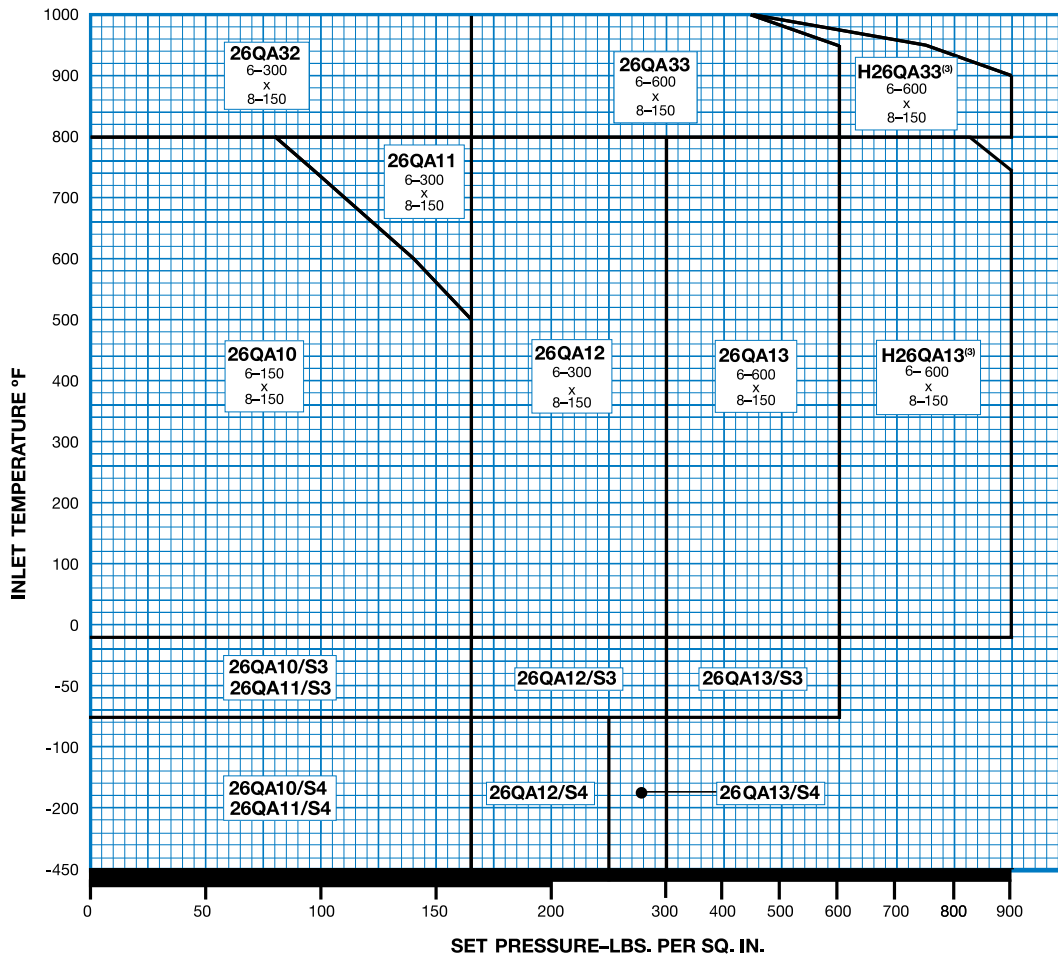
General Notes:

1. The type numbers shown on the Selection Chart indicate conventional valves. For BalanSeal, O-ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
2. Outlet pressure for temperatures above 100° F should not exceed the rating in ANSI B16.5.
3. For applications above 1000° F, consult the Farris Factory.

Q Orifice

API Area: 11.05 sq. in.
Actual Area: 12.27 sq. in.

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, PSIG						BACK PRESSURE LIMIT PSIG @ 100°F		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-450°F -76°F	-75°F -21°F	-20°F 100°F	450°F	800°F	1000°F	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26QA10	26QB10	6 x 8	150#	150#	—	—	165	165	80	—	115	70	CARBON STEEL	CHROME ALLOY	-20°F to 800°F
26QA11	26QB11	6 x 8	300#	150#	—	—	165	165	165	—	115	70			
26QA12	26QB12	6 x 8	300#	150#	—	—	300	300	300	—	115	115			
26QA13	26QB13	6 x 8	600#	150#	—	—	600	600	600	—	115	115			
H26QA13	H26QB13	6 x 8	600#	150#	—	—	900	900	825	—	285	200			
26QA32	26QB32	6 x 8	300#	150#	—	—	—	—	165	165	115	70	CHROME MOLY STEEL	HIGH TEMP. ALLOY	801°F to 1000°F
26QA33	26QB33	6 x 8	600#	150#	—	—	—	—	600	445	115	70			
H26QA33	H26QB33	6 x 8	600#	150#	—	—	—	—	900	445	285	200			
26QA10/S3	26QB10/S3	6 x 8	150#	150#	—	165	—	—	—	—	115	70	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-21°F to -75°F
26QA11/S3	26QB11/S3	6 x 8	300#	150#	—	165	—	—	—	—	115	70			
26QA12/S3	26QB12/S3	6 x 8	300#	150#	—	300	—	—	—	—	115	115			
26QA13/S3	26QB13/S3	6 x 8	600#	150#	—	600	—	—	—	—	115	115			
26QA10/S4	26QB10/S4	6 x 8	150#	150#	165	—	—	—	—	—	115	70	316 ST. ST.	316 ST. ST.	-76°F to -450°F
26QA11/S4	26QB11/S4	6 x 8	300#	150#	165	—	—	—	—	—	115	70			
26QA12/S4	26QB12/S4	6 x 8	300#	150#	250	—	—	—	—	—	115	115			
26QA13/S4	26QB13/S4	6 x 8	600#	150#	300	—	—	—	—	—	115	115			



Selection Chart

General Notes:

- The type numbers shown on the Selection Chart indicate conventional valves. For BalanSeal, O-ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
- Outlet pressure for temperatures above 100° F should not exceed the rating in ANSI B16.5.
- For applications above 1000° F, consult the Farris Factory.

R Orifice

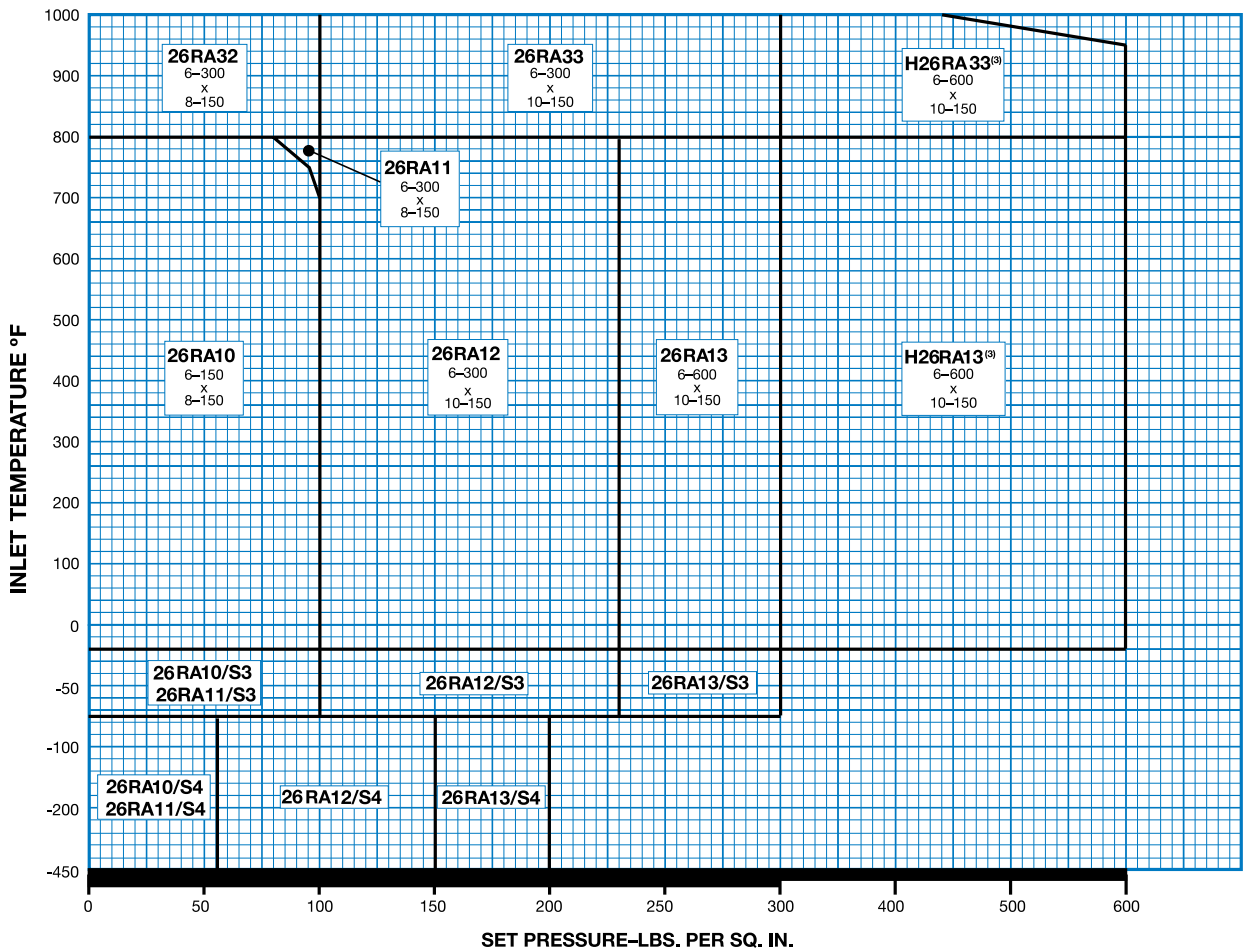
API Area: 16.00 sq. in.
Actual Area: 17.78 sq. in.

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, PSIG						BACK PRESSURE LIMIT PSIG @ 100°F		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-450°F -76°F	-75°F -21°F	-20°F 100°F	450°F	800°F	1000°F	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26RA10	26RB10	6 x 8	150#	150#	—	—	100	100	80	—	60	60	CARBON STEEL	CHROME ALLOY	-20°F to 800°F
26RA11	26RB11	6 x 8	300#	150#	—	—	100	100	100	—	60	60			
26RA12	26RB12	6 x 10	300#	150#	—	—	230	230	230	—	100	100			
26RA13	26RB13	6 x 10	600#	150#	—	—	300	300	300	—	100	100			
H26RA13	H26RB13	6 x 10	600#	150#	—	—	600	600	600	—	285	200			
26RA32	26RB32	6 x 8	300#	150#	—	—	—	—	100	100	60	60	CHROME MOLY STEEL	HIGH TEMP. ALLOY	801°F to 1000°F
26RA33	26RB33	6 x 10	600#	150#	—	—	—	—	300	300	100	100			
H26RA33	H26RB33	6 x 10	600#	150#	—	—	—	—	600	445	285	200			
26RA10/S3	26RB10/S3	6 x 8	150#	150#	—	100	—	—	—	—	60	60	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-21°F to -75°F
26RA11/S3	26RB11/S3	6 x 8	300#	150#	—	100	—	—	—	—	60	60			
26RA12/S3	26RB12/S3	6 x 10	300#	150#	—	230	—	—	—	—	100	100			
26RA13/S3	26RB13/S3	6 x 10	600#	150#	—	300	—	—	—	—	100	100			
26RA10/S4	26RB10/S4	6 x 8	150#	150#	55	—	—	—	—	—	55	55	316 ST. ST.	316 ST. ST.	-76°F to -450°F
26RA11/S4	26RB11/S4	6 x 8	300#	150#	55	—	—	—	—	—	55	55			
26RA12/S4	26RB12/S4	6 x 10	300#	150#	150	—	—	—	—	—	100	100			
26RA13/S4	26RB13/S4	6 x 10	600#	150#	200	—	—	—	—	—	100	100			

Selection Chart

General Notes:

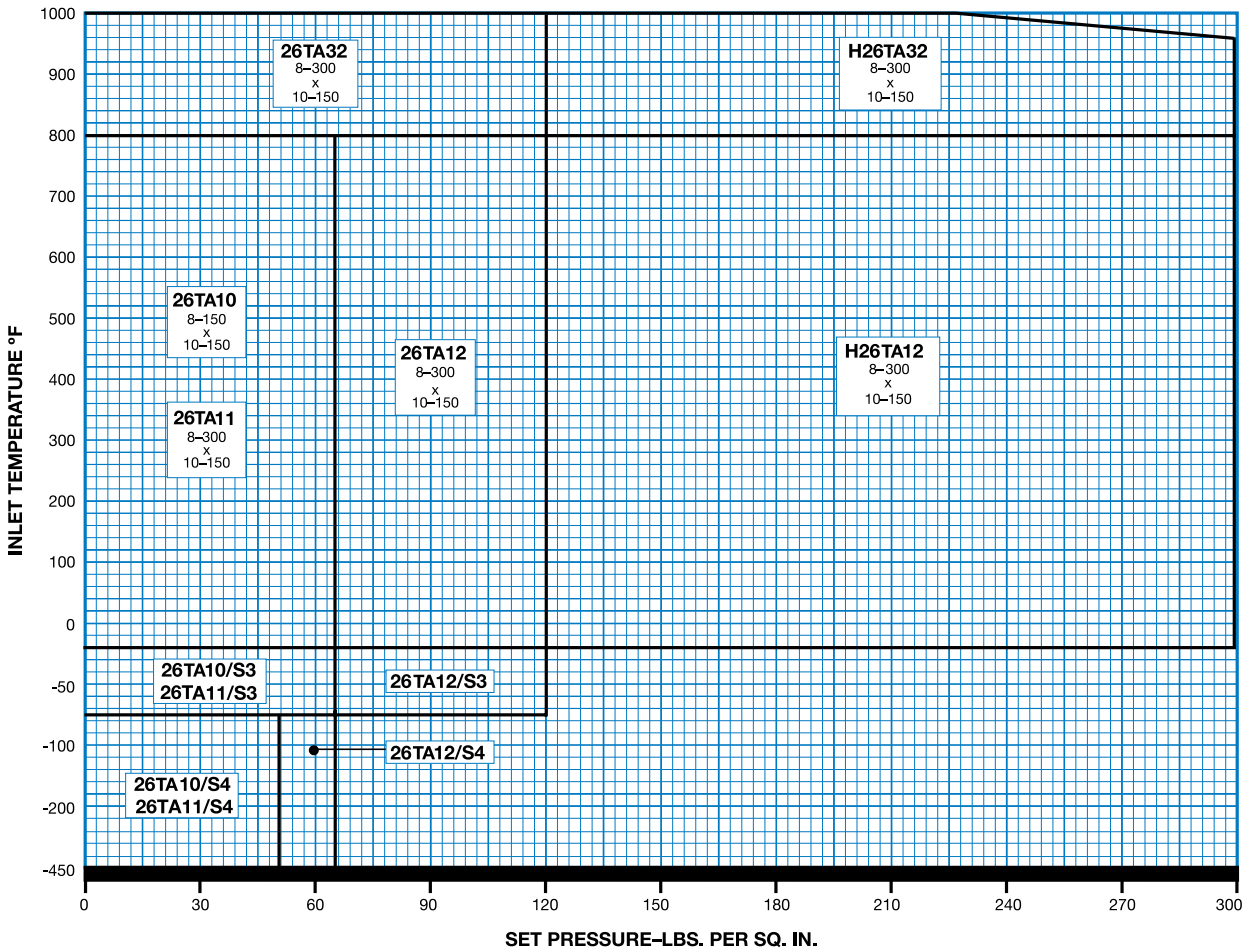
- The type numbers shown on the Selection Chart indicate conventional valves. For BalanSeal, O-ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
- Outlet pressure for temperatures above 100° F should not exceed the rating in ANSI B16.5.
- For applications above 1000° F, consult the Farris Factory.



T Orifice

API Area: 26.00 sq. in.
Actual Area: 28.94 sq. in.

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, PSIG						BACK PRESSURE LIMIT PSIG @ 100°F		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-450°F -76°F	-75°F -21°F	-20°F 100°F	450°F	800°F	1000°F	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26TA10	26TB10	8 x 10	150#	150#	—	—	65	65	65	—	30	30	CARBON STEEL	CHROME ALLOY	-20°F to 800°F
26TA11	26TB11	8 x 10	300#	150#	—	—	65	65	65	—	30	30			
26TA12	26TB12	8 x 10	300#	150#	—	—	120	120	120	—	60	60			
H26TA12	H26TB12	8 x 10	300#	150#	—	—	300	300	300	—	100	100			
26TA32	26TB32	8 x 10	300#	150#	—	—	—	—	120	120	60	60	CHROME MOLY ST.	HIGH TEMP. ALLOY	801°F to 1000°F
H26TA32	H26TB32	8 x 10	300#	150#	—	—	—	—	300	225	100	100			
26TA10/S3	26TB10/S3	8 x 10	150#	150#	—	65	—	—	—	—	30	30	316 ST. ST.	CHROME ALLOY NICKEL PLTD.	-21°F to -75°F
26TA11/S3	26TB11/S3	8 x 10	300#	150#	—	65	—	—	—	—	30	30			
26TA12/S3	26TB12/S3	8 x 10	300#	150#	—	120	—	—	—	—	60	60			
26TA10/S4	26TB10/S4	8 x 10	150#	150#	50	—	—	—	—	—	30	30	316 ST. ST.	316 ST. ST.	-76°F to -450°F
26TA11/S4	26TB11/S4	8 x 10	300#	150#	50	—	—	—	—	—	30	30			
26TA12/S4	26TB12/S4	8 x 10	300#	150#	65	—	—	—	—	—	60	60			



Selection Chart

General Notes:

1. The type numbers shown on the Selection Chart indicate conventional valves. For BalanSeal, O-ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
2. Outlet pressure for temperatures above 100° F should not exceed the rating in ANSI B16.5.
3. For applications above 1000° F, consult the Farris Factory.

API Standard 526, Flanged Steel Pressure Relief Valves, was revised to eliminate the use of 2½” size connections and to use 3” connections instead. The following is a

summary of the old type numbers previously offered. The original type numbers with 2½” connections are still available for replacement of existing valves.

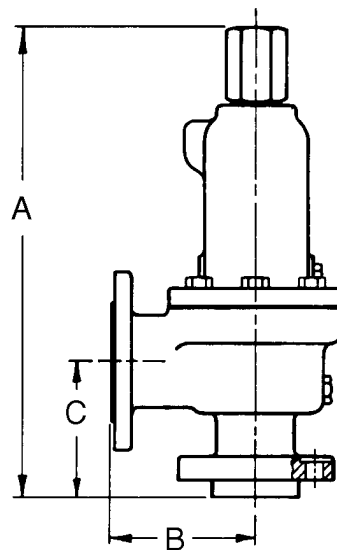
Oriface	Type Number		Valve Size Inlet x Outlet	ANSI Flange Class		Dimensions, Inches					Approx. Weight
	Air, Steam, & Vapor	Liquid		Inlet	Outlet	A	B	C	E	F	
D	26DA16	26DA16L	1 1/2 x 2 1/2	2500#	300#	22 3/4	6 1/2	5 1/2	11/16	2 7/16	80
E	26EA16	26EA16L	1 1/2 x 2 1/2	2500#	300#	22 3/4	6 1/2	5 1/2	11/16	2 7/16	80
F	26FA14	26FA14L	1 1/2 x 2 1/2	900#	300#	22 3/4	6	4 7/8	11/16	1 15/16	70
	26FA15	26FA15L	1 1/2 x 2 1/2	1500#	300#	22 3/4	6	4 7/8	11/16	1 15/16	70
	26FA16	26FA16L	1 1/2 x 2 1/2	2500#	300#	22 3/4	6 1/2	5 1/2	11/16	2 7/16	80
G	26GA10	26GA10L	1 1/2 x 2 1/2	150#	150#	18 5/8	4 3/4	4 7/8	11/16	1 1/4	50
	26GA11	26GA11L	1 1/2 x 2 1/2	300#	150#	18 5/8	4 3/4	4 7/8	11/16	1 9/16	50
	26GA12	26GA12L	1 1/2 x 2 1/2	300#	150#	22 1/4	6	4 7/8	11/16	1 9/16	60
	26GA13	26GA13L	1 1/2 x 2 1/2	600#	150#	22 1/4	6	4 7/8	11/16	1 9/16	60
	26GA14	26GA14L	1 1/2 x 2 1/2	900#	300#	23 3/4	6	4 7/8	11/16	1 15/16	70
J	26JA12	26JA12L	2 1/2 x 4	300#	150#	24 3/8	5 5/8	5 3/8	11/16	1 13/16	150
	26JA13	26JA13L	2 1/2 x 4	600#	150#	24 3/8	5 5/8	5 3/8	11/16	1 13/16	150
	26JA32	26JA32L	2 1/2 x 4	300#	150#	24 3/8	5 5/8	5 3/8	11/16	1 13/16	150
	26JA33	26JA33L	2 1/2 x 4	600#	150#	24 3/8	6 3/4	6 1/8	11/16	1 13/16	150
	26JA34	26JA34L	2 1/2 x 4	900#	150#	33 1/8	7 1/8	7 1/4	11/16	2 5/16	170
K	26KA34	26KA34L	3 x 4	900#	150#	32 3/8	7 1/8	7 1/4	11/16	2 3/16	175

Notes:

1. Pressure and temperature limitations are the same as the comparable orifice and flange classes shown in main Selection Tables.
2. The sizes and flange connections are also available in their respective high temperature type numbers. Example: 26DA36-120.
3. All standard constructions and accessories are available including balanced bellows, O-ring seats, test levers, etc.
4. Additional optional constructions may be specified by changing the seventh digit of the type number. See following table.

Optional Construction	7th Digit Designation	
	Air, Steam & Vapor	Liquids
Heat Transfer Fluid Service	F	G
Exposed Spring	C	N/A*

*Not applicable





Air Capacities: 10% Overpressure

ASME PRESSURE VESSEL CODE (UV)

CAPACITIES IN STANDARD CUBIC FEET PER MINUTE AT 60 °F

Set Pressure (psig)	Orifice Letter Designation & Areas, Sq. Inches													
	AREAS	D	E	F	G	H	J	K	L	M	N	P	Q	R
API	0.110	0.196	0.307	0.503	0.785	1.287	1.838	2.853	3.60	4.34	6.38	11.05	16.0	26.0
Actual	0.150	0.225	0.371	0.559	0.873	1.43	2.042	3.170	4.000	4.822	7.087	12.27	17.78	28.94
15	77	115	190	287	448	735	1050	1630	2057	2479	3644	6310	9144	14884
20	88	133	219	331	517	847	1210	1879	2371	2859	4202	7275	10542	17159
30	112	168	278	419	654	1072	1531	2378	3000	3617	5316	9205	13339	21711
40	138	207	342	516	805	1320	1885	2926	3692	4451	6542	11328	16415	26718
50	164	246	406	612	957	1567	2238	3475	4384	5286	7769	13450	19491	31725
60	190	285	470	709	1108	1815	2591	4023	5076	6120	8995	15573	22567	36732
70	216	324	535	806	1259	2062	2945	4571	5769	6954	10221	17696	25643	41738
80	242	363	599	902	1410	2309	3298	5120	6461	7788	11447	19819	28719	46745
90	268	402	663	999	1561	2557	3651	5668	7153	8623	12673	21942	31795	51752
100	294	441	727	1096	1712	2804	4004	6217	7845	9457	13899	24064	34871	56759
150	423	635	1048	1579	2467	4041	5771	8959	11305	13628	20030	34678	50251	81793
200	553	830	1369	2063	3222	5278	7537	11701	14765	17799	26160	45293	65632	106827
250	683	1025	1690	2547	3977	6515	9304	14443	18225	21970	32291	55907	81012	131862
300	813	1219	2011	3030	4732	7752	11070	17185	21685	26142	38421	66521	96393	156896
350	942	1414	2332	3514	5488	8989	12836	19928	25145	30313	44552	77135	111773	—
400	1072	1609	2653	3997	6243	10226	14603	22670	28606	34484	50682	87749	127154	—
450	1202	1803	2974	4481	6998	11463	16369	25412	32066	38655	56813	98363	142534	—
500	1332	1998	3295	4964	7753	12700	18136	28154	35526	42827	62943	108977	157914	—
550	1461	2192	3616	5448	8508	13937	19902	30896	38986	46998	69074	119591	173295	—
600	1591	2387	3936	5931	9263	15174	21669	33639	42446	51169	75204	130205	188675	—
650	1721	2582	4257	6415	10019	16411	23435	36381	45906	55340	81335	140819	—	—
700	1851	2776	4578	6899	10774	17648	25201	39123	49367	59511	87466	151433	—	—
750	1981	2971	4899	7382	11529	18885	26968	41865	52827	63683	93596	162047	—	—
800	2110	3166	5220	7866	12284	20122	28734	44607	56287	67854	99727	172661	—	—
850	2240	3360	5541	8349	13039	21359	30501	47349	59747	72025	105857	183275	—	—
900	2370	3555	5862	8833	13795	22596	32267	50092	63207	76196	111988	193889	—	—
950	2500	3750	6183	9316	14550	23833	34033	52834	66667	80368	118118	—	—	—
1000	2629	3944	6504	9800	15305	25070	35800	55576	70127	84539	124249	—	—	—
1050	2759	4139	6825	10283	16060	26307	37566	58318	73588	—	—	—	—	—
1100	2889	4333	7146	10767	16815	27544	39333	61060	77048	—	—	—	—	—
1150	3019	4528	7467	11251	17570	28781	41099	63802	—	—	—	—	—	—
1200	3148	4723	7788	11734	18326	30018	42865	66545	—	—	—	—	—	—
1250	3278	4917	8109	12218	19081	31255	44632	69287	—	—	—	—	—	—
1300	3408	5112	8429	12701	19836	32492	46398	72029	—	—	—	—	—	—
1350	3538	5307	8750	13185	20591	33729	48165	74771	—	—	—	—	—	—
1400	3667	5501	9071	13668	21346	34966	49931	77513	—	—	—	—	—	—
1450	3797	5696	9392	14152	22102	36203	51698	80256	—	—	—	—	—	—
1500	3927	5891	9713	14635	22857	37440	53464	82998	—	—	—	—	—	—
1550	4057	6085	10034	15119	23612	38677	55230	—	—	—	—	—	—	—
1600	4186	6280	10355	15603	24367	39914	56997	—	—	—	—	—	—	—
1650	4316	6474	10676	16086	25122	41151	58763	—	—	—	—	—	—	—
1700	4446	6669	10997	16570	25877	42388	60530	—	—	—	—	—	—	—
1750	4576	6864	11318	17053	26633	43625	62296	—	—	—	—	—	—	—
1800	4705	7058	11639	17537	27388	44862	64062	—	—	—	—	—	—	—
1850	4835	7253	11960	18020	28143	46099	65829	—	—	—	—	—	—	—
1900	4965	7448	12281	18504	28898	47336	67595	—	—	—	—	—	—	—
2000	5224	7837	12922	19471	30409	49810	71128	—	—	—	—	—	—	—
2100	5484	8226	13564	20438	31919	52284	74661	—	—	—	—	—	—	—
2200	5743	8615	14206	21405	33429	54758	78194	—	—	—	—	—	—	—
2300	6003	9005	14848	22372	34940	57232	—	—	—	—	—	—	—	—
2400	6262	9394	15490	23339	36450	59706	—	—	—	—	—	—	—	—
2500	6522	9783	16132	24307	37960	62180	—	—	—	—	—	—	—	—
2600	6781	10172	16774	25274	39471	64654	—	—	—	—	—	—	—	—
2700	7041	10562	17415	26241	40981	67128	—	—	—	—	—	—	—	—
2800	7301	10951	18057	27208	—	—	—	—	—	—	—	—	—	—
2900	7560	11340	18699	28175	—	—	—	—	—	—	—	—	—	—
3000	7820	11730	19341	29142	—	—	—	—	—	—	—	—	—	—
3500	9117	13676	22550	33978	—	—	—	—	—	—	—	—	—	—
3700	9636	14454	23834	35912	—	—	—	—	—	—	—	—	—	—
4000	10415	15622	25760	—	—	—	—	—	—	—	—	—	—	—
4500	11712	17569	28969	—	—	—	—	—	—	—	—	—	—	—
5000	13010	19515	32178	—	—	—	—	—	—	—	—	—	—	—
5500	14307	21461	—	—	—	—	—	—	—	—	—	—	—	—
6000	15605	23408	—	—	—	—	—	—	—	—	—	—	—	—

General Notes:

- Above capacities should also be used for 2600L series when used in air service.
- Capacities at 30 PSIG and below are based on 3 PSI overpressure.
- For sizing purposes the effective coefficient of discharge K_d for air, gas, and steam is 0.953 when sizing using the API effective areas. When sizing using the ASME actual areas, the certified coefficient of discharge K for air, gas, and steam service is 0.858.

Steam Capacities, 10% Overpressure



ASME PRESSURE VESSEL CODE (UV) CAPACITIES IN POUNDS PER HOUR AT SATURATION TEMPERATURE

Set Pressure (psig)	Orifice Letter Designation & Areas, Sq. Inches													
	AREAS	D	E	F	G	H	J	K	L	M	N	P	Q	R
API	0.110	0.196	0.307	0.503	0.785	1.287	1.838	2.853	3.60	4.34	6.38	11.05	16.0	26.0
Actual	0.150	0.225	0.371	0.559	0.873	1.43	2.042	3.170	4.000	4.822	7.087	12.27	17.78	28.94
15	216	325	536	807	1261	2066	2950	4580	5779	6967	10240	17729	25690	41815
20	249	374	618	931	1454	2382	3401	5280	6663	8032	11805	20439	29618	48209
30	316	474	781	1178	1840	3014	4303	6681	8430	10163	14937	25861	37475	60997
40	389	583	962	1449	2264	3709	5296	8222	10375	12507	18382	31825	46117	75063
50	461	692	1142	1721	2688	4404	6289	9763	12319	14850	21826	37789	54759	89130
60	534	802	1322	1993	3113	5099	7281	11303	14263	17194	25271	43753	63401	103196
70	607	911	1503	2265	3537	5794	8274	12844	16207	19538	28716	49717	72043	117263
80	680	1021	1683	2536	3961	6489	9266	14385	18152	21882	32160	55681	80685	131329
90	753	1130	1863	2808	4386	7184	10259	15926	20096	24226	35605	61645	89327	145396
100	826	1239	2044	3080	4810	7879	11251	17467	22040	26569	39050	67609	97969	159462
150	1191	1786	2945	4438	6931	11354	16214	25171	31761	38288	56273	97428	141180	229795
200	1555	2333	3847	5797	9053	14830	21176	32875	41482	50007	73497	127248	184390	300127
250	1920	2880	4749	7155	11175	18305	26139	40579	51203	61726	90720	157067	227601	370460
300	2284	3427	5650	8514	13296	21780	31102	48283	60925	73445	107943	186887	270811	440792
350	2649	3973	6552	9872	15418	25256	36064	55987	70646	85163	125167	216707	314022	—
400	3013	4520	7454	11231	17540	28731	41027	63691	80367	96882	142390	246526	357232	—
450	3378	5067	8355	12589	19661	32206	45990	71395	90088	108601	159614	276346	400443	—
500	3742	5614	9257	13948	21783	35681	50952	79099	99809	120320	176837	306165	443653	—
550	4107	6161	10158	15306	23905	39157	55915	86803	109530	132039	194061	335985	486864	—
600	4471	6707	11060	16665	26026	42632	60878	94507	119251	143758	211284	365805	530074	—
650	4836	7254	11962	18023	28148	46107	65840	102211	128973	155476	228507	395624	—	—
700	5201	7801	12863	19382	30269	49583	70803	109915	138694	167195	245731	425444	—	—
750	5565	8348	13765	20741	32391	53058	75766	117619	148415	178914	262954	455263	—	—
800	5930	8895	14667	22099	34513	56533	80728	125323	158136	190633	280178	485083	—	—
850	6294	9441	15568	23458	36634	60009	85691	133027	167857	202352	297401	514903	—	—
900	6659	9988	16470	24816	38756	63484	90653	140731	177578	214071	314625	544722	—	—
950	7023	10535	17372	26175	40878	66959	95616	148435	187299	225789	331848	—	—	—
1000	7388	11082	18273	27533	42999	70435	100579	156139	197020	237508	349071	—	—	—
1050	7752	11629	19175	28892	45121	73910	105541	163843	206742	—	—	—	—	—
1100	8117	12176	20076	30250	47243	77385	110504	171547	216463	—	—	—	—	—
1150	8481	12722	20978	31609	49364	80860	115467	179251	—	—	—	—	—	—
1200	8846	13269	21880	32967	51486	84336	120429	186955	—	—	—	—	—	—
1250	9211	13816	22781	34326	53608	87811	125392	194659	—	—	—	—	—	—
1300	9575	14363	23683	35684	55729	91286	130355	202363	—	—	—	—	—	—
1350	9940	14910	24585	37043	57851	94762	135317	210067	—	—	—	—	—	—
1400	10304	15456	25486	38401	59972	98237	140280	217771	—	—	—	—	—	—
1450	10669	16003	26388	39760	62094	101712	145242	225475	—	—	—	—	—	—
1500	11088	16633	27426	41324	64537	105714	150956	234345	—	—	—	—	—	—
1550	11489	17234	28417	42817	66868	109532	156409	—	—	—	—	—	—	—
1600	11891	17838	29413	44318	69212	113372	161891	—	—	—	—	—	—	—
1650	12309	18464	30444	45872	71640	117348	167569	—	—	—	—	—	—	—
1700	12728	19093	31483	47438	74083	121352	173287	—	—	—	—	—	—	—
1750	13152	19728	32529	49013	76545	125383	179043	—	—	—	—	—	—	—
1800	13564	20347	33549	50551	78947	129316	184661	—	—	—	—	—	—	—
1850	14006	21010	34643	52197	81518	133530	190677	—	—	—	—	—	—	—
1900	14438	21657	35711	53807	84031	137645	196553	—	—	—	—	—	—	—
2000	15325	22987	37903	57111	89191	146098	208625	—	—	—	—	—	—	—
2100	16240	24360	40167	60522	94517	154823	221084	—	—	—	—	—	—	—
2200	17202	25803	42546	64107	100118	163996	234181	—	—	—	—	—	—	—
2300	18182	27272	44970	67758	105819	173335	—	—	—	—	—	—	—	—
2400	19214	28821	47523	71605	111826	183175	—	—	—	—	—	—	—	—
2500	20285	30427	50171	75596	118059	193386	—	—	—	—	—	—	—	—
2600	21416	32124	52970	79811	124643	204168	—	—	—	—	—	—	—	—
2700	22631	33947	55975	84339	131714	215753	—	—	—	—	—	—	—	—
2800	23916	35874	59154	89129	—	—	—	—	—	—	—	—	—	—
2900	25318	37978	62622	94355	—	—	—	—	—	—	—	—	—	—

General Notes:

- Above capacities should also be used for 2600L series when used in steam service.
- Capacities at 30 PSIG and below are based on 3 PSI overpressure.
- For sizing purposes the effective coefficient of discharge K_d for air, gas, and steam is 0.953 when sizing using the API effective areas. When sizing using the ASME actual areas, the certified coefficient of discharge K for air, gas, and steam service is 0.858.



Water Capacities - 2600L: 10% Overpressure

ASME PRESSURE VESSEL CODE (UV)

CAPACITIES IN GALLONS PER MINUTE AT 70 °F

Set Pressure (psig)	Orifice Letter Designation & Areas, Sq. Inches													
	AREAS	D	E	F	G	H	J	K	L	M	N	P	Q	R
API	0.110	0.196	0.307	0.503	0.785	1.287	1.838	2.853	3.600	4.34	6.38	11.05	16.0	26.0
Actual	0.150	0.225	0.371	0.559	0.873	1.43	2.042	3.170	4.000	4.822	7.087	12.27	17.78	28.94
15	16	24	39	59	92	150	214	333	420	507	745	1289	1868	3041
20	18	27	44	66	104	170	242	376	475	573	842	1457	2112	3438
30	21	32	53	80	124	204	290	451	569	686	1008	1746	2530	4118
40	25	37	61	92	143	235	335	521	657	792	1164	2016	2921	4756
50	28	41	68	103	160	263	375	582	734	886	1302	2254	3266	5317
60	30	45	75	112	176	288	411	638	805	970	1426	2469	3578	5825
70	33	49	81	122	189	311	443	689	869	1048	1540	2667	3865	6292
80	35	52	86	130	203	332	474	736	929	1120	1647	2851	4132	6726
90	37	55	91	137	215	352	503	781	986	1188	1747	3024	4382	7134
100	39	58	96	145	227	372	530	823	1039	1252	1841	3188	4620	7520
150	48	72	118	177	278	455	649	1008	1272	1534	2255	3904	5658	9210
200	55	83	136	205	320	525	750	1164	1469	1771	2604	4508	6533	10635
250	62	92	152	229	358	587	838	1302	1643	1981	2911	5041	7304	11890
300	67	101	167	252	392	644	919	1426	1800	2170	3189	5522	8002	13025
350	73	109	180	271	424	695	992	1541	1944	2344	3445	5964	8643	—
400	78	117	193	290	453	743	1061	1647	2078	2505	3683	6376	9240	—
450	83	124	204	308	481	788	1125	1747	2204	2657	3906	6763	9800	—
500	87	131	215	325	507	831	1186	1841	2324	2801	4117	7129	10330	—
550	91	137	226	341	531	871	1244	1931	2437	2938	4318	7477	10834	—
600	95	143	236	356	555	910	1299	2017	2545	3069	4510	7809	11316	—
650	99	149	245	370	578	947	1352	2100	2649	3194	4694	8128	—	—
700	103	154	255	384	600	983	1403	2179	2749	3315	4872	8435	—	—
750	107	160	264	398	621	1018	1453	2255	2846	3431	5043	8731	—	—
800	110	165	272	411	641	1051	1500	2329	2939	3543	5208	9017	—	—
850	114	170	281	423	661	1083	1546	2401	3030	3653	5368	9295	—	—
900	117	175	289	436	680	1115	1591	2471	3118	3758	5524	9564	—	—
950	120	180	297	448	699	1145	1635	2538	3203	3861	5675	—	—	—
1000	123	185	304	459	717	1175	1677	2604	3286	3962	5823	—	—	—
1050	126	189	312	470	735	1204	1719	2669	3367	—	—	—	—	—
1100	129	194	319	482	752	1232	1759	2731	3447	—	—	—	—	—
1150	132	198	326	492	769	1260	1799	2793	—	—	—	—	—	—
1200	135	202	333	503	785	1287	1838	2853	—	—	—	—	—	—
1250	137	206	340	513	802	1313	1875	2912	—	—	—	—	—	—
1300	140	210	347	524	817	1340	1913	2969	—	—	—	—	—	—
1350	143	214	354	533	833	1365	1949	3026	—	—	—	—	—	—
1400	146	218	360	543	848	1390	1985	3082	—	—	—	—	—	—
1450	148	222	367	553	863	1414	2020	3136	—	—	—	—	—	—
1500	151	226	373	562	878	1439	2055	3190	—	—	—	—	—	—
1550	153	230	379	571	893	1462	2088	—	—	—	—	—	—	—
1600	155	233	385	581	907	1486	2122	—	—	—	—	—	—	—
1650	158	237	391	590	921	1509	2155	—	—	—	—	—	—	—
1700	160	241	397	598	935	1532	2187	—	—	—	—	—	—	—
1750	163	244	403	607	948	1554	2219	—	—	—	—	—	—	—
1800	165	248	409	616	962	1576	2251	—	—	—	—	—	—	—
1850	167	251	414	624	975	1598	2282	—	—	—	—	—	—	—
1900	169	254	420	633	988	1619	2312	—	—	—	—	—	—	—
2000	174	261	431	649	1014	1661	2372	—	—	—	—	—	—	—
2100	178	267	441	665	1039	1702	2431	—	—	—	—	—	—	—
2200	182	274	452	681	1063	1742	2488	—	—	—	—	—	—	—
2300	186	280	462	696	1087	1782	—	—	—	—	—	—	—	—
2400	190	286	472	711	1111	1820	—	—	—	—	—	—	—	—
2500	194	292	482	726	1134	1857	—	—	—	—	—	—	—	—
2600	198	298	491	740	1156	1894	—	—	—	—	—	—	—	—
2700	202	303	500	754	1178	1930	—	—	—	—	—	—	—	—
2800	206	309	510	768	—	—	—	—	—	—	—	—	—	—
2900	209	314	519	782	—	—	—	—	—	—	—	—	—	—
3000	213	320	528	795	—	—	—	—	—	—	—	—	—	—
3500	230	345	570	859	—	—	—	—	—	—	—	—	—	—
3700	237	355	586	883	—	—	—	—	—	—	—	—	—	—
4000	246	369	609	—	—	—	—	—	—	—	—	—	—	—
4500	261	392	646	—	—	—	—	—	—	—	—	—	—	—
5000	275	413	681	—	—	—	—	—	—	—	—	—	—	—
5500	289	433	—	—	—	—	—	—	—	—	—	—	—	—
6000	301	452	—	—	—	—	—	—	—	—	—	—	—	—

General Notes:
 1. Capacities at 30 PSIG and below are based on 3 PSI overpressure.
 2. For sizing purposes the effective coefficient of discharge K_d for liquids is 0.724 when sizing using the API effective areas. When sizing using the ASME actual areas, the certified coefficient of discharge K for water is 0.652.

Water Capacities - 2600: 25% Overpressure



NON-CODE

CAPACITIES IN GALLONS PER MINUTE AT 70 °F

Set Pressure (psig)	Orifice Letter Designation & Areas, Sq. Inches													
	AREAS	D	E	F	G	H	J	K	L	M	N	P	Q	R
API	0.110	0.196	0.307	0.503	0.785	1.287	1.838	2.853	3.600	4.34	6.38	11.05	16.0	26.0
Actual	0.150	0.225	0.371	0.559	0.873	1.43	2.042	3.170	4.000	4.822	7.087	12.27	17.78	28.94
15	14	21	35	53	82	136	193	300	379	457	672	1163	1685	2743
20	16	24	40	61	95	156	223	347	438	528	776	1342	1946	3167
30	20	30	49	75	117	192	274	425	536	646	950	1644	2383	3879
40	23	35	57	86	135	221	316	491	619	746	1097	1899	2752	4479
50	26	39	64	97	151	247	353	548	692	834	1226	2123	3076	5007
60	28	42	70	106	165	271	387	601	758	914	1343	2325	3370	5485
70	30	46	76	114	179	293	418	649	819	987	1451	2512	3640	5925
80	33	49	81	122	191	313	447	694	875	1055	1551	2685	3892	6334
90	35	52	86	130	203	332	474	736	929	1119	1645	2848	4128	6718
100	37	55	91	137	214	350	499	776	979	1180	1734	3002	4351	7082
150	45	71	111	168	261	428	611	950	1198	1445	2124	3677	5328	8673
200	52	77	128	193	302	495	706	1097	1384	1669	2452	4246	6153	10015
250	58	92	143	216	337	553	790	1226	1547	1866	2742	4747	6879	11197
300	64	95	157	237	370	606	865	1344	1695	2044	3004	5200	7536	12266
350	69	103	169	256	399	655	934	1451	1831	2208	3244	5617	8139	—
400	73	110	181	274	427	700	999	1551	1958	2360	3468	6005	8702	—
450	78	116	192	290	453	742	1060	1645	2076	2503	3678	6369	9229	—
500	82	123	203	306	477	782	1117	1734	2189	2638	3878	6713	9729	—
550	86	129	213	321	501	821	1171	1819	2295	2767	4067	7041	10204	—
600	90	135	222	335	523	857	1223	1900	2398	2890	4248	7354	10657	—
650	94	140	231	349	544	892	1273	1978	2495	3008	4421	7655	—	—
700	97	146	240	362	565	926	1322	2052	2590	3122	4588	7944	—	—
750	100	151	248	375	585	958	1368	2124	2681	3232	4749	8222	—	—
800	104	156	257	387	604	990	1413	2194	2768	3337	4905	8492	—	—
850	107	160	264	399	623	1020	1456	2262	2854	3440	5056	8753	—	—
900	110	165	272	410	641	1050	1499	2327	2936	3540	5203	9007	—	—
950	113	170	280	422	658	1078	1540	2391	3016	3637	5345	—	—	—
1000	116	174	287	432	675	1106	1580	2453	3095	3731	5484	—	—	—
1050	118	178	294	443	692	1133	1619	2513	3171	—	—	—	—	—
1100	122	182	301	454	708	1160	1657	2573	3246	—	—	—	—	—
1150	124	186	307	463	724	1186	1694	2630	—	—	—	—	—	—
1200	127	191	314	474	740	1212	1730	2687	—	—	—	—	—	—
1250	129	194	320	483	755	1237	1766	2742	—	—	—	—	—	—
1300	132	198	327	493	770	1262	1801	2797	—	—	—	—	—	—
1350	134	202	333	502	784	1285	1835	2850	—	—	—	—	—	—
1400	137	206	339	512	799	1309	1869	2902	—	—	—	—	—	—
1450	139	209	345	520	813	1332	1902	2953	—	—	—	—	—	—
1500	142	213	351	530	827	1355	1935	3004	—	—	—	—	—	—
1550	144	216	357	538	841	1377	1967	—	—	—	—	—	—	—
1600	147	220	363	547	854	1400	1998	—	—	—	—	—	—	—
1650	149	223	368	555	867	1421	2029	—	—	—	—	—	—	—
1700	151	227	374	564	880	1443	2060	—	—	—	—	—	—	—
1750	153	230	379	572	893	1463	2090	—	—	—	—	—	—	—
1800	156	233	385	580	906	1484	2120	—	—	—	—	—	—	—
1850	157	236	390	588	918	1505	2149	—	—	—	—	—	—	—
1900	160	239	395	596	931	1525	2178	—	—	—	—	—	—	—
2000	164	246	406	612	955	1564	2234	—	—	—	—	—	—	—
2100	168	252	416	627	978	1603	2289	—	—	—	—	—	—	—
2200	172	258	425	642	1002	1641	2343	—	—	—	—	—	—	—
2300	176	264	435	656	1024	1678	—	—	—	—	—	—	—	—
2400	180	270	444	670	1046	1714	—	—	—	—	—	—	—	—
2500	184	275	454	684	1068	1749	—	—	—	—	—	—	—	—
2600	187	281	463	698	1089	1784	—	—	—	—	—	—	—	—
2700	191	286	471	711	1110	1818	—	—	—	—	—	—	—	—
2800	194	291	480	724	—	—	—	—	—	—	—	—	—	—
2900	198	296	488	737	—	—	—	—	—	—	—	—	—	—
3000	201	301	497	749	—	—	—	—	—	—	—	—	—	—
3500	217	325	537	809	—	—	—	—	—	—	—	—	—	—
3700	223	334	552	832	—	—	—	—	—	—	—	—	—	—
4000	232	348	574	—	—	—	—	—	—	—	—	—	—	—
4500	246	369	609	—	—	—	—	—	—	—	—	—	—	—
5000	260	389	641	—	—	—	—	—	—	—	—	—	—	—
5500	272	408	—	—	—	—	—	—	—	—	—	—	—	—
6000	284	426	—	—	—	—	—	—	—	—	—	—	—	—

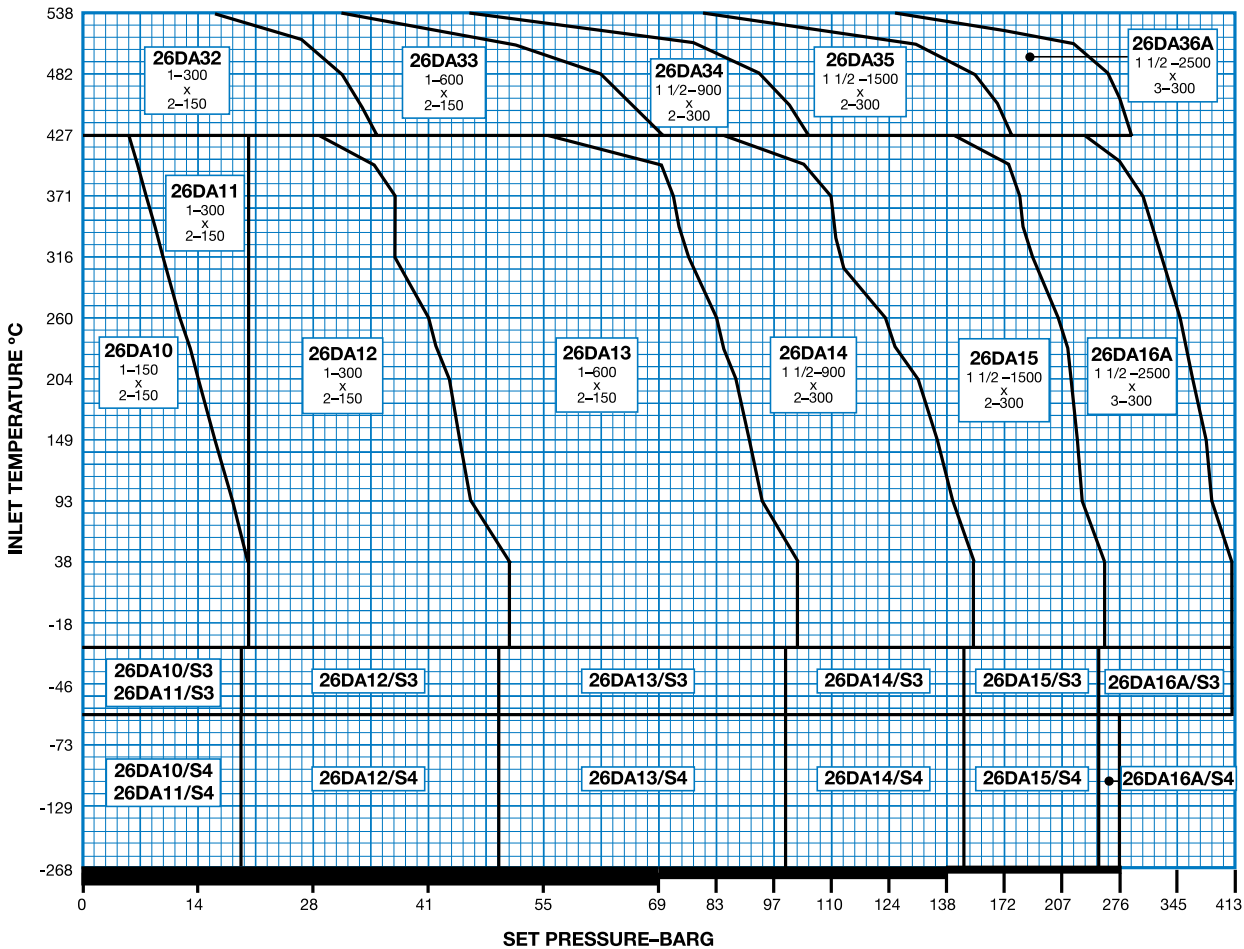
General Notes:
 1. Capacities at 30 PSIG and below are based on 3 PSI overpressure.
 2. For sizing purposes the effective coefficient of discharge K_d for liquids is 0.64 when sizing using the API effective areas. When sizing using the actual areas, the coefficient of discharge K for water is 0.576.

D Orifice

API Area: 71 sq. mm

Actual Area: 97 sq. mm

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, BARG						BACK PRESSURE LIMIT BARG @ 38°C		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-268°C -60°C	-59°C -30°C	-29°C +38°C	+232°C	+427°C	+538°C	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26DA10	26DB10	1 x 2	150#	150#	—	—	19.6	12.7	5.5	—	19.6	15.8	CARBON STEEL	CHROME ALLOY	-29°C to 427°C
26DA11	26DB11	1 x 2	300#	150#	—	—	19.6	19.6	19.6	—	19.6	15.8			
26DA12	26DB12	1 x 2	300#	150#	—	—	51.0	42.4	28.2	—	19.6	15.8			
26DA13	26DB13	1 x 2	600#	150#	—	—	102	85.1	56.8	—	19.6	15.8			
26DA14	—	1 1/2 x 2	900#	300#	—	—	153	127	85.1	—	41.3	34.5			
26DA15	—	1 1/2 x 2	1500#	300#	—	—	255	212	142	—	41.3	34.5			
26DA16A	—	1 1/2 x 3	2500#	300#	—	—	413	354	236	—	51	34.5			
26DA32	26DB32	1 x 2	300#	150#	—	—	—	—	35.1	15.5	19.6	15.8	CHROME MOLY STEEL	HIGH TEMP. ALLOY	428°C to 538°C
26DA33	26DB33	1 x 2	600#	150#	—	—	—	—	69.9	30.6	19.6	15.8			
26DA34	—	1 1/2 x 2	900#	300#	—	—	—	—	105	46.2	41.3	34.5			
26DA35	—	1 1/2 x 2	1500#	300#	—	—	—	—	175	76.8	41.3	34.5			
26DA36A	—	1 1/2 x 3	2500#	300#	—	—	—	—	291	128	51	34.5			
26DA10/S3	26DB10/S3	1 x 2	150#	150#	—	18.9	—	—	—	—	18.9	15.8	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-30°C to -59°C
26DA11/S3	26DB11/S3	1 x 2	300#	150#	—	18.9	—	—	—	—	18.9	15.8			
26DA12/S3	26DB12/S3	1 x 2	300#	150#	—	49.6	—	—	—	—	18.9	15.8			
26DA13/S3	26DB13/S3	1 x 2	600#	150#	—	99.2	—	—	—	—	18.9	15.8			
26DA14/S3	—	1 1/2 x 2	900#	300#	—	149	—	—	—	—	41.3	34.5			
26DA15/S3	—	1 1/2 x 2	1500#	300#	—	248	—	—	—	—	41.3	34.5			
26DA16A/S3	—	1 1/2 x 3	2500#	300#	—	413	—	—	—	—	49.6	34.5			
26DA10/S4	26DB10/S4	1 x 2	150#	150#	18.9	—	—	—	—	—	18.9	15.8			
26DA11/S4	26DB11/S4	1 x 2	300#	150#	18.9	—	—	—	—	—	18.9	15.8	316 ST. ST.	316 ST. ST.	-60°C to -268°C
26DA12/S4	26DB12/S4	1 x 2	300#	150#	49.6	—	—	—	—	—	18.9	15.8			
26DA13/S4	26DB13/S4	1 x 2	600#	150#	99.2	—	—	—	—	—	18.9	15.8			
26DA14/S4	—	1 1/2 x 2	900#	300#	149	—	—	—	—	—	41.3	34.5			
26DA15/S4	—	1 1/2 x 2	1500#	300#	248	—	—	—	—	—	41.3	34.5			
26DA16A/S4	—	1 1/2 x 3	2500#	300#	276	—	—	—	—	—	49.6	34.5			



Selection Chart

- Notes:**
- The type numbers shown on the selection chart indicate conventional valves. For BalanSeal, "O" ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
 - Outlet pressure for temperature above 38°C should not exceed the rating in ANSI B16.5.
 - For applications above 538°C, consult the Farris Factory.

E Orifice

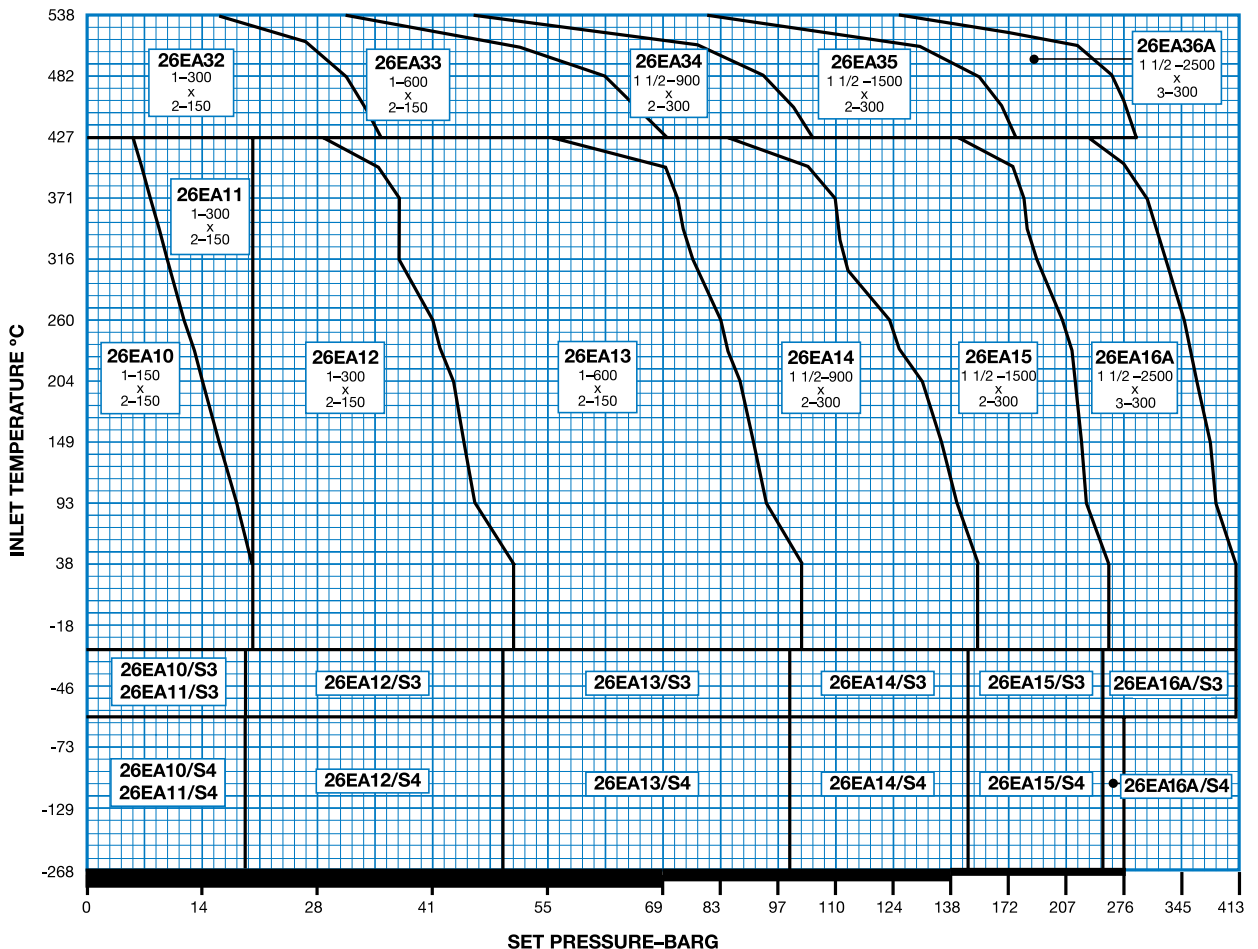
API Area: 126 sq. mm
Actual Area: 145 sq. mm

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, BARG						BACK PRESSURE LIMIT BARG @ 38°C		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-268°C -60°C	-59°C -30°C	-29°C +38°C	+232°C	+427°C	+538°C	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26EA10	26EB10	1 x 2	150#	150#	—	—	19.6	12.7	5.5	—	19.6	15.8	CARBON STEEL	CHROME ALLOY	-29°C to 427°C
26EA11	26EB11	1 x 2	300#	150#	—	—	19.6	19.6	19.6	—	19.6	15.8			
26EA12	26EB12	1 x 2	300#	150#	—	—	51.0	42.4	28.2	—	19.6	15.8			
26EA13	26EB13	1 x 2	600#	150#	—	—	102	85.1	56.8	—	19.6	15.8			
26EA14	—	1 1/2 x 2	900#	300#	—	—	153	127	85.1	—	41.3	34.5			
26EA15	—	1 1/2 x 2	1500#	300#	—	—	255	212	142	—	41.3	34.5			
26EA16A	—	1 1/2 x 3	2500#	300#	—	—	413	354	236	—	51	34.5			
26EA32	26EB32	1 x 2	300#	150#	—	—	—	—	35.1	15.5	19.6	15.8	CHROME MOLY STEEL	HIGH TEMP. ALLOY	428°C to 538°C
26EA33	26EB33	1 x 2	600#	150#	—	—	—	—	69.9	30.6	19.6	15.8			
26EA34	26EB34*	1 1/2 x 2	900#	300#	—	—	—	—	105	46.2	41.3	34.5			
26EA35	26EB35*	1 1/2 x 2	1500#	300#	—	—	—	—	175	76.8	41.3	34.5			
26EA36A	26EB36A*	1 1/2 x 3	2500#	300#	—	—	—	—	291	128	51	34.5			
26EA10/S3	26EB10/S3	1 x 2	150#	150#	—	18.9	—	—	—	—	18.9	15.8	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-30°C to -59°C
26EA11/S3	26EB11/S3	1 x 2	300#	150#	—	18.9	—	—	—	—	18.9	15.8			
26EA12/S3	26EB12/S3	1 x 2	300#	150#	—	49.6	—	—	—	—	18.9	15.8			
26EA13/S3	26EB13/S3	1 x 2	600#	150#	—	99.2	—	—	—	—	18.9	15.8			
26EA14/S3	—	1 1/2 x 2	900#	300#	—	149	—	—	—	—	41.3	34.5			
26EA15/S3	—	1 1/2 x 2	1500#	300#	—	248	—	—	—	—	41.3	34.5			
26EA16A/S3	—	1 1/2 x 3	2500#	300#	—	413	—	—	—	—	49.6	34.5			
26EA10/S4	26EB10/S4	1 x 2	150#	150#	18.9	—	—	—	—	—	18.9	15.8	316 ST. ST.	316 ST. ST.	-60°C to -268°C
26EA11/S4	26EB11/S4	1 x 2	300#	150#	18.9	—	—	—	—	—	18.9	15.8			
26EA12/S4	26EB12/S4	1 x 2	300#	150#	49.6	—	—	—	—	—	18.9	15.8			
26EA13/S4	26EB13/S4	1 x 2	600#	150#	99.2	—	—	—	—	—	18.9	15.8			
26EA14/S4	—	1 1/2 x 2	900#	300#	149	—	—	—	—	—	41.3	34.5			
26EA15/S4	—	1 1/2 x 2	1500#	300#	248	—	—	—	—	—	41.3	34.5			
26EA16A/S4	—	1 1/2 x 3	2500#	300#	276	—	—	—	—	—	49.6	34.5			

Selection Chart

Notes:

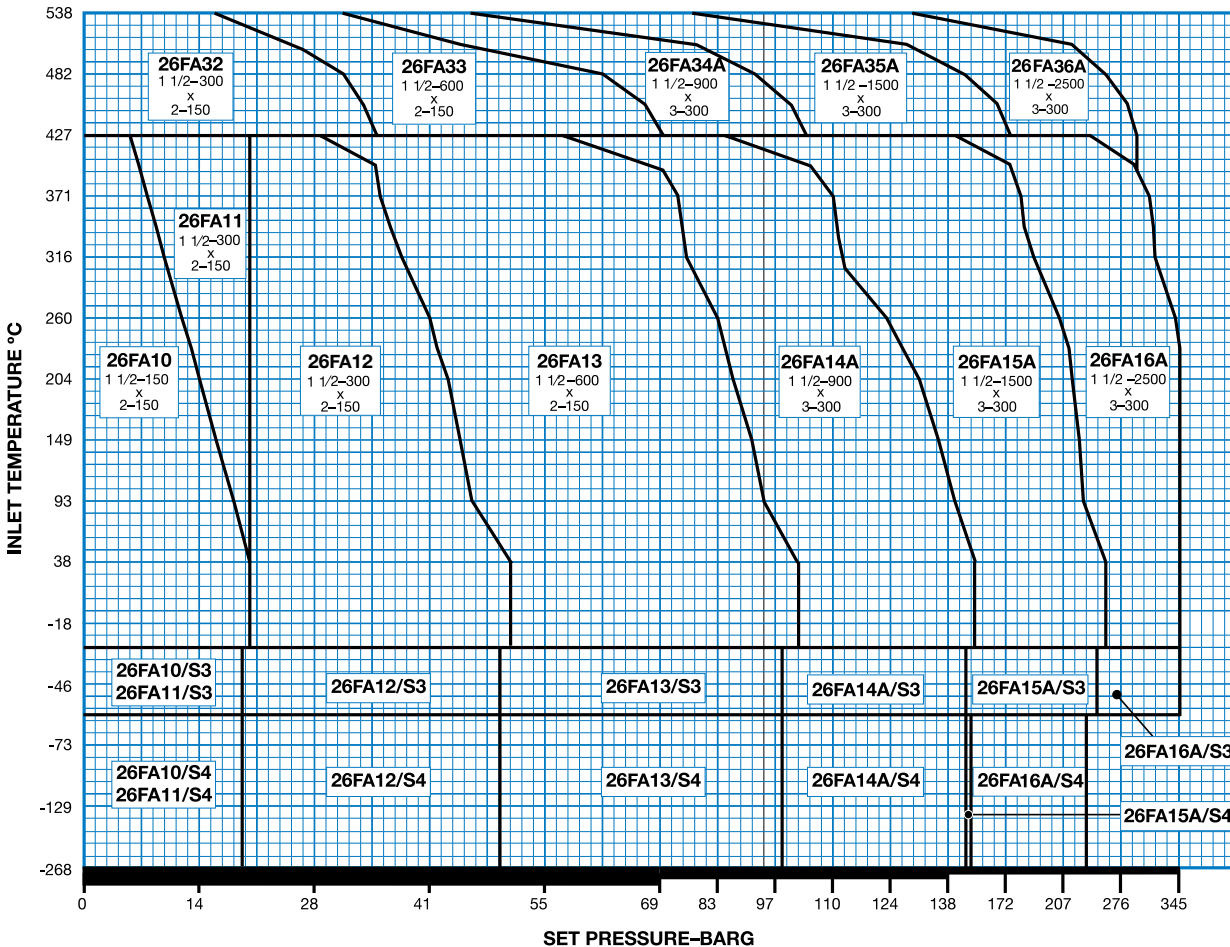
- The type numbers shown on the selection chart indicate conventional valves. For BalanSeal, "O" ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
- Outlet pressure for temperature above 38°C should not exceed the rating in ANSI B16.5.
- For applications above 538°C, consult the Farris Factory.



F Orifice

API Area: 198 sq. mm
Actual Area: 239 sq. mm

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, BARG						BACK PRESSURE LIMIT BARG @ 38°C		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-268°C -60°C	-59°C -30°C	-29°C +38°C	+232°C	+427°C	+538°C	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26FA10	26FB10	1 1/2 x 2	150#	150#	—	—	19.6	12.7	5.5	—	19.6	15.8	CARBON STEEL	CHROME ALLOY	-29°C to 427°C
26FA11	26FB11	1 1/2 x 2	300#	150#	—	—	19.6	19.6	19.6	—	19.6	15.8			
26FA12	26FB12	1 1/2 x 2	300#	150#	—	—	51.0	42.4	28.2	—	19.6	15.8			
26FA13	26FB13	1 1/2 x 2	600#	150#	—	—	102	85.1	56.8	—	19.6	15.8			
26FA14A	26FB14A	1 1/2 x 3	900#	300#	—	—	153	127	85.1	—	51.0	34.5			
26FA15A	26FB15A	1 1/2 x 3	1500#	300#	—	—	255	212	142	—	51.0	34.5			
26FA16A	26FB16A	1 1/2 x 3	2500#	300#	—	—	345	345	236	—	51.0	34.5			
26FA32	26FB32	1 1/2 x 2	300#	150#	—	—	—	—	35.1	15.5	19.6	15.8	CHROME MOLY STEEL	HIGH TEMP. ALLOY	428°C to 538°C
26FA33	26FB33	1 1/2 x 2	600#	150#	—	—	—	—	69.9	30.6	19.6	15.8			
26FA34A	26FB34A	1 1/2 x 3	900#	300#	—	—	—	—	105	46.2	51.0	34.5			
26FA35A	26FB35A	1 1/2 x 3	1500#	300#	—	—	—	—	175	76.8	51.0	34.5			
26FA36A	26FB36A	1 1/2 x 3	2500#	300#	—	—	—	—	291	128	51.0	34.5			
26FA10/S3	26FB10/S3	1 1/2 x 2	150#	150#	—	18.9	—	—	—	—	18.9	15.8	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-30°C to -59°C
26FA11/S3	26FB11/S3	1 1/2 x 2	300#	150#	—	18.9	—	—	—	—	18.9	15.8			
26FA12/S3	26FB12/S3	1 1/2 x 2	300#	150#	—	49.6	—	—	—	—	18.9	15.8			
26FA13/S3	26FB13/S3	1 1/2 x 2	600#	150#	—	99.2	—	—	—	—	18.9	15.8			
26FA14A/S3	26FB14A/S3	1 1/2 x 3	900#	300#	—	149	—	—	—	—	49.6	34.5			
26FA15A/S3	26FB15A/S3	1 1/2 x 3	1500#	300#	—	248	—	—	—	—	49.6	34.5			
26FA16A/S3	26FB16A/S3	1 1/2 x 3	2500#	300#	—	345	—	—	—	—	49.6	34.5			
26FA10/S4	26FB10/S4	1 1/2 x 2	150#	150#	18.9	—	—	—	—	—	18.9	15.8	316 ST. ST.	316 ST. ST.	-60°C to -268°C
26FA11/S4	26FB11/S4	1 1/2 x 2	300#	150#	18.9	—	—	—	—	—	18.9	15.8			
26FA12/S4	26FB12/S4	1 1/2 x 2	300#	150#	49.6	—	—	—	—	—	18.9	15.8			
26FA13/S4	26FB13/S4	1 1/2 x 2	600#	150#	99.2	—	—	—	—	—	18.9	15.8			
26FA14A/S4	26FB14A/S4	1 1/2 x 3	900#	300#	149	—	—	—	—	—	49.6	34.5			
26FA15A/S4	26FB15A/S4	1 1/2 x 3	1500#	300#	152	—	—	—	—	—	49.6	34.5			
26FA16A/S4	26FB16A/S4	1 1/2 x 3	2500#	300#	234	—	—	—	—	—	49.6	34.5			



Selection Chart

- Notes:**
- The type numbers shown on the selection chart indicate conventional valves. For BalanSeal, "O" ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
 - Outlet pressure for temperature above 38°C should not exceed the rating in ANSI B16.5.
 - For applications above 538°C, consult the Farris Factory.

G Orifice

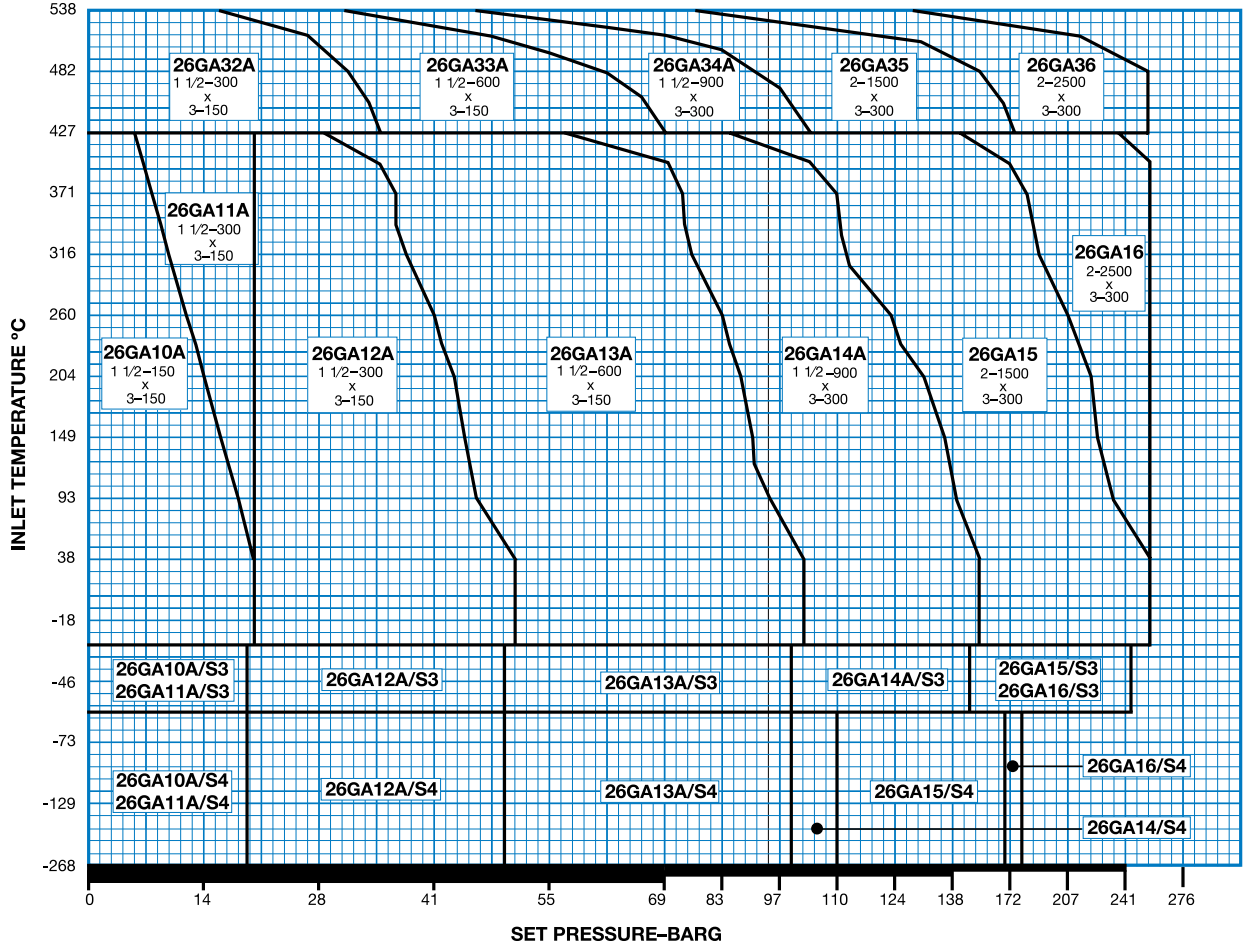
API Area: 325 sq. mm
Actual Area: 361 sq. mm

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, BARG						BACK PRESSURE LIMIT BARG @ 38°C		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-268°C -60°C	-59°C -30°C	-29°C +38°C	+232°C	+427°C	+538°C	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26GA10A	26GB10A	1 1/2 x 3	150#	150#	—	—	19.6	12.7	5.5	—	19.6	15.8	CARBON STEEL	CHROME ALLOY	-29°C to 427°C
26GA11A	26GB11A	1 1/2 x 3	300#	150#	—	—	19.6	19.6	19.6	—	19.6	15.8			
26GA12A	26GB12A	1 1/2 x 3	300#	150#	—	—	51.0	42.4	28.2	—	19.6	15.8			
26GA13A	26GB13A	1 1/2 x 3	600#	150#	—	—	102	85.1	56.8	—	19.6	15.8			
26GA14A	26GB14A	1 1/2 x 3	900#	300#	—	—	153	127	85.1	—	51.0	32.4			
26GA15	26GB15	2 x 3	1500#	300#	—	—	255	212	142	—	51.0	32.4			
26GA16	26GB16	2 x 3	2500#	300#	—	—	255	255	236	—	51.0	32.4			
26GA32A	26GB32A	1 1/2 x 3	300#	150#	—	—	—	—	35.1	15.5	19.6	15.8	CHROME MOLY STEEL	HIGH TEMP. ALLOY	428°C to 538°C
26GA33A	26GB33A	1 1/2 x 3	600#	150#	—	—	—	—	69.9	30.6	19.6	15.8			
26GA34A	26GB34A	1 1/2 x 3	900#	300#	—	—	—	—	105	46.2	51.0	32.4			
26GA35	26GB35	2 x 3	1500#	300#	—	—	—	—	175	76.8	51.0	32.4			
26GA36	26GB36	2 x 3	2500#	300#	—	—	—	—	255	128	51.0	32.4			
26GA10A/S3	26GB10A/S3	1 1/2 x 3	150#	150#	—	18.9	—	—	—	—	18.9	15.8			
26GA11A/S3	26GB11A/S3	1 1/2 x 3	300#	150#	—	18.9	—	—	—	—	18.9	15.8			
26GA12A/S3	26GB12A/S3	1 1/2 x 3	300#	150#	—	49.6	—	—	—	—	18.9	15.8			
26GA13A/S3	26GB13A/S3	1 1/2 x 3	600#	150#	—	99.2	—	—	—	—	18.9	15.8			
26GA14A/S3	26GB14A/S3	1 1/2 x 3	900#	300#	—	149	—	—	—	—	49.6	32.4			
26GA15/S3	26GB15/S3	2 x 3	1500#	300#	—	248	—	—	—	—	49.6	32.4			
26GA16/S3	26GB16/S3	2 x 3	2500#	300#	—	248	—	—	—	—	49.6	32.4			
26GA10A/S4	26GB10A/S4	1 1/2 x 3	150#	150#	18.9	—	—	—	—	—	18.9	15.8	316 ST. ST.	316 ST. ST.	-60°C to -268°C
26GA11A/S4	26GB11A/S4	1 1/2 x 3	300#	150#	18.9	—	—	—	—	—	18.9	15.8			
26GA12A/S4	26GB12A/S4	1 1/2 x 3	300#	150#	49.6	—	—	—	—	—	18.9	15.8			
26GA13A/S4	26GB13A/S4	1 1/2 x 3	600#	150#	99.2	—	—	—	—	—	18.9	15.8			
26GA14A/S4	26GB14A/S4	1 1/2 x 3	900#	300#	110	—	—	—	—	—	49.6	32.4			
26GA15/S4	26GB15/S4	2 x 3	1500#	300#	169	—	—	—	—	—	49.6	32.4			
26GA16/S4	26GB16/S4	2 x 3	2500#	300#	179	—	—	—	—	—	49.6	32.4			

Selection Chart

Notes:

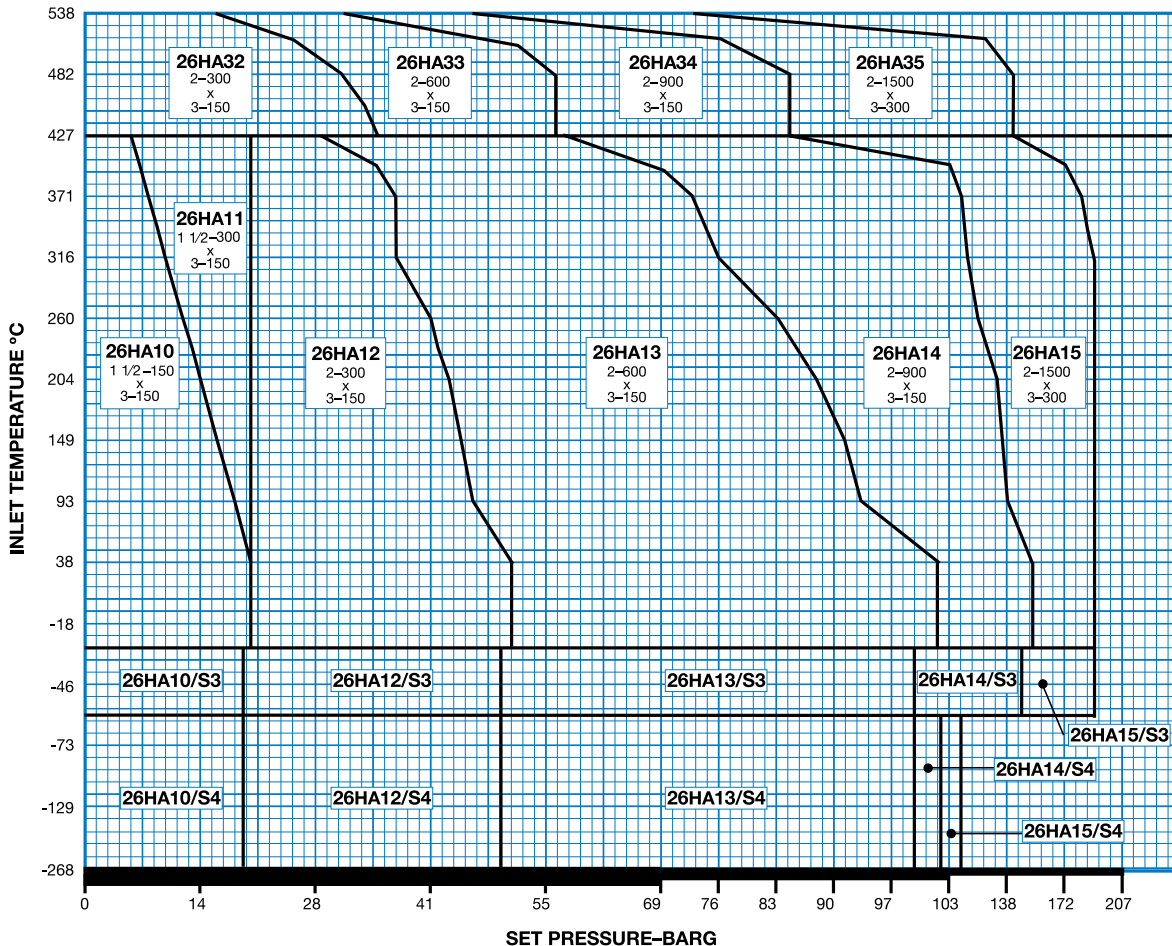
- The type numbers shown on the selection chart indicate conventional valves. For BalanSeal, "O" ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
- Outlet pressure for temperature above 38°C should not exceed the rating in ANSI B16.5.
- For applications above 538°C, consult the Farris Factory.



H Orifice

API Area: 506 sq. mm
Actual Area: 563 sq. mm

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, BARG						BACK PRESSURE LIMIT BARG @ 38°C		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-268°C -60°C	-59°C -30°C	-29°C +38°C	+232°C	+427°C	+538°C	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26HA10	26HB10	1 1/2 x 3	150#	150#	—	—	19.6	12.7	5.5	—	19.6	15.8	CARBON STEEL	CHROME ALLOY	-29°C to 427°C
26HA11	26HB11	1 1/2 x 3	300#	150#	—	—	19.6	19.6	19.6	—	19.6	15.8			
26HA12	26HB12	2 x 3	300#	150#	—	—	51.0	42.4	28.2	—	19.6	15.8			
26HA13	26HB13	2 x 3	600#	150#	—	—	102	85.1	56.8	—	19.6	15.8			
26HA14	26HB14	2 x 3	900#	150#	—	—	153	127	85.1	—	19.6	15.8			
26HA15	26HB15	2 x 3	1500#	300#	—	—	189	189	142	—	51.0	28.6			
26HA32	26HB32	2 x 3	300#	150#	—	—	—	—	35.1	15.5	19.6	15.8	CHROME MOLY STEEL	HIGH TEMP. ALLOY	428°C to 538°C
26HA33	26HB33	2 x 3	600#	150#	—	—	—	—	56.2	30.6	19.6	15.8			
26HA34	26HB34	2 x 3	900#	150#	—	—	—	—	84.4	46.2	19.6	15.8			
26HA35	26HB35	2 x 3	1500#	300#	—	—	—	—	141	76.8	51.0	28.6			
26HA10/S3	26HB10/S3	1 1/2 x 3	150#	150#	—	18.9	—	—	—	—	18.9	15.8	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-30°C to -59°C
26HA11/S3	26HB11/S3	1 1/2 x 3	300#	150#	—	18.9	—	—	—	—	18.9	15.8			
26HA12/S3	26HB12/S3	2 x 3	300#	150#	—	49.6	—	—	—	—	18.9	15.8			
26HA13/S3	26HB13/S3	2 x 3	600#	150#	—	99.2	—	—	—	—	18.9	15.8			
26HA14/S3	26HB14/S3	2 x 3	900#	150#	—	149	—	—	—	—	18.9	15.8			
26HA15/S3	26HB15/S3	2 x 3	1500#	300#	—	189	—	—	—	—	49.6	28.6			
26HA10/S4	26HB10/S4	1 1/2 x 3	150#	150#	18.9	—	—	—	—	—	18.9	15.8	316 ST. ST.	316 ST. ST.	-60°C to -268°C
26HA11/S4	26HB11/S4	1 1/2 x 3	300#	150#	18.9	—	—	—	—	—	18.9	15.8			
26HA12/S4	26HB12/S4	2 x 3	300#	150#	49.6	—	—	—	—	—	18.9	15.8			
26HA13/S4	26HB13/S4	2 x 3	600#	150#	99.2	—	—	—	—	—	18.9	15.8			
26HA14/S4	26HB14/S4	2 x 3	900#	150#	102	—	—	—	—	—	18.9	15.8			
26HA15/S4	26HB15/S4	2 x 3	1500#	300#	110	—	—	—	—	—	49.6	28.6			



Selection Chart

- Notes:**
- The type numbers shown on the selection chart indicate conventional valves. For BalanSeal, "O" ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
 - Outlet pressure for temperature above 38°C should not exceed the rating in ANSI B16.5.
 - For applications above 538°C, consult the Farris Factory.

J Orifice

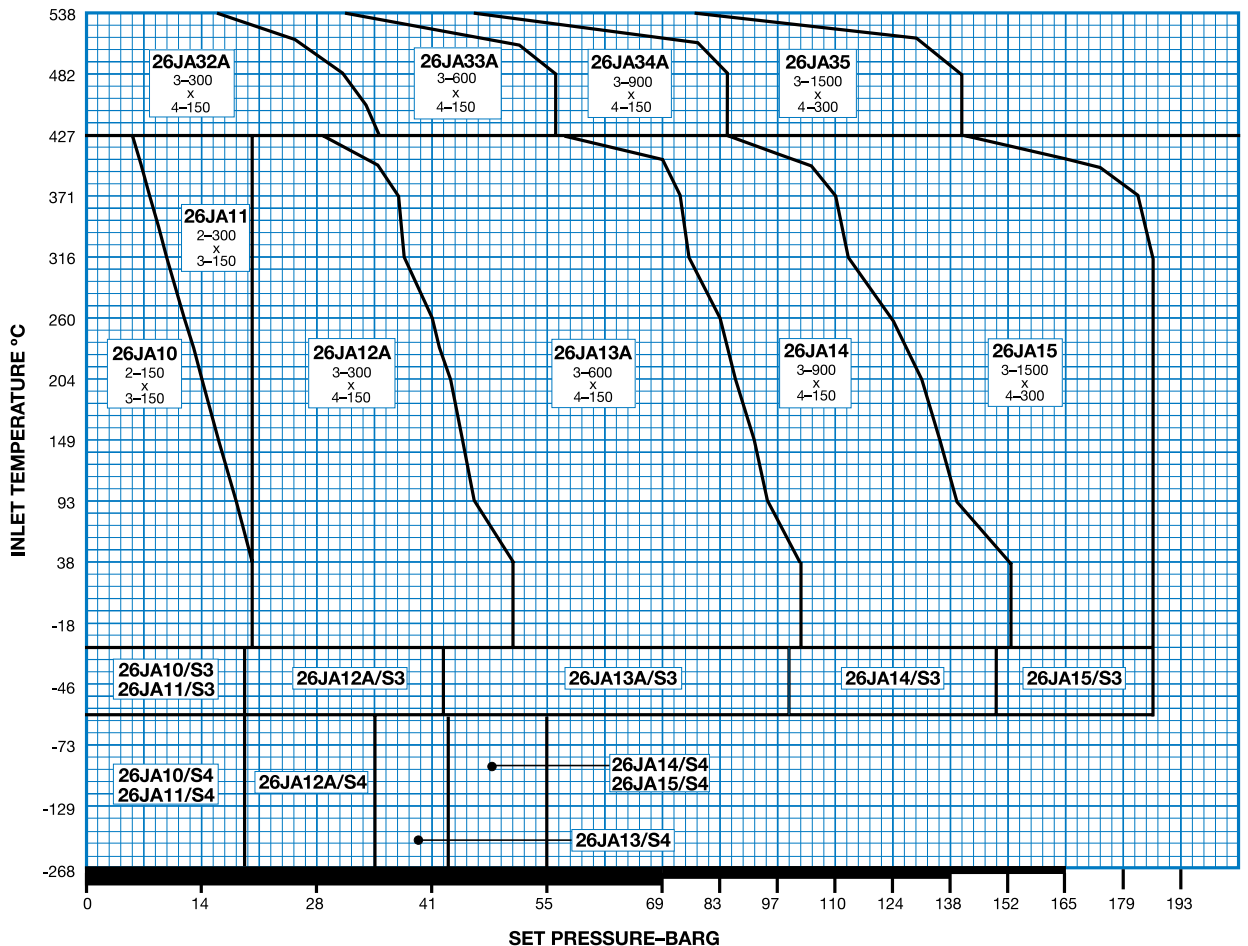
API Area: 830 sq. mm
Actual Area: 923 sq. mm

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, BARG						BACK PRESSURE LIMIT BARG @ 38°C		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-268°C -60°C	-59°C -30°C	-29°C +38°C	+232°C	+427°C	+538°C	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26JA10	26JB10	2 x 3	150#	150#	—	—	19.6	12.7	5.5	—	19.6	15.8	CARBON STEEL	CHROME ALLOY	-29°C to 427°C
26JA11	26JB11	2 x 3	300#	150#	—	—	19.6	19.6	19.6	—	19.6	15.8			
26JA12A	26JB12A	3 x 4	300#	150#	—	—	51.0	42.4	28.2	—	19.6	15.8			
26JA13A	26JB13A	3 x 4	600#	150#	—	—	102	85.1	56.8	—	19.6	15.8			
26JA14	26JB14	3 x 4	900#	150#	—	—	153	127	85.1	—	19.6	15.8			
26JA15	26JB15	3 x 4	1500#	300#	—	—	186	186	142	—	41.3	15.8			
26JA32A	26JB32A	3 x 4	300#	150#	—	—	—	—	35.1	15.5	19.6	15.8	CHROME MOLY STEEL	HIGH TEMP. ALLOY	428°C to 538°C
26JA33A	26JB33A	3 x 4	600#	150#	—	—	—	—	56.2	30.6	19.6	15.8			
26JA34A	26JB34A	3 x 4	900#	150#	—	—	—	—	84.4	46.2	19.6	15.8			
26JA35	26JB35	3 x 4	1500#	300#	—	—	—	—	141	76.8	41.3	15.8			
26JA10/S3	26JB10/S3	2 x 3	150#	150#	—	18.9	—	—	—	—	18.9	15.8	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-30°C to -59°C
26JA11/S3	26JB11/S3	2 x 3	300#	150#	—	18.9	—	—	—	—	18.9	15.8			
26JA12A/S3	26JB12A/S3	3 x 4	300#	150#	—	49.6	—	—	—	—	18.9	15.8			
26JA13A/S3	26JB13A/S3	3 x 4	600#	150#	—	99.2	—	—	—	—	18.9	15.8			
26JA14/S3	26JB14/S3	3 x 4	900#	150#	—	149	—	—	—	—	18.9	15.8			
26JA15/S3	26JB15/S3	3 x 4	1500#	300#	—	186	—	—	—	—	41.3	15.8			
26JA10/S4	26JB10/S4	2 x 3	150#	150#	18.9	—	—	—	—	—	18.9	15.8	316 ST. ST.	316 ST. ST.	-60°C to -268°C
26JA11/S4	26JB11/S4	2 x 3	300#	150#	18.9	—	—	—	—	—	18.9	15.8			
26JA12A/S4	26JB12A/S4	3 x 4	300#	150#	34.5	—	—	—	—	—	18.9	15.8			
26JA13A/S4	26JB13A/S4	3 x 4	600#	150#	43.1	—	—	—	—	—	18.9	15.8			
26JA14/S4	26JB14/S4	3 x 4	900#	150#	55	—	—	—	—	—	18.9	15.8			
26JA15/S4	26JB15/S4	3 x 4	1500#	300#	55	—	—	—	—	—	41.3	15.8			

Selection Chart

Notes:

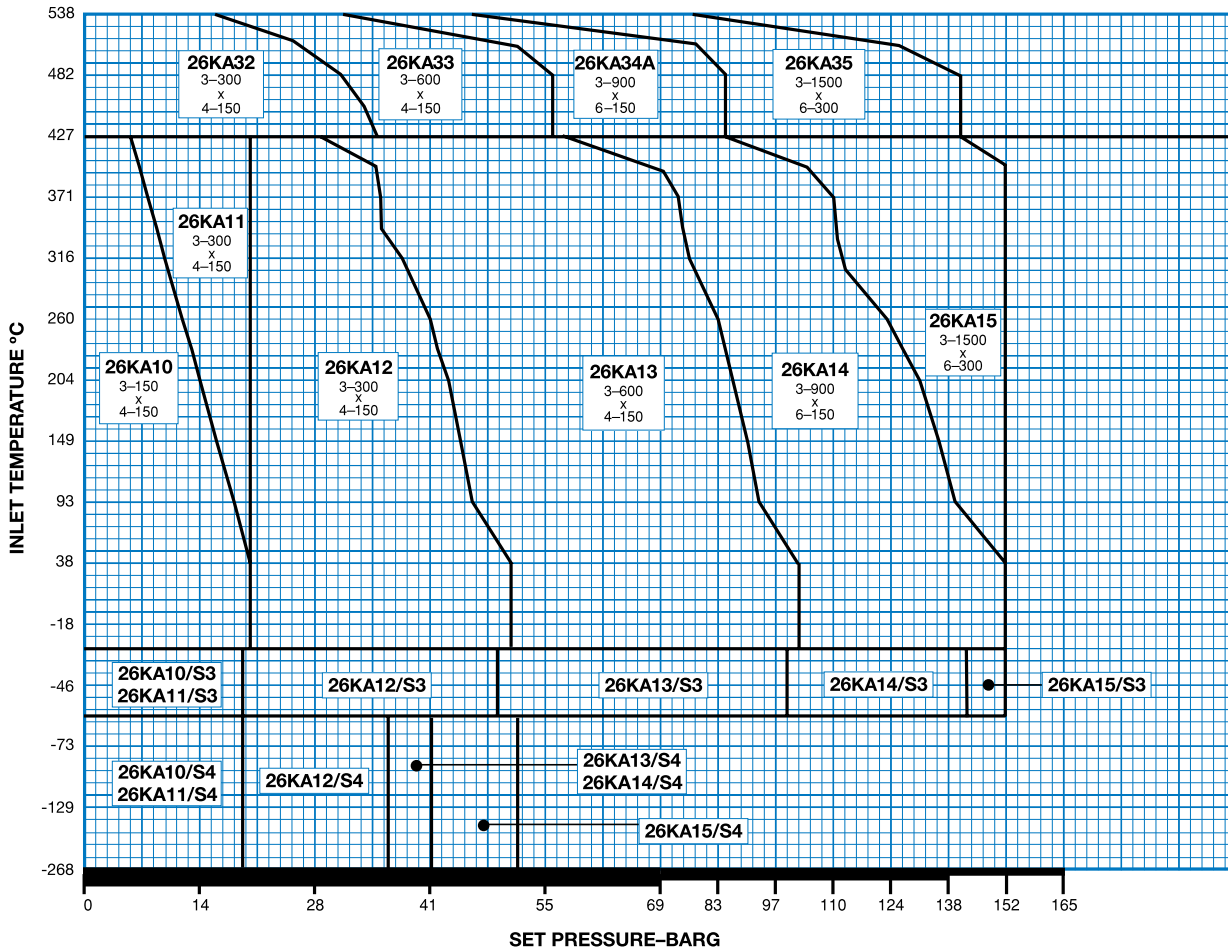
- The type numbers shown on the selection chart indicate conventional valves. For BalanSeal, "O" ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
- Outlet pressure for temperature above 38°C should not exceed the rating in ANSI B16.5.
- For applications above 538°C, consult the Farris Factory.



K Orifice

API Area: 1186 sq. mm
Actual Area: 1317 sq. mm

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, BARG						BACK PRESSURE LIMIT BARG @ 38°C		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-268°C -60°C	-59°C -30°C	-29°C +38°C	+232°C	+427°C	+538°C	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26KA10	26KB10	3 x 4	150#	150#	—	—	19.6	12.7	5.5	—	19.6	10.3	CARBON STEEL	CHROME ALLOY	-29°C to 427°C
26KA11	26KB11	3 x 4	300#	150#	—	—	19.6	19.6	19.6	—	19.6	10.3			
26KA12	26KB12	3 x 4	300#	150#	—	—	51.0	42.4	28.2	—	19.6	10.3			
26KA13	26KB13	3 x 4	600#	150#	—	—	102	85.1	56.8	—	19.6	13.8			
26KA14	26KB14	3 x 6	900#	150#	—	—	153	127	85.1	—	19.6	13.8			
26KA15	26KB15	3 x 6	1500#	300#	—	—	153	153	142	—	41.3	13.8			
26KA32	26KB32	3 x 4	300#	150#	—	—	—	—	35.1	15.5	19.6	10.3	CHROME MOLY STEEL	HIGH TEMP. ALLOY	428°C to 538°C
26KA33	26KB33	3 x 4	600#	150#	—	—	—	—	56.2	30.6	19.6	13.8			
26KA34A	26KB34A	3 x 6	900#	150#	—	—	—	—	84.4	46.2	19.6	13.8			
26KA35	26KB35	3 x 6	1500#	300#	—	—	—	—	141	76.8	41.3	13.8			
26KA10/S3	26KB10/S3	3 x 4	150#	150#	—	18.9	—	—	—	—	18.9	10.3	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-30°C to -59°C
26KA11/S3	26KB11/S3	3 x 4	300#	150#	—	18.9	—	—	—	—	18.9	10.3			
26KA12/S3	26KB12/S3	3 x 4	300#	150#	—	49.6	—	—	—	—	18.9	10.3			
26KA13/S3	26KB13/S3	3 x 4	600#	150#	—	99.2	—	—	—	—	18.9	13.8			
26KA14/S3	26KB14/S3	3 x 6	900#	150#	—	149	—	—	—	—	18.9	13.8			
26KA15/S3	26KB15/S3	3 x 6	1500#	300#	—	153	—	—	—	—	41.3	13.8			
26KA10/S4	26KB10/S4	3 x 4	150#	150#	18.9	—	—	—	—	—	18.9	10.3	316 ST. ST.	316 ST. ST.	-60°C to -268°C
26KA11/S4	26KB11/S4	3 x 4	300#	150#	18.9	—	—	—	—	—	18.9	10.3			
26KA12/S4	26KB12/S4	3 x 4	300#	150#	36.2	—	—	—	—	—	18.9	10.3			
26KA13/S4	26KB13/S4	3 x 4	600#	150#	41.3	—	—	—	—	—	18.9	13.8			
26KA14/S4	26KB14/S4	3 x 6	900#	150#	41.3	—	—	—	—	—	18.9	13.8			
26KA15/S4	26KB15/S4	3 x 6	1500#	300#	51.7	—	—	—	—	—	41.3	13.8			



Selection Chart

- Notes:**
1. The type numbers shown on the selection chart indicate conventional valves. For BalanSeal, "O" ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
 2. Outlet pressure for temperature above 38°C should not exceed the rating in ANSI B16.5.
 3. For applications above 538°C, consult the Farris Factory.

L Orifice

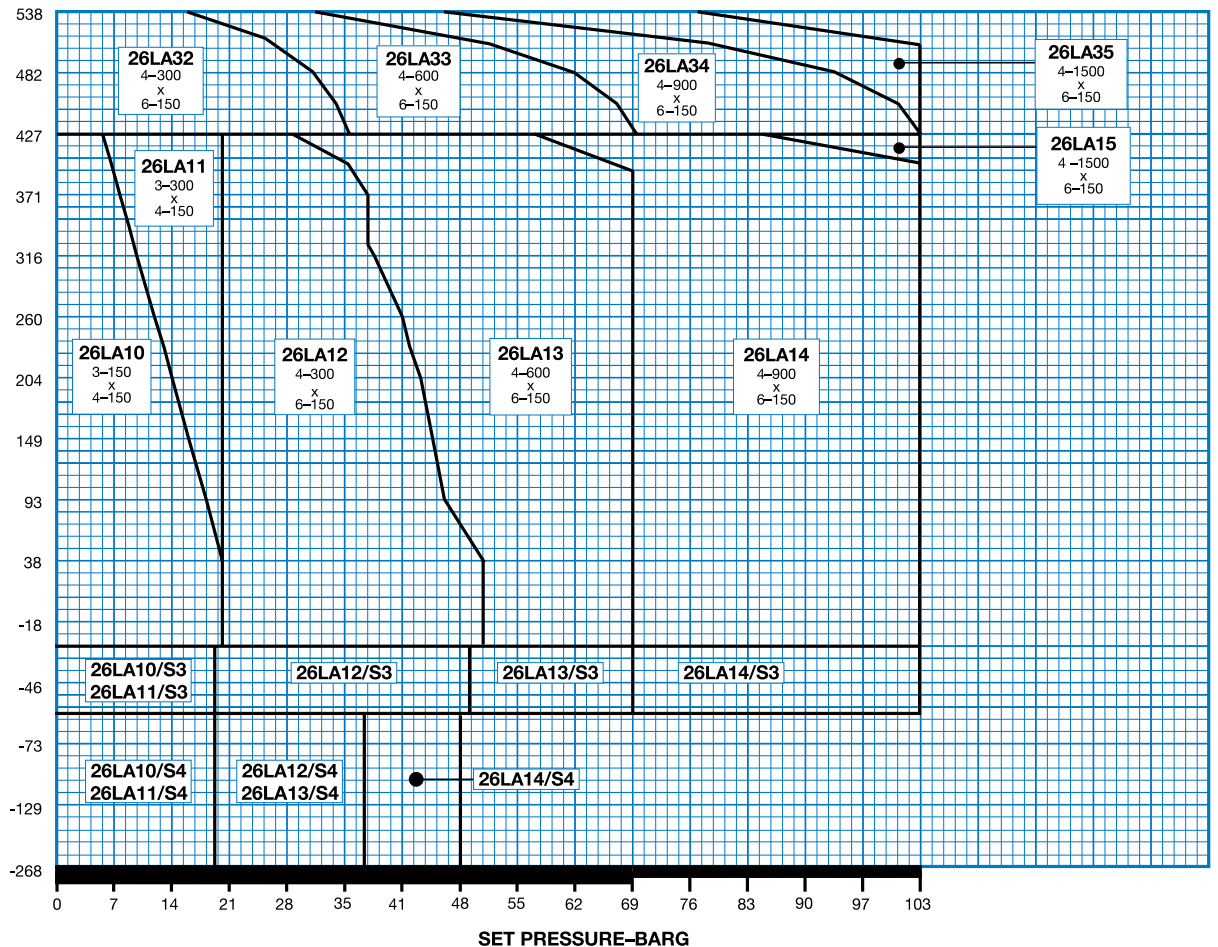
API Area: 1841 sq. mm
Actual Area: 2045 sq. mm

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, BARG						BACK PRESSURE LIMIT BARG @ 38°C		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-268°C -60°C	-59°C -30°C	-29°C +38°C	+232°C	+427°C	+538°C	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26LA10	26LB10	3 x 4	150#	150#	—	—	19.6	12.7	5.5	—	19.6	6.9	CARBON STEEL	CHROME ALLOY	-29°C to 427°C
26LA11	26LB11	3 x 4	300#	150#	—	—	19.6	19.6	19.6	—	19.6	6.9			
26LA12	26LB12	4 x 6	300#	150#	—	—	51.0	42.4	28.2	—	19.6	11.7			
26LA13	26LB13	4 x 6	600#	150#	—	—	68.9	68.9	56.8	—	19.6	11.7			
26LA14	26LB14	4 x 6	900#	150#	—	—	103	103	85.1	—	19.6	11.7			
26LA15	26LB15	4 x 6	1500#	150#	—	—	103	103	103	—	19.6	11.7			
26LA32	26LB32	4 x 6	300#	150#	—	—	—	—	35.1	15.5	19.6	11.7	CHROME MOLY STEEL	HIGH TEMP. ALLOY	428°C to 538°C
26LA33	26LB33	4 x 6	600#	150#	—	—	—	—	68.9	30.6	19.6	11.7			
26LA34	26LB34	4 x 6	900#	150#	—	—	—	—	103	46.2	19.6	11.7			
26LA35	26LB35	4 x 6	1500#	150#	—	—	—	—	103	76.8	19.6	11.7			
26LA10/S3	26LB10/S3	3 x 4	150#	150#	—	18.9	—	—	—	—	18.9	6.9	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-30°C to -59°C
26LA11/S3	26LB11/S3	3 x 4	300#	150#	—	18.9	—	—	—	—	18.9	6.9			
26LA12/S3	26LB12/S3	4 x 6	300#	150#	—	49.6	—	—	—	—	18.9	11.7			
26LA13/S3	26LB13/S3	4 x 6	600#	150#	—	68.9	—	—	—	—	18.9	11.7			
26LA14/S3	26LB14/S3	4 x 6	900#	150#	—	103	—	—	—	—	18.9	11.7			
26LA10/S4	26LB10/S4	3 x 4	150#	150#	18.9	—	—	—	—	—	18.9	6.9	316 ST. ST.	316 ST. ST.	-60°C to -268°C
26LA11/S4	26LB11/S4	3 x 4	300#	150#	18.9	—	—	—	—	—	18.9	6.9			
26LA12/S4	26LB12/S4	4 x 6	300#	150#	36.9	—	—	—	—	—	18.9	11.7			
26LA13/S4	26LB13/S4	4 x 6	600#	150#	36.9	—	—	—	—	—	18.9	11.7			
26LA14/S4	26LB14/S4	4 x 6	900#	150#	48.2	—	—	—	—	—	18.9	11.7			

Selection Chart

Notes:

- The type numbers shown on the selection chart indicate conventional valves. For BalanSeal, "O" ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
- Outlet pressure for temperature above 38°C should not exceed the rating in ANSI B16.5.
- For applications above 538°C, consult the Farris Factory.

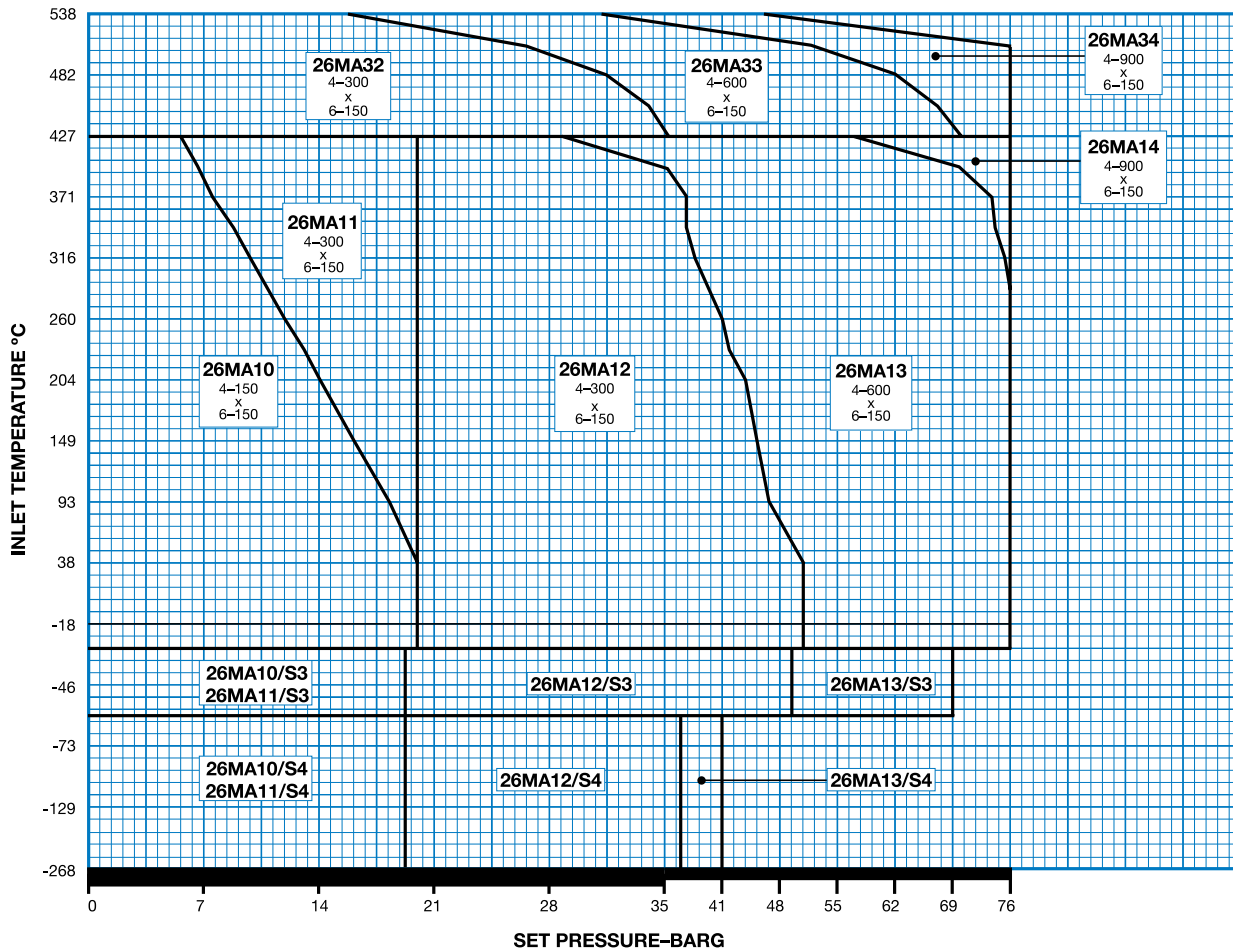


M Orifice

API Area: 2323 sq. mm

Actual Area: 2581 sq. mm

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, BARG						BACK PRESSURE LIMIT BARG @ 38°C		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-268°C -60°C	-59°C -30°C	-29°C +38°C	+232°C	+427°C	+538°C	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26MA10	26MB10	4 x 6	150#	150#	—	—	19.6	12.7	5.5	—	19.6	5.5	CARBON STEEL	CHROME ALLOY	-29°C to 427°C
26MA11	26MB11	4 x 6	300#	150#	—	—	19.6	19.6	19.6	—	19.6	5.5			
26MA12	26MB12	4 x 6	300#	150#	—	—	51.0	42.4	28.2	—	19.6	11.0			
26MA13	26MB13	4 x 6	600#	150#	—	—	75.8	75.8	56.8	—	19.6	11.0			
26MA14	26MB14	4 x 6	900#	150#	—	—	75.8	75.8	75.8	—	19.6	11.0			
26MA32	26MB32	4 x 6	300#	150#	—	—	—	—	35.1	15.5	19.6	11.0	CHROME MOLY STEEL	HIGH TEMP. ALLOY	428°C to 538°C
26MA33	26MB33	4 x 6	600#	150#	—	—	—	—	69.9	30.6	19.6	11.0			
26MA34	26MB34	4 x 6	900#	150#	—	—	—	—	75.8	46.2	19.6	11.0			
26MA10/S3	26MB10/S3	4 x 6	150#	150#	—	18.9	—	—	—	—	18.9	5.5	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-30°C to -59°C
26MA11/S3	26MB11/S3	4 x 6	300#	150#	—	18.9	—	—	—	—	18.9	5.5			
26MA12/S3	26MB12/S3	4 x 6	300#	150#	—	49.6	—	—	—	—	18.9	11.0			
26MA13/S3	26MB13/S3	4 x 6	600#	150#	—	68.9	—	—	—	—	18.9	11.0			
26MA10/S4	26MB10/S4	4 x 6	150#	150#	18.9	—	—	—	—	—	18.9	5.5	316 ST. ST.	316 ST. ST.	-60°C to -268°C
26MA11/S4	26MB11/S4	4 x 6	300#	150#	18.9	—	—	—	—	—	18.9	5.5			
26MA12/S4	26MB12/S4	4 x 6	300#	150#	36.2	—	—	—	—	—	18.9	11.0			
26MA13/S4	26MB13/S4	4 x 6	600#	150#	41.3	—	—	—	—	—	18.9	11.0			



Selection Chart

- Notes:**
1. The type numbers shown on the selection chart indicate conventional valves. For BalanSeal, "O" ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
 2. Outlet pressure for temperature above 38°C should not exceed the rating in ANSI B16.5.
 3. For applications above 538°C, consult the Farris Factory.

N Orifice

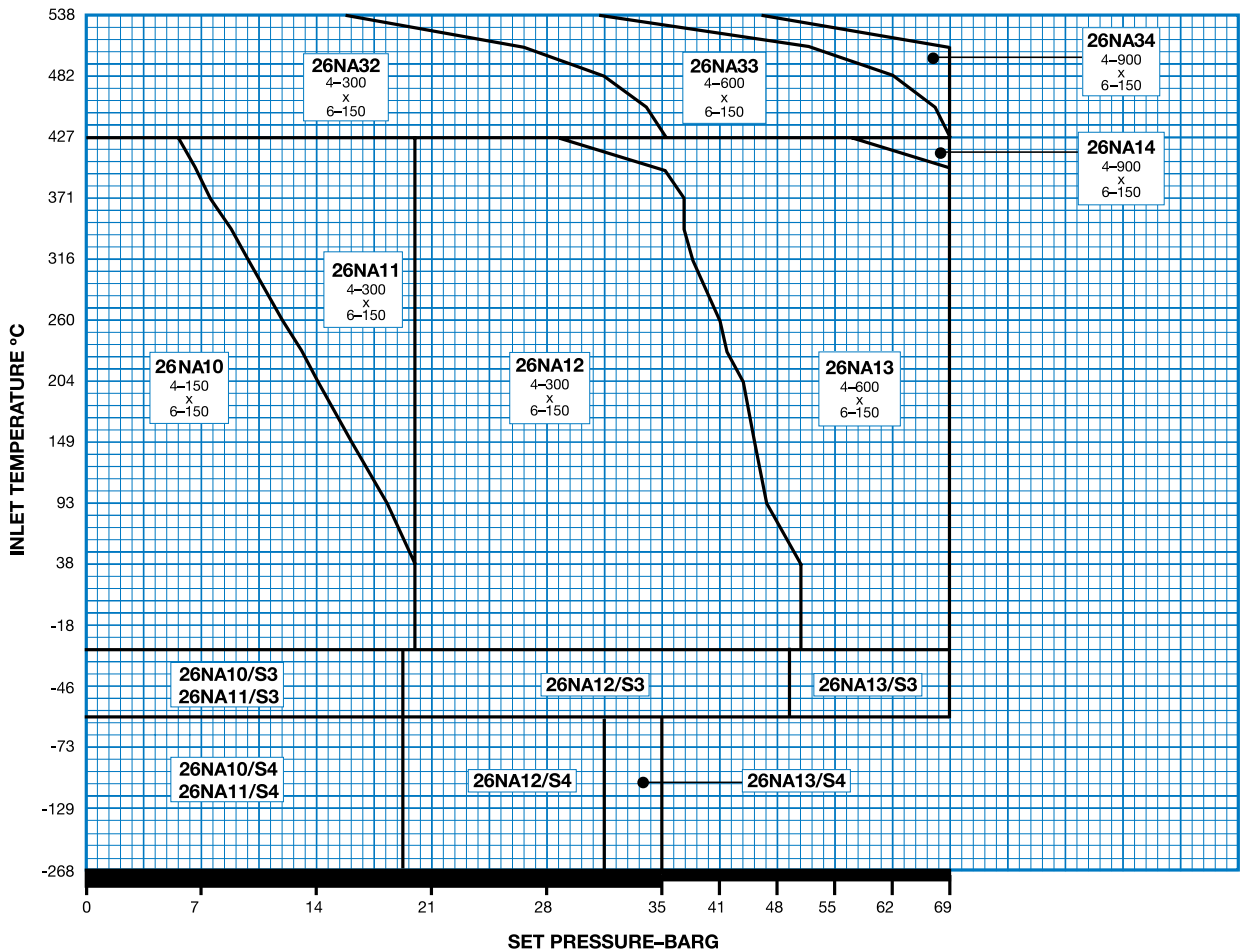
API Area: 2800 sq. mm
Actual Area: 3111 sq. mm

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, BARG						BACK PRESSURE LIMIT BARG @ 38°C		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-268°C -60°C	-59°C -30°C	-29°C +38°C	+232°C	+427°C	+538°C	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26NA10	26NB10	4 x 6	150#	150#	—	—	19.6	12.7	5.5	—	19.6	5.5	CARBON STEEL	CHROME ALLOY	-29°C to 427°C
26NA11	26NB11	4 x 6	300#	150#	—	—	19.6	19.6	19.6	—	19.6	5.5			
26NA12	26NB12	4 x 6	300#	150#	—	—	51.0	42.4	28.2	—	19.6	11.0			
26NA13	26NB13	4 x 6	600#	150#	—	—	68.9	68.9	56.8	—	19.6	11.0			
26NA14	26NB14	4 x 6	900#	150#	—	—	68.9	68.9	68.9	—	19.6	11.0			
26NA32	26NB32	4 x 6	300#	150#	—	—	—	—	35.1	15.5	19.6	11.0	CHROME MOLY STEEL	HIGH TEMP. ALLOY	428°C to 538°C
26NA33	26NB33	4 x 6	600#	150#	—	—	—	—	68.9	30.6	19.6	11.0	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-30°C to -59°C
26NA34	26NB34	4 x 6	900#	150#	—	—	—	—	68.9	46.2	19.6	11.0			
26NA10/S3	26NB10/S3	4 x 6	150#	150#	—	18.9	—	—	—	—	18.9	5.5			
26NA11/S3	26NB11/S3	4 x 6	300#	150#	—	18.9	—	—	—	—	18.9	5.5	316 ST. ST.	316 ST. ST.	-60°C to -268°C
26NA12/S3	26NB12/S3	4 x 6	300#	150#	—	49.6	—	—	—	—	18.9	11.0			
26NA13/S3	26NB13/S3	4 x 6	600#	150#	—	68.9	—	—	—	—	18.9	11.0			
26NA10/S4	26NB10/S4	4 x 6	150#	150#	18.9	—	—	—	—	—	18.9	5.5	316 ST. ST.	316 ST. ST.	-60°C to -268°C
26NA11/S4	26NB11/S4	4 x 6	300#	150#	18.9	—	—	—	—	—	18.9	5.5			
26NA12/S4	26NB12/S4	4 x 6	300#	150#	31.0	—	—	—	—	—	18.9	11.0			
26NA13/S4	26NB13/S4	4 x 6	600#	150#	34.5	—	—	—	—	—	18.9	11.0			

Selection Chart

Notes:

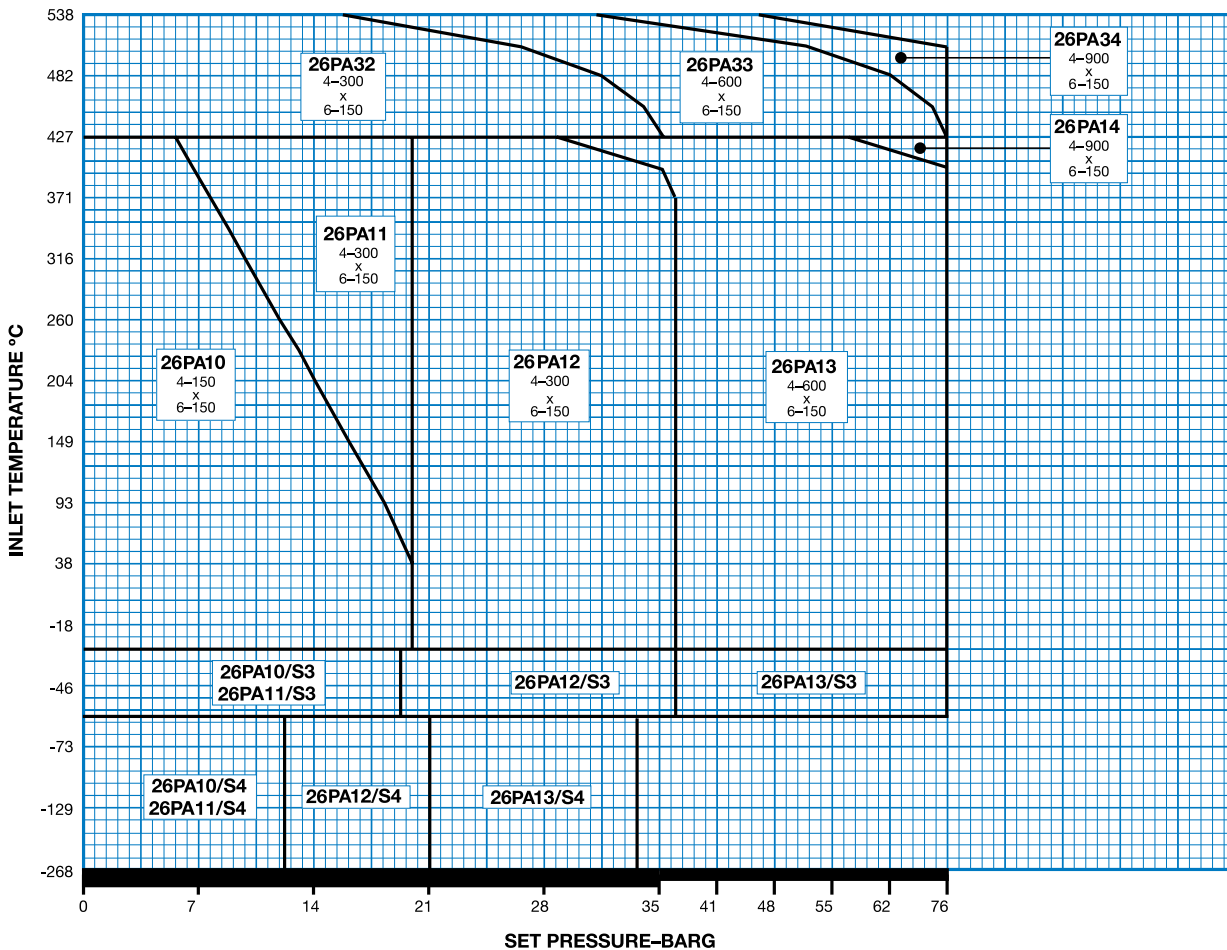
- The type numbers shown on the selection chart indicate conventional valves. For BalanSeal, "O" ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
- Outlet pressure for temperature above 38°C should not exceed the rating in ANSI B16.5.
- For applications above 538°C, consult the Farris Factory.



P Orifice

API Area: 4116 sq. mm
Actual Area: 4572 sq. mm

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, BARG						BACK PRESSURE LIMIT BARG @ 38°C		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-268°C -60°C	-59°C -30°C	-29°C +38°C	+232°C	+427°C	+538°C	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26PA10	26PB10	4 x 6	150#	150#	—	—	19.6	12.7	5.5	—	19.6	5.5	CARBON STEEL	CHROME ALLOY	-29°C to 427°C
26PA11	26PB11	4 x 6	300#	150#	—	—	19.6	19.6	19.6	—	19.6	5.5			
26PA12	26PB12	4 x 6	300#	150#	—	—	36.2	36.2	28.2	—	19.6	10.3			
26PA13	26PB13	4 x 6	600#	150#	—	—	68.9	68.9	56.8	—	19.6	10.3			
26PA14	26PB14	4 x 6	900#	150#	—	—	68.9	68.9	68.9	—	19.6	10.3			
26PA32	26PB32	4 x 6	300#	150#	—	—	—	—	35.1	15.5	19.6	10.3	CHROME MOLY STEEL	HIGH TEMP. ALLOY	428°C to 538°C
26PA33	26PB33	4 x 6	600#	150#	—	—	—	—	68.9	30.6	19.6	10.3			
26PA34	26PB34	4 x 6	900#	150#	—	—	—	—	68.9	46.2	19.6	10.3			
26PA10/S3	26PB10/S3	4 x 6	150#	150#	—	18.9	—	—	—	—	18.9	5.5	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-30°C to -59°C
26PA11/S3	26PB11/S3	4 x 6	300#	150#	—	18.9	—	—	—	—	18.9	5.5			
26PA12/S3	26PB12/S3	4 x 6	300#	150#	—	49.6	—	—	—	—	18.9	10.3			
26PA13/S3	26PB13/S3	4 x 6	600#	150#	—	68.9	—	—	—	—	18.9	10.3			
26PA10/S4	26PB10/S4	4 x 6	150#	150#	12.1	—	—	—	—	—	12.0	5.5	316 ST. ST.	316 ST. ST.	-60°C to -268°C
26PA11/S4	26PB11/S4	4 x 6	300#	150#	12.1	—	—	—	—	—	12.0	5.5			
26PA12/S4	26PB12/S4	4 x 6	300#	150#	20.7	—	—	—	—	—	18.9	10.3			
26PA13/S4	26PB13/S4	4 x 6	600#	150#	33.1	—	—	—	—	—	18.9	10.3			



Selection Chart

Notes:

1. The type numbers shown on the selection chart indicate conventional valves. For BalanSeal, "O" ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
2. Outlet pressure for temperature above 38°C should not exceed the rating in ANSI B16.5.
3. For applications above 538°C, consult the Farris Factory.

Q Orifice

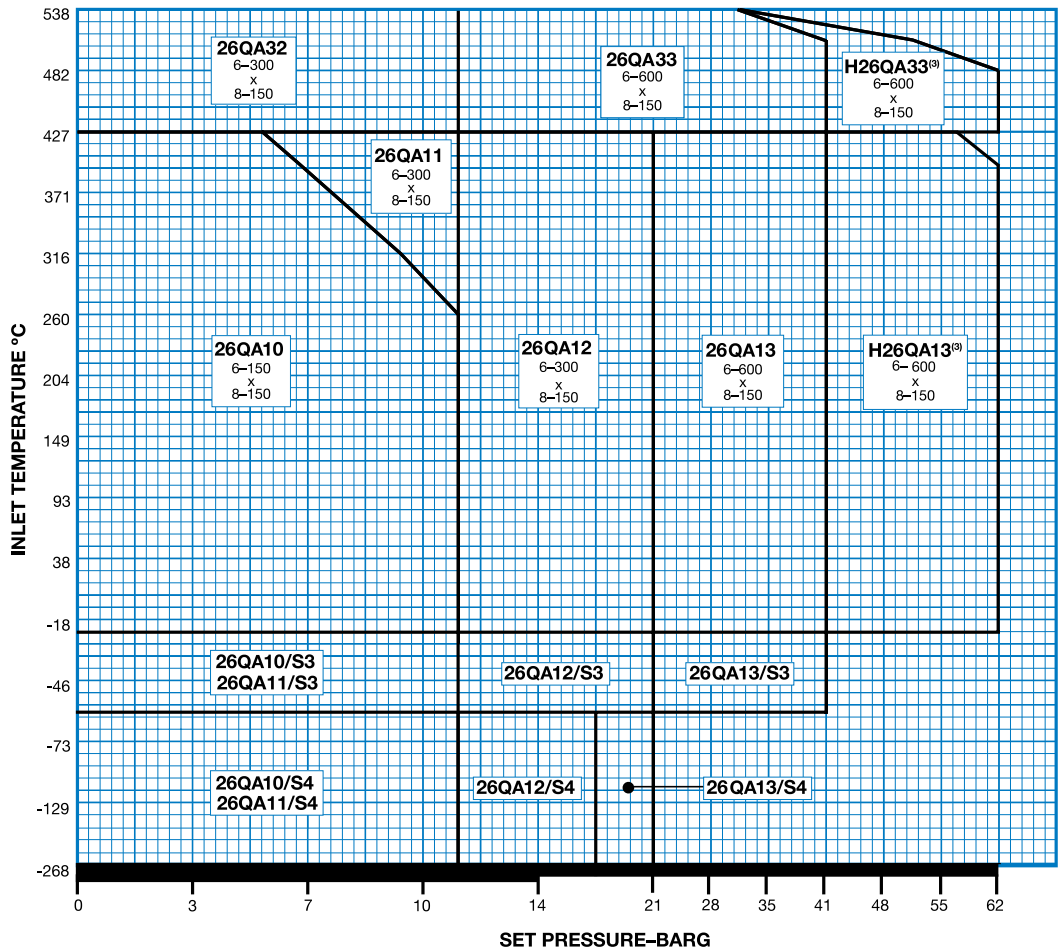
API Area: 7129 sq. mm
Actual Area: 7916 sq. mm

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, BARG						BACK PRESSURE LIMIT BARG @ 38°C		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-268°C -60°C	-59°C -30°C	-29°C +38°C	+232°C	+427°C	+538°C	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26QA10	26QB10	6 x 8	150#	150#	—	—	11.4	11.4	5.5	—	7.9	4.8	CARBON STEEL	CHROME ALLOY	-29°C to 427°C
26QA11	26QB11	6 x 8	300#	150#	—	—	11.4	11.4	11.4	—	7.9	4.8			
26QA12	26QB12	6 x 8	300#	150#	—	—	20.7	20.7	20.7	—	7.9	7.9			
26QA13	26QB13	6 x 8	600#	150#	—	—	41.3	41.3	41.3	—	7.9	7.9			
H26QA13	H26QB13	6 x 8	600#	150#	—	—	62.0	62.0	56.8	—	19.6	13.8			
26QA32	26QB32	6 x 8	300#	150#	—	—	—	—	11.4	11.4	7.9	4.8	CHROME MOLY STEEL	HIGH TEMP. ALLOY	428°C to 538°C
26QA33	26QB33	6 x 8	600#	150#	—	—	—	—	41.3	30.6	7.9	4.8			
H26QA33	H26QB33	6 x 8	600#	150#	—	—	—	—	62.0	30.7	19.6	13.8			
26QA10/S3	26QB10/S3	6 x 8	150#	150#	—	11.4	—	—	—	—	7.9	4.8	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-30°C to -59°C
26QA11/S3	26QB11/S3	6 x 8	300#	150#	—	11.4	—	—	—	—	7.9	4.8			
26QA12/S3	26QB12/S3	6 x 8	300#	150#	—	20.7	—	—	—	—	7.9	7.9			
26QA13/S3	26QB13/S3	6 x 8	600#	150#	—	41.3	—	—	—	—	7.9	7.9			
26QA10/S4	26QB10/S4	6 x 8	150#	150#	11.4	—	—	—	—	—	7.9	4.8	316 ST. ST.	316 ST. ST.	-60°C to -268°C
26QA11/S4	26QB11/S4	6 x 8	300#	150#	11.4	—	—	—	—	—	7.9	4.8			
26QA12/S4	26QB12/S4	6 x 8	300#	150#	17.2	—	—	—	—	—	7.9	7.9			
26QA13/S4	26QB13/S4	6 x 8	600#	150#	20.7	—	—	—	—	—	7.9	7.9			

Selection Chart

Notes:

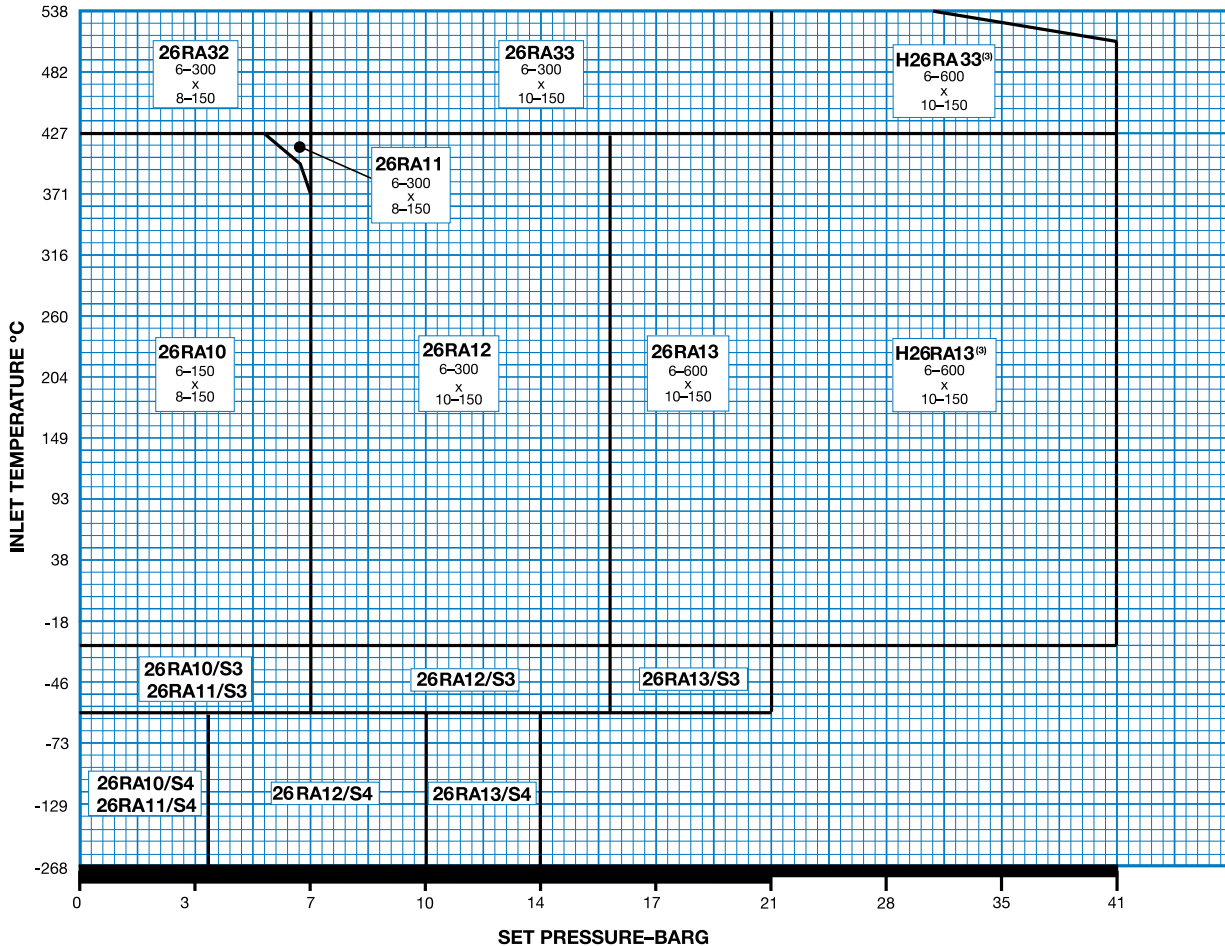
- The type numbers shown on the selection chart indicate conventional valves. For BalanSeal, "O" ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
- Outlet pressure for temperature above 38°C should not exceed the rating in ANSI B16.5.
- For applications above 538°C, consult the Farris Factory.



R Orifice

API Area: 10323 sq. mm
Actual Area: 11471 sq. mm

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, BARG						BACK PRESSURE LIMIT BARG @ 38°C		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-268°C -60°C	-59°C -30°C	-29°C +38°C	+232°C	+427°C	+538°C	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26RA10	26RB10	6 x 8	150#	150#	—	—	6.9	6.9	5.5	—	4.1	4.1	CARBON STEEL	CHROME ALLOY	-29°C to 427°C
26RA11	26RB11	6 x 8	300#	150#	—	—	6.9	6.9	6.9	—	4.1	4.1			
26RA12	26RB12	6 x 10	300#	150#	—	—	15.8	15.8	15.8	—	6.9	6.9			
26RA13	26RB13	6 x 10	600#	150#	—	—	20.7	20.7	20.7	—	6.9	6.9			
H26RA13	H26RB13	6 x 10	600#	150#	—	—	41.3	41.3	41.3	—	19.6	13.8			
26RA32	26RB32	6 x 8	300#	150#	—	—	—	—	6.9	6.8	4.1	4.1	CHROME MOLY STEEL	HIGH TEMP. ALLOY	428°C to 538°C
26RA33	26RB33	6 x 10	600#	150#	—	—	—	—	20.7	20.7	6.9	6.9			
H26RA33	H26RB33	6 x 10	600#	150#	—	—	—	—	41.3	30.7	19.6	13.8			
26RA10/S3	26RB10/S3	6 x 8	150#	150#	—	6.9	—	—	—	—	4.1	3.8	316 ST. ST.	CHROME ALLOY NICKEL PLATED	-30°C to -59°C
26RA11/S3	26RB11/S3	6 x 8	300#	150#	—	6.9	—	—	—	—	4.1	3.8			
26RA12/S3	26RB12/S3	6 x 10	300#	150#	—	15.8	—	—	—	—	6.9	6.9			
26RA13/S3	26RB13/S3	6 x 10	600#	150#	—	20.7	—	—	—	—	6.9	6.9			
26RA10/S4	26RB10/S4	6 x 8	150#	150#	3.8	—	—	—	—	—	4.1	3.8	316 ST. ST.	316 ST. ST.	-60°C to -268°C
26RA11/S4	26RB11/S4	6 x 8	300#	150#	3.8	—	—	—	—	—	4.1	3.8			
26RA12/S4	26RB12/S4	6 x 10	300#	150#	10.3	—	—	—	—	—	6.9	6.9			
26RA13/S4	26RB13/S4	6 x 10	600#	150#	13.8	—	—	—	—	—	6.9	6.9			



Selection Chart

- Notes:**
1. The type numbers shown on the selection chart indicate conventional valves. For BalanSeal, "O" ring construction, balanced piston design and other valve options, see the type numbering system on pages 10 and 11.
 2. Outlet pressure for temperature above 38°C should not exceed the rating in ANSI B16.5.
 3. For applications above 538°C, consult the Farris Factory.

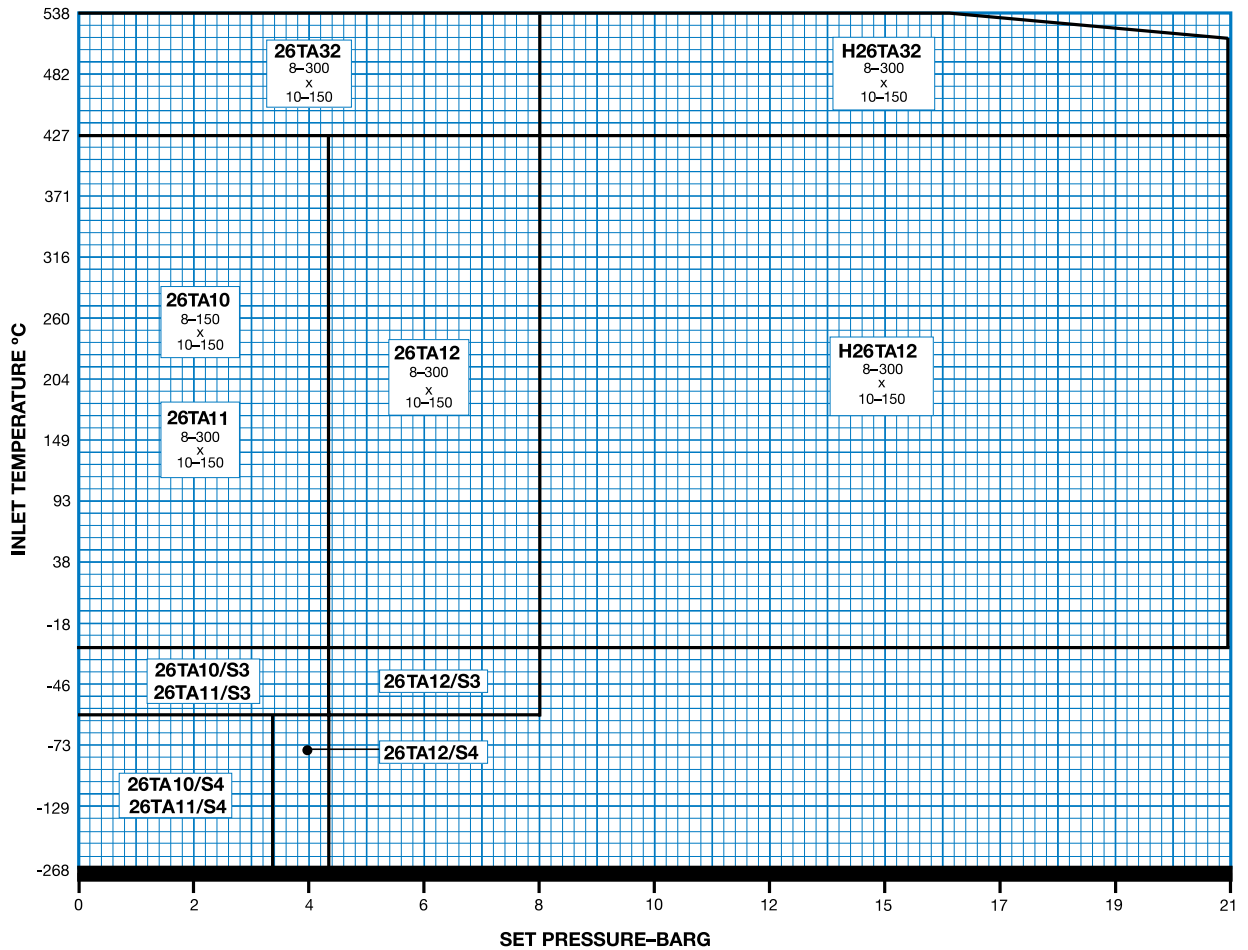
T Orifice

API Area: 16774 sq. mm
Actual Area: 18671 sq. mm

TYPE NUMBER		VALVE SIZE	ANSI FLANGE CLASS		MAXIMUM SET PRESSURE, BARG						BACK PRESSURE LIMIT BARG @ 38°C		MATERIAL		INLET TEMP. RANGE
CONVENTIONAL	BALANSEAL	INLET OUTLET	INLET RF OR RJ	OUTLET RF	-268°C -60°C	-59°C -30°C	-29°C +38°C	+232°C	+427°C	+538°C	CONVENTIONAL TYPE	BALANSEAL TYPE	BODY & BONNET	SPRING	
26TA10	26TB10	8 x 10	150#	150#	—	—	4.5	4.5	4.5	—	2.1	2.1	CARBON STEEL	CHROME ALLOY	-29°C to 232°C
26TA11	26TB11	8 x 10	300#	150#	—	—	4.5	4.5	4.5	—	2.1	2.1			
26TA12	26TB12	8 x 10	300#	150#	—	—	8.3	8.3	8.3	—	4.1	4.1			
H26TA12	H26TB12	8 x 10	300#	150#	—	—	20.7	20.7	20.7	—	6.9	6.9			
26TA32	26TB32	8 x 10	300#	150#	—	—	—	—	8.3	8.2	4.1	4.1	CHROME MOLY STEEL	HIGH TEMP. ALLOY	428°C to 538°C
H26TA32	H26TB32	8 x 10	300#	150#	—	—	—	—	20.7	15.5	6.9	6.9			
26TA10/S3	26TB10/S3	8 x 10	150#	150#	—	4.5	—	—	—	—	2.1	2.1	316 ST. ST.	CHROME ALLOY NICKEL PLTD.	-30°C to -59°C
26TA11/S3	26TB11/S3	8 x 10	300#	150#	—	4.5	—	—	—	—	2.1	2.1			
26TA12/S3	26TB12/S3	8 x 10	300#	150#	—	8.3	—	—	—	—	4.1	4.1			
26TA10/S4	26TB10/S4	8 x 10	150#	150#	3.4	—	—	—	—	—	2.1	2.1	316 ST. ST.	316 ST. ST.	-60°C to -268°C
26TA11/S4	26TB11/S4	8 x 10	300#	150#	3.4	—	—	—	—	—	2.1	2.1			
26TA12/S4	26TB12/S4	8 x 10	300#	150#	4.5	—	—	—	—	—	4.1	4.1			

Selection Chart

- Notes:**
- The type numbers shown on the selection chart indicate conventional valves. For BalanSeal, "O" ring piston design and other valve options, see the type numbering system on pages 10 and 11.
 - Outlet pressure for temperature above 38°C should not exceed the rating in ANSI B16.5.
 - For applications above 538°C, consult the Farris Factory.





Air Capacities: 10% Overpressure

ASME PRESSURE VESSEL CODE (UV)

CAPACITIES IN STANDARD CUBIC METERS PER MINUTE AT 15.6 °C

Set Pressure (barg)	Orifice Letter Designation & Areas, Sq. mm													
	AREAS	D	E	F	G	H	J	K	L	M	N	P	Q	R
API	71	126	198	325	506	830	1186	1841	2323	2800	4116	7129	10323	16774
Actual	97	145	239	361	563	923	1317	2045	2581	3111	4572	7916	11471	18671
1	2.1	3.2	5.3	8.0	12.5	20.5	29.2	45.4	57.3	69.1	101	176	255	415
2	3.1	4.6	7.7	11.6	18.1	29.7	42.5	65.9	83.2	100	147	255	370	602
3	4.1	6.2	10.3	15.5	24.3	39.8	56.9	88.3	111	134	197	342	495	806
4	5.2	7.8	12.9	19.5	30.5	50.0	71.4	110	139	168	247	429	622	1012
5	6.3	9.4	15.6	23.5	36.7	60.2	85.9	133	168	203	298	516	748	1218
6	7.3	11.0	18.2	27.5	42.9	70.3	100	156	196	237	348	603	875	1424
7	8.4	12.6	20.8	31.4	49.1	80.5	115	178	225	271	399	691	1001	1630
8	9.0	14.2	23.5	35.4	55.3	90.7	129	201	253	305	449	778	1127	1835
9	10.5	15.8	26.1	39.4	61.5	100	144	223	282	340	499	865	1254	2041
10	11.6	17.4	28.8	43.4	67.7	111	158	246	310	374	550	952	1380	2247
12	13.7	20.6	34.0	51.3	80.2	131	187	291	367	443	651	1127	1633	2659
14	15.9	23.8	39.3	59.3	92.6	151	216	336	424	511	751	1301	1886	3070
16	18.0	27.0	44.6	67.2	105	172	245	381	481	580	852	1476	2139	3482
18	20.1	30.2	49.9	75.2	117	192	274	426	538	648	953	1650	2392	3893
20	22.3	33.4	55.1	83.1	129	212	303	471	595	717	1054	1825	2645	4305
22	24.4	36.6	60.4	91.1	142	233	332	516	651	785	1155	1999	2898	—
24	26.5	39.8	65.7	99.0	154	253	361	561	708	854	1255	2174	3150	—
26	28.7	43.0	71.0	107	167	273	390	606	765	923	1356	2348	3403	—
28	30.8	46.2	76.2	114	179	294	419	651	822	991	1457	2523	3656	—
30	32.9	49.4	81.5	122	191	314	448	697	879	1060	1558	2697	3909	—
32	35.1	52.6	86.8	130	204	334	478	742	936	1128	1659	2872	4162	—
34	37.2	55.8	92.1	138	216	355	507	787	993	1197	1759	3046	4415	—
36	39.3	59.0	97.4	146	229	375	536	832	1050	1266	1860	3221	4668	—
38	41.5	62.2	102	154	241	395	565	877	1107	1334	1961	3395	4920	—
40	43.6	65.4	107	162	254	416	594	922	1163	1403	2062	3570	5173	—
42	45.7	68.6	113	170	266	436	623	967	1220	1471	2163	3745	—	—
44	47.9	71.8	118	178	278	456	652	1012	1277	1540	2263	3919	—	—
46	50.0	75.0	123	186	291	477	681	1057	1334	1608	2364	4094	—	—
48	52.1	78.2	129	194	303	497	710	1102	1391	1677	2465	4268	—	—
50	54.3	81.4	134	202	316	517	739	1147	1448	1746	2566	4443	—	—
60	64.9	97.4	160	242	378	619	884	1373	1732	2088	3070	5315	—	—
70	75.6	113	187	281	440	721	1029	1598	2017	—	—	—	—	—
80	86.3	129	213	321	502	822	1175	1824	—	—	—	—	—	—
90	96.9	145	239	361	564	924	1320	2049	—	—	—	—	—	—
100	107	161	266	401	626	1026	1465	2274	—	—	—	—	—	—
110	118	177	292	440	688	1127	1610	—	—	—	—	—	—	—
120	128	193	319	480	750	1229	1755	—	—	—	—	—	—	—
130	139	209	345	520	812	1331	1901	—	—	—	—	—	—	—
140	150	225	371	560	874	1433	2046	—	—	—	—	—	—	—
150	160	241	398	599	936	1534	2191	—	—	—	—	—	—	—
160	171	257	424	639	999	1636	—	—	—	—	—	—	—	—
170	182	273	450	679	1061	1738	—	—	—	—	—	—	—	—
180	192	289	477	719	1123	1839	—	—	—	—	—	—	—	—
190	203	305	503	758	—	—	—	—	—	—	—	—	—	—
200	214	321	530	798	—	—	—	—	—	—	—	—	—	—
210	224	337	556	838	—	—	—	—	—	—	—	—	—	—
220	235	353	582	878	—	—	—	—	—	—	—	—	—	—
230	246	369	609	917	—	—	—	—	—	—	—	—	—	—
240	256	385	635	957	—	—	—	—	—	—	—	—	—	—
250	267	401	661	997	—	—	—	—	—	—	—	—	—	—
260	278	417	688	—	—	—	—	—	—	—	—	—	—	—
270	288	433	714	—	—	—	—	—	—	—	—	—	—	—
280	299	449	741	—	—	—	—	—	—	—	—	—	—	—
290	310	465	767	—	—	—	—	—	—	—	—	—	—	—
300	320	481	793	—	—	—	—	—	—	—	—	—	—	—
310	331	497	820	—	—	—	—	—	—	—	—	—	—	—
320	342	513	846	—	—	—	—	—	—	—	—	—	—	—
330	352	529	873	—	—	—	—	—	—	—	—	—	—	—
340	363	545	899	—	—	—	—	—	—	—	—	—	—	—
350	374	561	—	—	—	—	—	—	—	—	—	—	—	—
360	384	577	—	—	—	—	—	—	—	—	—	—	—	—
370	395	593	—	—	—	—	—	—	—	—	—	—	—	—
380	406	609	—	—	—	—	—	—	—	—	—	—	—	—
390	416	625	—	—	—	—	—	—	—	—	—	—	—	—
400	427	641	—	—	—	—	—	—	—	—	—	—	—	—
410	438	657	—	—	—	—	—	—	—	—	—	—	—	—

General Notes:

- Above capacities should also be used for 2600L series when used in air service.
- Capacities at 2.0 Barg set pressure and below are based on 0.2 Bar overpressure.
- For sizing purposes the effective coefficient of discharge K_d for air, gas, and steam is 0.953 when sizing using the API effective areas. When sizing using the ASME actual areas, the certified coefficient of discharge K for air, gas, and steam service is 0.858.



ASME PRESSURE VESSEL CODE (UV) CAPACITIES IN KILOGRAMS PER HOUR AT SATURATION TEMPERATURE

Set Pressure (barg)	Orifice Letter Designation & Areas, Sq. mm													
	AREAS	D	E	F	G	H	J	K	L	M	N	P	Q	R
API	71	126	198	325	506	830	1186	1841	2323	2800	4116	7129	10323	16774
Actual	97	145	239	361	563	923	1317	2045	2581	3111	4572	7916	11471	18761
1	96	145	239	360	563	923	1318	2046	2582	3113	4575	7922	11479	18685
2	140	210	347	523	817	1339	1912	2968	3746	4516	6637	11491	16652	27104
3	188	282	465	701	1095	1794	2561	3977	5018	6049	8891	15394	22307	36308
4	236	354	584	880	1374	2251	3215	4991	6298	7592	11159	19320	27996	45569
5	284	426	702	1059	1653	2709	3868	6005	7578	9135	13427	23246	33686	54829
6	332	498	821	1237	1933	3166	4522	7020	8858	10678	15694	27173	39375	64090
7	380	570	940	1416	2212	3624	5175	8034	10138	12221	17962	31099	45064	73351
8	428	642	1059	1595	2492	4082	5829	9049	11418	13764	20230	35025	50754	82611
9	476	714	1177	1774	2771	4539	6482	10063	12698	15307	22498	38952	56443	91872
10	524	786	1296	1953	3050	4997	7135	11077	13978	16850	24766	42878	62133	101132
11	572	858	1415	2132	3330	5454	7789	12092	15258	18393	27033	46804	67822	110393
12	620	930	1533	2311	3609	5912	8442	13106	16538	19936	29301	50731	73512	119654
13	668	1002	1652	2490	3888	6370	9096	14120	17818	21479	31569	54657	79201	128914
14	716	1074	1771	2668	4168	6827	9749	15135	19098	23022	33837	58583	84891	138175
15	764	1146	1890	2847	4447	7285	10403	16149	20378	24565	36104	62509	90580	147435
16	812	1218	2008	3026	4726	7742	11056	17164	21658	26108	38372	66436	96270	156696
17	860	1290	2127	3205	5006	8200	11709	18178	22938	27651	40640	70362	101959	165957
18	908	1362	2246	3384	5285	8657	12363	19192	24218	29194	42908	74288	107649	175217
19	956	1434	2364	3563	5564	9115	13016	20207	25498	30737	45176	78215	113338	184478
20	1004	1506	2483	3742	5844	9573	13670	21221	26778	32280	47443	82141	119028	193738
22	1100	1650	2721	4099	6403	10488	14977	23250	29337	35366	51979	89994	130407	—
24	1196	1794	2958	4457	6961	11403	16283	25279	31897	38452	56515	97846	141786	—
26	1292	1938	3195	4815	7520	12318	17590	27307	34457	41538	61050	105699	153165	—
28	1388	2082	3433	5173	8079	13233	18897	29336	37017	44624	65586	113552	164544	—
30	1484	2226	3670	5530	8637	14149	20204	31365	39577	47710	70121	121404	175923	—
32	1580	2370	3908	5888	9196	15064	21511	33394	42137	50796	74657	129257	187302	—
34	1676	2514	4145	6246	9755	15979	22818	35422	44697	53883	79193	137110	198681	—
36	1772	2658	4383	6604	10313	16894	24125	37451	47257	56969	83728	144962	210059	—
38	1868	2802	4620	6962	10872	17809	25431	39480	49817	60055	88264	152815	221438	—
40	1964	2946	4858	7319	11431	18724	26738	41509	52377	63141	92799	160667	232817	—
42	2060	3090	5095	7677	11990	19640	28045	43537	54937	66227	97335	168520	—	—
44	2156	3234	5332	8035	12548	20555	29352	45566	57497	69313	101870	176373	—	—
46	2252	3378	5570	8393	13107	21470	30659	47595	60057	72399	106406	184225	—	—
48	2348	3522	5807	8750	13666	22385	31966	49624	62617	75485	110942	192078	—	—
50	2444	3666	6045	9108	14224	23300	33272	51652	65177	78571	115477	199931	—	—
52	2540	3810	6282	9466	14783	24216	34579	53681	67737	81657	120013	207783	—	—
54	2636	3954	6520	9824	15342	25131	35886	55710	70297	84743	124548	215636	—	—
56	2732	4098	6757	10181	15901	26046	37193	57739	72857	87829	129084	223489	—	—
58	2828	4242	6994	10539	16459	26961	38500	59767	75417	90915	133620	231341	—	—
60	2924	4386	7232	10897	17018	27876	39807	61796	77976	94001	138155	239194	—	—
62	3020	4530	7469	11255	17577	28791	41114	63825	80536	97087	142691	247046	—	—
64	3116	4674	7707	11612	18135	29707	42420	65854	83096	100173	147226	—	—	—
66	3212	4818	7944	11970	18694	30622	43727	67883	85656	103259	151762	—	—	—
68	3308	4962	8182	12328	19253	31537	45034	69911	88216	106345	156298	—	—	—
70	3404	5106	8419	12686	19812	32452	46341	71940	90776	—	—	—	—	—
72	3500	5250	8656	13043	20370	33367	47648	73969	93336	—	—	—	—	—
74	3596	5394	8894	13401	20929	34283	48955	75998	95896	—	—	—	—	—
76	3692	5538	9131	13759	21488	35198	50262	78026	—	—	—	—	—	—
78	3788	5682	9369	14117	22046	36113	51568	80055	—	—	—	—	—	—
80	3884	5826	9606	14474	22605	37028	52875	82084	—	—	—	—	—	—
82	3980	5970	9844	14832	23164	37943	54182	84113	—	—	—	—	—	—
84	4076	6114	10081	15190	23722	38858	55489	86141	—	—	—	—	—	—
86	4172	6258	10319	15548	24281	39774	56796	88170	—	—	—	—	—	—
88	4268	6402	10556	15905	24840	40689	58103	90199	—	—	—	—	—	—
90	4364	6546	10793	16263	25399	41604	59410	92228	—	—	—	—	—	—
92	4460	6690	11031	16621	25957	42519	60716	94256	—	—	—	—	—	—
94	4556	6834	11268	16979	26516	43434	62023	96285	—	—	—	—	—	—
96	4652	6978	11506	17336	27075	44350	63330	98314	—	—	—	—	—	—
98	4748	7122	11743	17694	27633	45265	64637	100343	—	—	—	—	—	—
100	4844	7266	11981	18052	28192	46180	65944	102371	—	—	—	—	—	—
110	5324	7986	13168	19841	30986	50756	72478	—	—	—	—	—	—	—
120	5804	8706	14355	21629	33779	55332	79012	—	—	—	—	—	—	—
130	6284	9426	15542	23418	36573	59908	85547	—	—	—	—	—	—	—
140	6764	10146	16729	25207	39366	64484	92081	—	—	—	—	—	—	—
150	7244	10866	17916	26996	42160	69059	98615	—	—	—	—	—	—	—
160	7724	11586	19104	28784	44953	73635	—	—	—	—	—	—	—	—
170	8204	12306	20291	30573	47747	78211	—	—	—	—	—	—	—	—
180	8684	13026	21478	32362	50540	82787	—	—	—	—	—	—	—	—
190	9164	13746	22665	34151	—	—	—	—	—	—	—	—	—	—
200	9643	14465	23852	35939	—	—	—	—	—	—	—	—	—	—

General Notes:

- Above capacities should also be used for 2600L series when used in steam service.
- Capacities at 2.0 Barg set pressure and below are based on 0.2 Bar overpressure.
- For sizing purposes the effective coefficient of discharge K_d for air, gas, and steam is 0.953 when sizing using the API effective areas. When sizing using the ASME actual areas, the certified coefficient of discharge K for air, gas, and steam service is 0.858.



Water Capacities - 2600L, 10% Overpressure

ASME PRESSURE VESSEL CODE (UV)

CAPACITIES IN LITERS PER MINUTE AT 21 °C

Set Pressure (barg)	Orifice Letter Designation & Areas, Sq. mm													
	AREAS	D	E	F	G	H	J	K	L	M	N	P	Q	R
API	71	126	198	325	506	830	1186	1841	2323	2800	4116	7129	10323	16774
Actual	97	145	239	361	563	923	1317	2045	2581	3111	4572	7916	11471	18761
1	58.8	88.2	145	219	342	561	801	1244	1569	1892	2781	4815	6977	11357
2	79.6	119	196	296	463	758	1083	1682	2122	2559	3761	6511	9435	15358
3	97.3	146	240	362	566	928	1325	2057	2595	3129	4599	7962	11538	18781
4	112	168	278	418	654	1071	1530	2375	2997	3613	5310	9194	13323	21686
5	125	188	310	468	731	1198	1710	2655	3351	4040	5937	10280	14896	24246
6	137	206	340	513	801	1312	1874	2909	3671	4425	6504	11261	16318	26561
7	148	223	367	554	865	1417	2024	3142	3965	4780	7025	12163	17625	28689
8	158	238	393	592	925	1515	2164	3359	4239	5110	7510	13003	18842	30670
9	168	252	417	628	981	1607	2295	3563	4496	5420	7966	13792	19985	32530
10	177	266	439	662	1034	1694	2419	3756	4739	5713	8397	14538	21066	34290
12	194	292	481	725	1133	1856	2650	4114	5191	6258	9198	15925	23077	37562
14	210	315	520	783	1223	2004	2862	4444	5607	6760	9935	17202	24926	40572
16	224	337	556	837	1308	2143	3060	4751	5995	7226	10621	18389	26647	43373
18	238	357	589	888	1387	2273	3246	5039	6358	7665	11265	19505	28264	46005
20	251	377	621	936	1462	2396	3421	5311	6702	8080	11875	20560	29793	—
22	263	395	652	982	1534	2513	3588	5571	7029	8474	12455	21563	31247	—
24	275	413	681	1026	1602	2624	3748	5818	7342	8851	13008	22522	32636	—
26	286	429	708	1067	1667	2732	3901	6056	7642	9212	13540	23442	33969	—
28	297	446	735	1108	1730	2835	4048	6285	7930	9560	14051	24327	35251	—
30	307	461	761	1147	1791	2934	4190	6505	8209	9895	14544	25181	36489	—
32	317	476	786	1184	1850	3030	4328	6719	8478	10220	15021	26006	—	—
34	327	491	810	1221	1907	3124	4461	6925	8739	10535	15483	26807	—	—
36	337	505	834	1256	1962	3214	4590	7126	8992	10840	15932	27584	—	—
38	346	519	856	1291	2016	3302	4716	7321	9238	11137	16369	28340	—	—
40	355	533	879	1324	2068	3388	4839	7512	9478	11426	16794	29076	—	—
42	364	546	900	1357	2119	3472	4958	7697	9713	11709	17209	29794	—	—
44	372	559	922	1389	2169	3554	5075	7878	9941	11984	17614	—	—	—
46	381	571	942	1420	2218	3634	5189	8055	10165	12253	18009	—	—	—
48	389	584	963	1451	2266	3712	5300	8229	10383	—	—	—	—	—
50	397	596	982	1481	2312	3788	5410	8398	10597	—	—	—	—	—
60	435	653	1076	1622	2533	4150	5926	9200	—	—	—	—	—	—
70	470	705	1163	1752	2736	4482	6401	9937	—	—	—	—	—	—
80	502	754	1243	1873	2925	4792	6843	10623	—	—	—	—	—	—
90	533	799	1318	1987	3103	5083	7258	11268	—	—	—	—	—	—
100	562	843	1390	2094	3271	5358	7651	11877	—	—	—	—	—	—
110	589	884	1457	2196	3430	5619	8024	12457	—	—	—	—	—	—
120	615	923	1522	2294	3583	5869	8381	13011	—	—	—	—	—	—
130	640	961	1584	2388	3729	6109	8723	13542	—	—	—	—	—	—
140	665	997	1644	2478	3870	6339	9052	—	—	—	—	—	—	—
150	688	1032	1702	2565	4006	6562	9370	—	—	—	—	—	—	—
160	710	1066	1758	2649	4137	6777	9678	—	—	—	—	—	—	—
170	732	1099	1812	2730	4264	6986	9975	—	—	—	—	—	—	—
180	754	1131	1865	2810	4388	7188	10265	—	—	—	—	—	—	—
190	774	1162	1916	2887	4508	7385	10546	—	—	—	—	—	—	—
200	794	1192	1965	2962	4625	7577	10820	—	—	—	—	—	—	—
210	814	1221	2014	3035	4740	7764	11087	—	—	—	—	—	—	—
220	833	1250	2061	3106	4851	7947	11348	—	—	—	—	—	—	—
230	852	1278	2108	3176	4960	8125	11603	—	—	—	—	—	—	—
240	870	1306	2153	3244	5067	8300	11853	—	—	—	—	—	—	—
250	888	1332	2197	3311	5171	8471	—	—	—	—	—	—	—	—
260	906	1359	2241	3377	5274	8639	—	—	—	—	—	—	—	—
270	923	1385	2284	3441	5374	8804	—	—	—	—	—	—	—	—
280	940	1410	2326	3504	5473	8965	—	—	—	—	—	—	—	—
290	957	1435	2367	3566	5570	9124	—	—	—	—	—	—	—	—
300	973	1460	2407	3627	—	—	—	—	—	—	—	—	—	—
310	989	1484	2447	3687	—	—	—	—	—	—	—	—	—	—
320	1005	1508	2486	3746	—	—	—	—	—	—	—	—	—	—
330	1020	1531	2525	3804	—	—	—	—	—	—	—	—	—	—
340	1036	1554	2563	3862	—	—	—	—	—	—	—	—	—	—
350	1051	1577	2600	—	—	—	—	—	—	—	—	—	—	—
360	1066	1599	2637	—	—	—	—	—	—	—	—	—	—	—
370	1081	1621	2673	—	—	—	—	—	—	—	—	—	—	—
380	1095	1643	—	—	—	—	—	—	—	—	—	—	—	—
390	1109	1664	—	—	—	—	—	—	—	—	—	—	—	—
400	1124	1686	—	—	—	—	—	—	—	—	—	—	—	—
410	1138	1707	—	—	—	—	—	—	—	—	—	—	—	—

General Notes:
 1. Capacities at 2.0 Barg set pressure and below are based on 0.2 Bar overpressure.
 2. For sizing purposes the effective coefficient of discharge K_d for liquids is 0.724 when sizing using the API effective areas. When sizing using the ASME actual areas, the certified coefficient of discharge K for water is 0.652.

Water Capacities - 2600: 25% Overpressure



NON-CODE

CAPACITIES IN LITERS PER MINUTE AT 21 °C

Set Pressure (barg)	Orifice Letter Designation & Areas, Sq. mm													
	AREAS	D	E	F	G	H	J	K	L	M	N	P	Q	R
API	71	126	198	325	506	830	1186	1841	2323	2800	4116	7129	10323	16774
Actual	97	145	239	361	563	923	1317	2045	2581	3111	4572	7916	11471	18761
1	52.9	79.3	130	197	308	504	720	1118	1411	1701	2500	4329	6273	10211
2	74.8	112	185	278	435	713	1019	1581	1996	2406	3536	6122	8872	14441
3	91.6	137	226	341	533	873	1248	1937	2444	2947	4331	7499	10866	17687
4	105	158	261	394	616	1009	1441	2237	2822	3402	5001	8659	12547	20423
5	118	177	292	441	688	1128	1611	2501	3156	3804	5591	9681	14028	22834
6	129	194	320	483	754	1235	1764	2739	3457	4167	6125	10605	15367	25013
7	140	210	346	521	815	1335	1906	2959	3734	4501	6616	11455	16599	27017
8	149	224	370	557	871	1427	2038	3163	3992	4812	7073	12245	17745	28883
9	158	238	392	591	924	1513	2161	3355	4234	5104	7502	12988	18821	30635
10	167	251	413	623	974	1595	2278	3537	4463	5380	7907	13691	19839	32292
12	183	275	453	683	1067	1747	2496	3874	4889	5894	8662	14998	21733	35374
14	198	297	489	738	1152	1888	2696	4185	5281	6366	9356	16199	23474	38209
16	211	317	523	788	1232	2018	2882	4474	5645	6805	10002	17318	25095	40847
18	224	336	555	836	1306	2140	3057	4745	5988	7218	10609	18368	26617	43325
20	236	355	585	882	1377	2256	3222	5002	6312	7609	11183	19362	28057	—
22	248	372	614	925	1444	2366	3379	5246	6620	7980	11729	20307	29427	—
24	259	388	641	966	1509	2471	3529	5479	6914	8335	12251	21210	30735	—
26	269	404	667	1005	1570	2572	3674	5703	7196	8675	12751	22076	31990	—
28	280	420	692	1043	1630	2670	3812	5918	7468	9003	13232	22910	33198	—
30	289	434	717	1080	1687	2763	3946	6126	7730	9319	13697	23714	34363	—
32	299	449	740	1115	1742	2854	4076	6327	7984	9625	14146	24491	—	—
34	308	462	763	1150	1796	2942	4201	6522	8230	9921	14581	25245	—	—
36	317	476	785	1183	1848	3027	4323	6711	8468	10208	15004	25977	—	—
38	326	489	806	1215	1898	3110	4441	6895	8700	10488	15415	26689	—	—
40	334	502	827	1247	1948	3191	4557	7074	8926	10761	15815	27382	—	—
42	343	514	848	1278	1996	3270	4669	7249	9147	11026	16206	28059	—	—
44	351	526	868	1308	2043	3347	4779	7419	9362	11286	16587	—	—	—
46	358	538	887	1337	2089	3422	4886	7586	9572	11540	16960	—	—	—
48	366	550	906	1366	2134	3495	4992	7749	9778	—	—	—	—	—
50	374	561	925	1394	2178	3568	5095	7909	9980	—	—	—	—	—
60	409	614	1014	1527	2386	3908	5581	8664	—	—	—	—	—	—
70	442	664	1095	1650	2577	4221	6028	9358	—	—	—	—	—	—
80	473	710	1170	1764	2755	4513	6444	10004	—	—	—	—	—	—
90	502	753	1241	1871	2922	4786	6835	10611	—	—	—	—	—	—
100	529	793	1309	1972	3080	5045	7205	11185	—	—	—	—	—	—
110	555	832	1373	2068	3230	5292	7557	11731	—	—	—	—	—	—
120	579	869	1434	2160	3374	5527	7893	12253	—	—	—	—	—	—
130	603	905	1492	2248	3512	5753	8215	12753	—	—	—	—	—	—
140	626	939	1548	2333	3644	5970	8525	—	—	—	—	—	—	—
150	648	972	1603	2415	3772	6179	8824	—	—	—	—	—	—	—
160	669	1004	1655	2495	3896	6382	9114	—	—	—	—	—	—	—
170	690	1035	1706	2571	4016	6579	9394	—	—	—	—	—	—	—
180	710	1065	1756	2646	4132	6769	9667	—	—	—	—	—	—	—
190	729	1094	1804	2718	4246	6955	9931	—	—	—	—	—	—	—
200	748	1122	1851	2789	4356	7136	10190	—	—	—	—	—	—	—
210	767	1150	1897	2858	4464	7312	10441	—	—	—	—	—	—	—
220	785	1177	1941	2925	4569	7484	10687	—	—	—	—	—	—	—
230	802	1204	1985	2991	4671	7652	10927	—	—	—	—	—	—	—
240	819	1229	2028	3055	4772	7817	11162	—	—	—	—	—	—	—
250	836	1255	2069	3118	4870	7978	—	—	—	—	—	—	—	—
260	853	1280	2110	3180	4967	8136	—	—	—	—	—	—	—	—
270	869	1304	2151	3241	5061	8291	—	—	—	—	—	—	—	—
280	885	1328	2190	3300	5154	8443	—	—	—	—	—	—	—	—
290	901	1352	2229	3359	5245	8592	—	—	—	—	—	—	—	—
300	916	1375	2267	3416	—	—	—	—	—	—	—	—	—	—
310	931	1397	2304	3472	—	—	—	—	—	—	—	—	—	—
320	946	1420	2341	3528	—	—	—	—	—	—	—	—	—	—
330	961	1442	2378	3583	—	—	—	—	—	—	—	—	—	—
340	975	1463	2413	3637	—	—	—	—	—	—	—	—	—	—
350	990	1485	2449	—	—	—	—	—	—	—	—	—	—	—
360	1004	1506	2483	—	—	—	—	—	—	—	—	—	—	—
370	1018	1527	2518	—	—	—	—	—	—	—	—	—	—	—
380	1031	1547	—	—	—	—	—	—	—	—	—	—	—	—
390	1045	1567	—	—	—	—	—	—	—	—	—	—	—	—
400	1058	1587	—	—	—	—	—	—	—	—	—	—	—	—
410	1071	1607	—	—	—	—	—	—	—	—	—	—	—	—

General Notes:
 1. Capacities at 2.0 Barg set pressure and below are based on 0.2 Bar overpressure.
 2. For sizing purposes the effective coefficient of discharge K_d for liquids is 0.64 when sizing using the API effective areas. When sizing using the ASME actual areas, the certified coefficient of discharge K for water is 0.576.



2600 Series Super Capacity Pressure Relief Valves

Farris Engineering offers a complete line of large orifice, spring-loaded safety relief valves for applications requiring flows larger than the standard API “T” orifice. These large orifice valves offer the same superior design, construction, metallurgy, and options as the standard 2600 Series. Features include full nozzle, balanced bellows, isolation of bonnet spring chamber, integral one-piece sleeve guide, temperature equalizing disc, and positive connection of internal parts. Six sizes with inlets ranging from 8” to 20” and effective orifice areas from 31.5 to 176.7 square inches are available.

The 2600 Series large orifice valves are offered in both conventional and BalanSeal construction with ANSI Class 300 RF flanged inlet by ANSI Class 150 RF flanged outlet, and temperature range from -20° to 800° F. They are designed and built in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII. Capacity ratings are certified by the National Board of Boiler and Pressure Vessel Inspectors.

Orifice	Actual Orifice Area		Type Number		Valve Size Inlet X Outlet (inches)	Maximum Set Pressure, PSIG		Maximum Set Pressure, BARG		Maximum Back Pressure All Designs	
	Square Inches	Square Centimeters	Conventional	BalanSeal		-20°F to +450°F	+451°F to +800°F	-29°C to +232°C	+233°C to +427°C	PSIG @ 100°F	BARG @ 38°C
U	31.5	203.2	26UA10	26UB10	8 x 10	65	65	4.5	4.5	30	2.1
			26UA11	26UB11		65	65	4.5	4.5	30	2.1
			26UA12	26UB12		120	120	8.3	8.3	60	4.1
			H26UA12	H26UB12		300	300	20.7	20.7	100	6.9
W	63.6	410.2	26WA12	26WB12	12 x 16	300	300	20.7	20.7	100	6.9
W2	104.0	670.8	26W2A12	26W2B12	16 x 18	300	300	20.7	20.7	100	6.9
X	113.1	729.5	26XA12	26XB12	16 x 20	300	300	20.7	20.7	100	6.9
Y	143.1	923.0	26YA12	26YB12	18 x 24	300	300	20.7	20.7	100	6.9
Z	176.7	1139.7	26ZA12	26ZB12	20 x 24	300	200	20.7	13.8	100	6.9

Materials of Construction: Carbon steel body and bonnet, stainless steel trim and chrome alloy spring. Other materials available on application. Consult the factory.

Connections: ANSI Class 300#RF inlet x 150#RF. Other connection types available on application. Consult the factory.

General Notes:

1. All valves supplied with plain caps unless otherwise specified. Standard suffix for type number is “-120”. For other cap construction, refer to page 69.
2. For set pressures under 20 psig (1.4 barg) consult the factory.
3. ASME Boiler and Pressure Vessel Code Section VIII requires all valves have a lifting lever when used for air, steam and hot water (over 140°F).
4. For corrosive, low and high temperature materials, ANSI Class 150 inlet flange and open yoke designs, consult the Factory.
5. Standard flange finish is serrated unless otherwise specified.
6. Optional equipment includes: air set device for set pressure testing, extra large lapping glass for valve seat maintenance, spring compression device for set pressure adjustment, and special disassembly and reassembly equipment.
7. The “U” orifice with 300# inlet flange is available up to 1000°F. Set pressures are the same as the comparable “T” orifice.

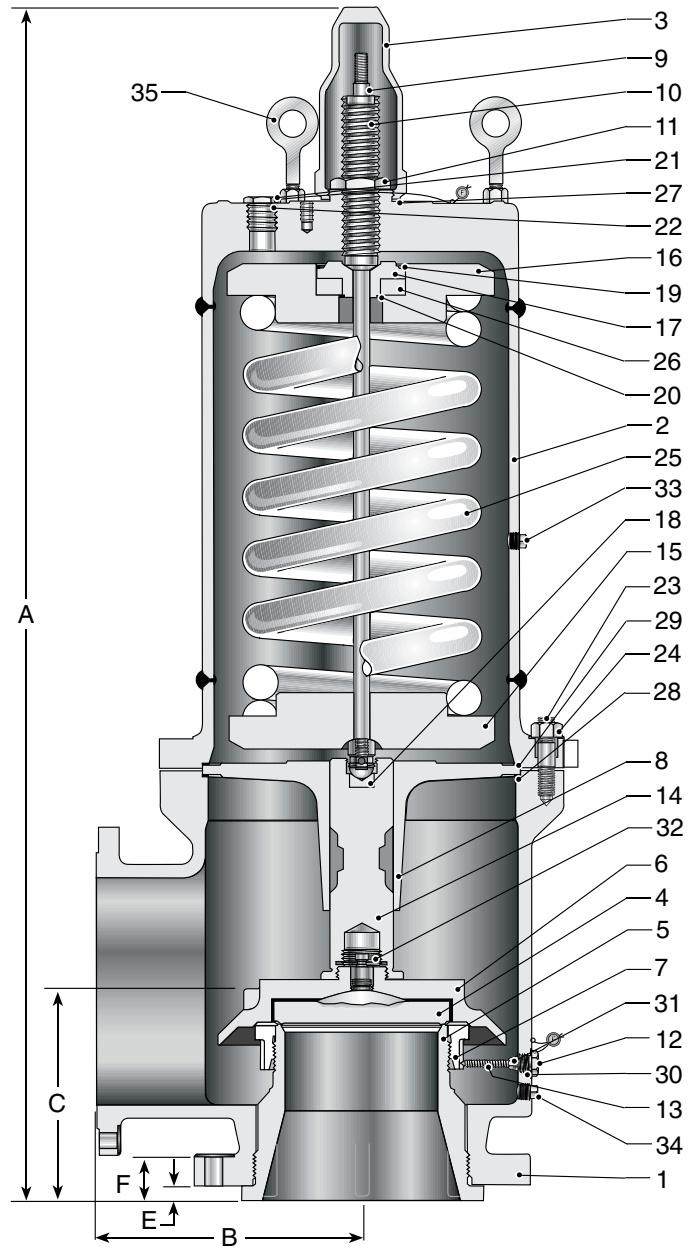
2600 Series Large Orifice Conventional



Bill of Materials—Conventional

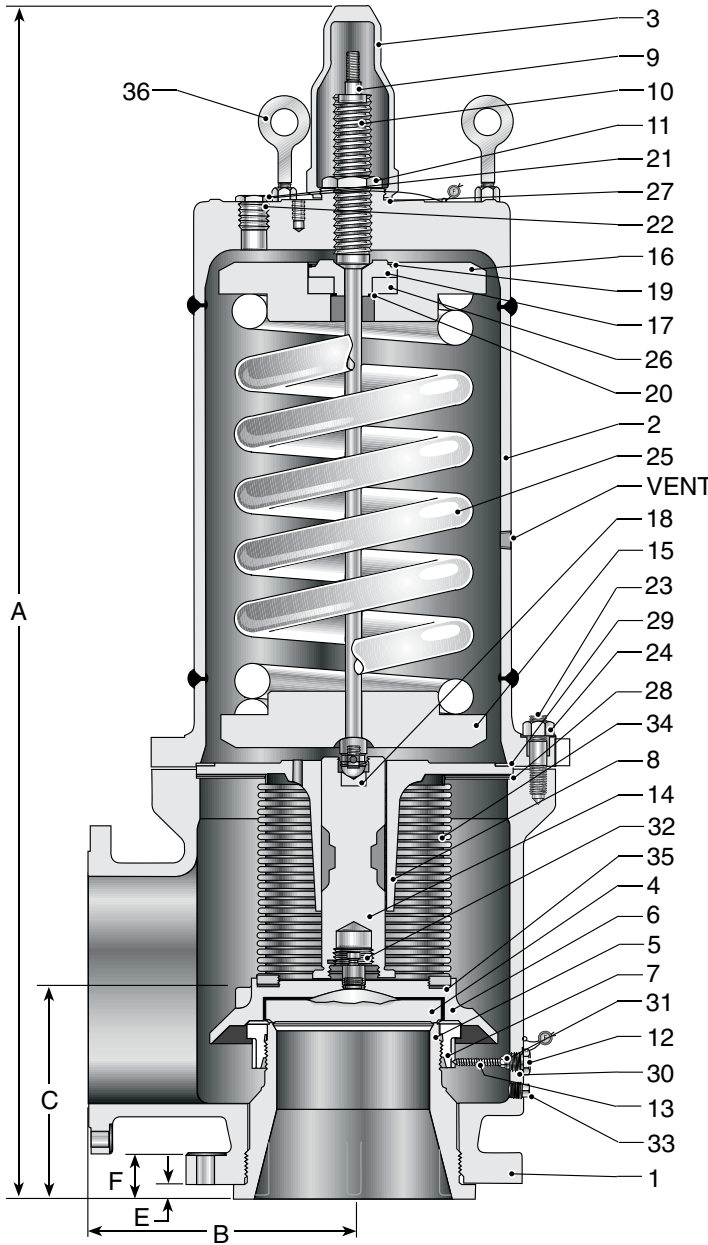
ITEM	PART NAME	MATERIAL
1	Body 26()A12	ASTM A216 Gr. WCB. Carb. St.
2	Bonnet 26()A12	ASTM A216 Gr. WCB. Carb. St.
3	Cap, Plain Screwed	ASTM A216 Gr. WCB. Carb. St.
4	Disc	Stainless Steel
5	Nozzle	316 St. St.
6	Disc Holder	Stainless Steel
7	Blowdown Ring	Stainless Steel
8	Sleeve Guide 26()A12	Stainless Steel
9	Stem	Stainless Steel
10	Spring Adjusting Screw	Stainless Steel
11	Jam Nut (Spr. Adj. Screw)	Stainless Steel
12	Lock Screw (B.D.R.)	Stainless Steel
13	Lock Screw Stud	Stainless Steel
14	Stem Retainer	Stainless Steel
15	Spring Button, Lower	Carbon St. Rust Proofed
16	Spring Button, Upper	Carbon St. Rust Proofed
17*	Insert, Spring Button Upper	Stainless Steel
18	Stem Insert	Stainless Steel
19*	Retaining Ring	Stainless Steel
20*	Back-Up Ring	Teflon
21*	Cylinder Plug	Stainless Steel
22*	O-Ring, Cylinder Plug	Ethylene Propylene
23	Body Stud	ASTM A193 Gr. B7, Alloy St.
24	Hex Nut (Body)	ASTM A194 Gr. 2H, Alloy St.
25	Spring 26()A12	Chrome Alloy, Rust Proofed
26*	Roller Thrust Bearing	Hardened Alloy Steel
27	Cap Gasket	Soft Iron or Steel
28	Body Gasket	Soft Iron or Steel
29	Bonnet Gasket	Soft Iron or Steel
30	Lock Screw Gasket	Soft Iron or Steel
31	Hex Nut (B.D.R.L.S.)	Stainless Steel
32	Lock Screw (D.H.)	Stainless Steel
33	Pipe Plug (Bonnet)	Steel
34	Pipe Plug (Body)	Steel
35*	Forged Eye Bolt	Steel, Galvanized

*Not supplied on U & W orifice



VALVE SIZE INLET X OUTLET	ANSI FLANGE CLASS		TYPE NUMBER CONV.	DIMENSIONS, IN./MM.					APPROX. WEIGHT Lbs./Kg
	INLET RF	OUTLET RF		A (max.)	B	C	E	F	
8 U 10	300	150	26UA12	54½ 1385	11 279	10⅞ 276	1⅜ 21	2⅞ 62	650 295
12 W 16	300	150	26WA12	70½ 1791	16 406	14⅞ 359	1⅜ 21	2⅞ 71	2800 1270
16 W2 18	300	150	26W2A12	90¾ 2305	20 508	16 406	1¼ 32	3½ 89	4200 1905
16 X 20	300	150	26XA12	93½ 2375	21 533	17 432	1¼ 32	3½ 89	5500 2495
18 Y 24	300	150	26YA12	97½ 2477	25 635	20 508	1¼ 32	3⅝ 92	7000 3175
20 Z 24	300	150	26ZA12	109 2769	25 635	20 508	1¼ 32	3¾ 95	7500 3402

Note: The "U" orifice weights and dimensions are identical to the "T" orifice on page 75.



Bill of Materials—BalanSeal

ITEM	PART NAME	MATERIAL
1	Body 26()B12	ASTM A216 Gr. WCB. Carb. St.
2	Bonnet 26()B12	ASTM A216 Gr. WCB. Carb. St.
3	Cap, Plain Screwed	ASTM A216 Gr. WCB. Carb. St.
4	Disc	Stainless Steel
5	Nozzle	316 St. St.
6	Disc Holder	Stainless Steel
7	Blowdown Ring	Stainless Steel
8	Sleeve Guide 26()B12	Stainless Steel
9	Stem	Stainless Steel
10	Spring Adjusting Screw	Stainless Steel
11	Jam Nut (Spr. Adj. Screw)	Stainless Steel
12	Lock Screw (B.D.R.)	Stainless Steel
13	Lock Screw Stud	Stainless Steel
14	Stem Retainer	Stainless Steel
15	Spring Button, Lower	Carbon St. Rust Proofed
16	Spring Button, Upper	Carbon St. Rust Proofed
17*	Insert, Spring Button Upper	Stainless Steel
18	Stem Insert	Stainless Steel
19*	Retaining Ring	Stainless Steel
20*	Back-Up Ring	Teflon
21*	Cylinder Plug	Stainless Steel
22*	O-Ring, Cylinder Plug	Ethylene Propylene
23	Body Stud	ASTM A193 Gr. B7, Alloy St.
24	Hex Nut (Body)	ASTM A194 Gr. 2H, Alloy St.
25	Spring 26()B12	Chrome Alloy, Rust Proofed
26*	Roller Thrust Bearing	Hardened Alloy Steel
27	Cap Gasket	Soft Iron or Steel
28	Body Gasket	Soft Iron or Steel
29	Bonnet Gasket	Soft Iron or Steel
30	Lock Screw Gasket	Soft Iron or Steel
31	Hex Nut (B.D.R.L.S.)	Stainless Steel
32	Lock Screw (D.H.)	Stainless Steel
33	Pipe Plug (Body)	Steel
34	Bellows	Inconel Composite
35*	Bellows Gasket	Flexible Graphite
36*	Forged Eye Bolt	Steel, Galvanized

*Not supplied on U & W orifice

VALVE SIZE INLET X OUTLET	ANSI FLANGE CLASS		TYPE NUMBER CONV.	DIMENSIONS, IN./MM.					APPROX. WEIGHT Lbs./Kg
	INLET RF	OUTLET RF		A (max.)	B	C	E	F	
8 U 10	300	150	26UB12	54½	11	10⅞	1⅜	27/16	700
				1385	279	276	21	62	317
12 W 16	300	150	26WB12	70½	16	14⅞	1⅜	2 1⅜	2850
				1791	406	359	21	71	1293
16 W2 18	300	150	26W2B12	90¾	20	16	1¼	3½	4250
				2305	508	406	32	89	1927
16 X 20	300	150	26XB12	93½	21	17	1¼	3½	5550
				2375	533	432	32	89	2517
18 Y 24	300	150	26YB12	97½	25	20	1¼	3⅞	7050
				2477	635	508	32	92	3197
20 Z 24	300	150	26ZB12	109	25	20	1¼	3¾	7550
				2769	635	508	32	95	3424

Note: The "U" orifice weights and dimensions are identical to the "T" orifice on page 75.



AIR CAPACITIES

10% OVERPRESSURE.

ASME PRESSURE VESSEL CODE (UV)

CAPACITIES IN STANDARD CUBIC FEET PER MINUTE AT 60 °F

Set Pressure (psig)	Orifice Letter Designation & Areas, Sq. Inches					
	U	W	W2	X	Y	Z
	31.5	63.62	104.0	113.1	143.1	176.7
20	18677	37723	61666	67062	84850	104773
30	23632	47729	78023	84850	107357	132564
40	29081	58736	96016	104417	132114	163135
50	34531	69742	114009	123984	156872	193705
60	39981	80749	132001	143552	181629	224276
70	45431	91756	149994	163119	206387	254846
80	50880	102763	167987	182686	231144	285417
90	56330	113769	185980	202253	255901	315987
100	61780	124776	203973	221820	280659	346558
125	75404	152293	248955	270738	342552	422984
150	89029	179810	293937	319656	404446	499410
175	102653	207327	338919	368574	466340	575837
200	116277	234844	383901	417492	528233	652263
250	143526	289878	473865	515328	652020	805116
300	170775	344912	563829	613164	775808	957968

STEAM CAPACITIES

10% OVERPRESSURE

ASME PRESSURE VESSEL CODE (UV)

CAPACITIES IN POUNDS PER HOUR AT SATURATION TEMPERATURE

Set Pressure (psig)	Orifice Letter Designation & Areas, Sq. Inches					
	U	W	W2	X	Y	Z
	31.5	63.62	104.0	113.1	143.1	176.7
20	52474	105981	173248	188407	238383	294355
30	66393	134093	219202	238383	238383	372434
40	81703	165016	269752	293356	371169	458320
50	97014	195939	320302	348329	440724	544206
60	112325	226861	370852	403302	510278	630092
70	127636	257784	421402	458275	579833	715979
80	142947	288707	471952	513248	649388	801865
90	158257	319630	522502	568221	718943	887751
100	173568	350553	573052	623194	788498	973638
125	211845	427861	699427	760627	962384	1188353
150	250122	505168	825802	898059	1136271	1403069
175	288399	582475	952176	1035492	1310158	1617785
200	326676	659783	1078551	1172924	1484045	1832500
250	403230	814397	1331301	1447790	1831819	2261932
300	479784	969012	1584050	1722655	2179593	2691363



2600 Series Super Capacity Pressure Relief Valves - U.S. Units

WATER CAPACITIES		25% OVERPRESSURE⁴					NON CODE
		CAPACITIES IN GALLONS PER MINUTE AT 70 °F					
Set Pressure (psig)	Orifice Letter Designation & Areas, Sq. Inches						
	U	W	W2	X	Y	Z	
	31.5	63.62	104.0	113.1	143.1	176.7	
20	3742	6962	11381	12377	15660	19337	
30	4483	8527	13939	15159	19179	23683	
40	5176	9846	16095	17504	22147	27347	
50	5787	11008	17995	19570	24761	30575	
60	6340	12059	19713	21438	27124	33493	
70	6848	13025	21292	23155	29297	36177	
80	7320	13924	22762	24754	31320	38674	
90	7765	14769	24143	26256	33220	41020	
100	8185	15568	25449	27676	35017	43239	
125	9151	17405	28453	30943	39150	48343	
150	—	19067	31169	33896	42887	52957	
175	—	20594	33666	36612	46324	57200	
200	—	22016	35991	39140	49522	61150	
250	—	24615	40239	43760	55367	68368	
300	—	26965	44080	47937	60652	74893	

General Notes:

1. Capacities at 30 PSIG and below are based on 3 PSI overpressure.
2. For sizing purposes using the ASME actual areas, the certified coefficient of discharge K for air, gas, and steam service is 0.858.
3. For sizing purposes using the actual areas, the coefficient of discharge K for water is 0.576.
4. The "U" orifice meets the requirements of ASME Code Section VIII. Capacities listed in the table for the "U" orifice are based on 10% overpressure.



AIR CAPACITIES 10% OVERPRESSURE ASME PRESSURE VESSEL CODE (UV) CAPACITIES IN STANDARD CUBIC METERS PER MINUTE AT 15.6 °C

Set Pressure (barg)	Orifice Letter Designation & Areas, Sq. cm					
	U	W	W2	X	Y	Z
	203.2	410.2	670.8	729.5	923.0	1139.7
1.4	533	1077	1761	1915	2423	2992
2	655	1324	2164	2353	2978	3677
3	878	1773	2899	3153	3989	4926
4	1102	2226	3639	3957	5007	6183
5	1326	2678	4378	4761	6024	7439
6	1550	3131	5118	5566	7042	8696
7	1774	3583	5857	6370	8060	9952
8	1998	4035	6597	7174	9077	11209
9	2222	4488	7336	7978	10095	12465
10	2446	4940	8076	8783	11113	13722
12	2894	5845	9555	10391	13148	16235
14	3342	6750	11034	12000	15183	18748
16	3790	7655	12513	13608	17218	21261
18	4238	8559	13993	15217	19253	23774
20.7	4843	9781	15989	17388	22001	27167

STEAM CAPACITIES 10% OVERPRESSURE ASME PRESSURE VESSEL CODE (UV) CAPACITIES IN KILOGRAMS PER HOUR AT SATURATION TEMPERATURE

Set Pressure (barg)	Orifice Letter Designation & Areas, Sq. cm					
	U	W	W2	X	Y	Z
	203.2	410.2	670.8	729.5	923.0	1139.7
1.4	24003	48480	79251	86185	109046	134650
2	29501	59584	97403	105926	134023	165492
3	39520	79818	130480	141897	179535	221690
4	49600	100176	163759	178088	225326	278233
5	59679	120534	197038	214279	271117	334776
6	69759	140892	230317	250470	316908	391319
7	79839	161250	263597	286662	362699	447861
8	89919	181608	296876	322853	408490	504404
9	99999	201966	330155	359044	454281	560947
10	110078	222324	363435	395235	500072	617490
12	130238	263040	429993	467618	591654	730576
14	150398	303756	496552	540000	683237	843661
16	170557	344472	563111	612383	774819	956747
18	190717	385188	629669	684765	866401	1069833
20.7	217932	440154	719523	782482	990037	1222498



WATER CAPACITIES						
25% OVERPRESSURE ⁴						
CAPACITIES IN LITERS PER MINUTE AT 21 °C						
NON CODE						
Set Pressure (barg)	Orifice Letter Designation & Areas, Sq. cm					
	U	W	W2	X	Y	Z
	203.2	410.2	670.8	729.5	923.0	1139.7
20	14166	25276	41319	44935	56854	70203
30	16968	30276	49493	53824	68101	84091
40	19593	9236	15099	16420	20775	25654
50	21906	39087	63895	69486	87918	108561
60	23997	42817	69994	76119	96309	118923
70	25920	46248	75602	82217	104026	128451
80	27709	49441	80822	87894	111208	137320
90	29390	52440	85725	93226	117954	145650
100	30980	55277	90362	98269	124335	153529
125	34637	61802	101028	109868	139011	171651
150	37943	67700	110671	120354	152279	188034
175	40983	73125	119538	129997	164480	203100
200	43813	78174	127791	138973	175836	217123
250	48984	87401	142875	155377	196591	242751
300	53660	95743	156512	170207	215355	265920

General Notes:

1. Capacities at 30 PSIG and below are based on 3 PSI overpressure.
2. For sizing purposes using the ASME actual areas, the certified coefficient of discharge K for air, gas, and steam service is 0.858.
3. For sizing purposes using the actual areas, the coefficient of discharge K for water is 0.576.
4. The "U" orifice meets the requirements of ASME Code Section VIII. Capacities listed in the table for the "U" orifice are based on 10% overpressure.

Cap Constructions

Standard Material & Material for Corrosive/Low Temperature Service - Stainless Steel

Cap Description	Part Name	Std. Materials S1, N1 -20°F to 800°F	316 St. St.	
			S3 -75°F to 800°F	S4 -450 °F to 450°F
Packed Lever	Cap	Carbon Steel	316 St.	316 St.
	Test Lever	Carbon Steel	—	—
	Cam	316 St. St.	—	—
	Cam Shaft	316 St. St.	—	—
	Gland	316 St. St.	—	—
	Stem Jam Nut	316 St. St.	—	—
	Stem Test Nut	316 St. St.	—	—
	Packing Ring	Graphite	—	—
	Plain Washer	Steel	—	—
	Lever Hex. Jam Nut	Steel	—	—
	Cap Stud	Alloy Steel	Stainless Steel	Stainless Steel
	Cap Hex. Nut	Alloy Steel	Stainless Steel	Stainless Steel
Open Lever (Single or Double Acting)	Cap	Iron	—	—
	Test Lever	Iron	—	—
	Test Lever Fork	Iron	—	—
	Stem Jam Nut	316 St. St.	—	—
	Stem Test Nut	316 St. St.	—	—
	Cap Screw	Steel, Plated	—	—
	Fork Rd. Hd. Rivet	Steel	—	—
	Lever Rd. Hd. Rivet	Steel	—	—
	Cotter Pin	Steel, Plated	—	—

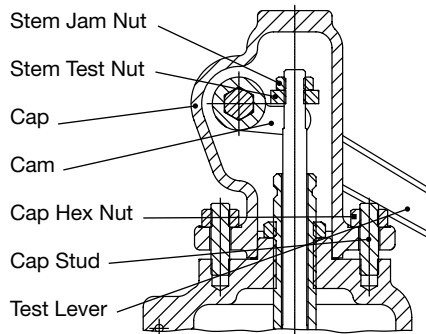
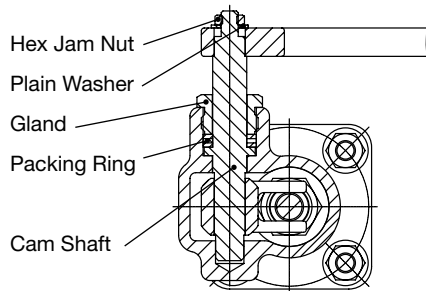
Cap Constructions

Standard Material for Corrosive Service - Monel & Hastelloy C

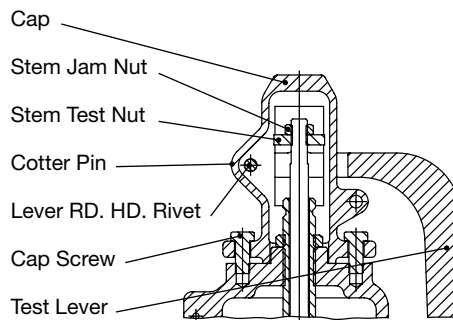
Cap Description	Part Name	Monel			Hastelloy C		
		M2 -20°F to 800°F		M3 & M4 -20°F to 800°F	H2 -20°F to 500°F		H3 & H4 -20°F to 500°F
		Conventional	BalanSeal	Conventional & BalanSeal	Conventional	BalanSeal	Conventional & BalanSeal
Packed Lever	Cap	—	—	Monel	—	—	Hastelloy C
	Test Lever	—	—	—	—	—	—
	Cam	Monel	—	Monel	Monel	—	Hastelloy C
	Cam Shaft	Monel	—	Monel	Monel	—	Hastelloy C
	Gland	Monel	—	Monel	Monel	—	Hastelloy C
	Stem Jam Nut	Monel	—	Monel	Monel	—	Hastelloy C
	Stem Test Nut	Monel	—	Monel	Monel	—	Graphite
	Packing Ring	Graphite	—	Graphite	Graphite	—	Not Used
	Plain Washer	—	—	—	—	—	—
	Lever Hex. Jam Nut	—	—	—	—	—	—
	Cap Stud	—	—	Hastelloy C	—	—	Hastelloy C
Cap Hex. Nut	—	—	Hastelloy C	—	—	Hastelloy C	
Open Lever (Single or Double Acting)	Cap	—	—	—	—	—	—
	Test Lever	—	—	—	—	—	—
	Test Lever Fork	—	—	—	—	—	—
	Stem Jam Nut	Monel	—	Monel	Monel	—	Hastelloy C
	Stem Test Nut	Monel	—	Monel	Monel	—	Hastelloy C
	Cap Screw	—	—	—	—	—	—
	Fork Rd. Hd. Rivet	—	—	—	—	—	—
	Lever Rd. Hd. Rivet	—	—	—	—	—	—
Cotter Pin	—	—	—	—	—	—	

Notes:

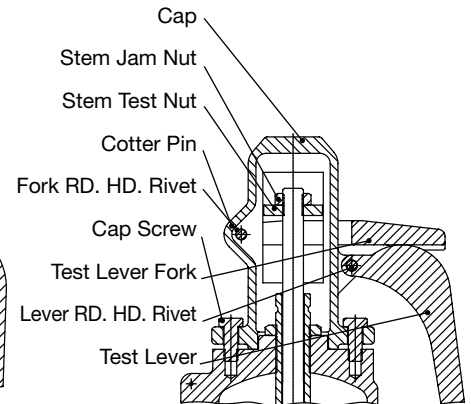
1. Any part denoted with a dash is standard. Cap assembly materials are standard in M1 & H1 trim.
2. Cap assembly materials N1 & N4 are the same as standard BalanSeal design, except the cap studs and hex nuts are B7M & 2HM (N1 trim) and B8MA & 8MA (N4 trim) respectively.



Packed Lever
2600 Series, All Sizes

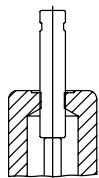


Open Lever
(Single Acting Lever)
2600 Series, Types 26()A10, A11,
A20, A21,
All Sizes Except 8x10

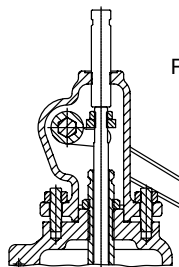


Open Lever
(Double Acting Lever)
2600 Series, Sizes 1x2 Thru 6x10
Except
Types 26()A10, A11, A20, A21,
Sizes 8x10, All Types

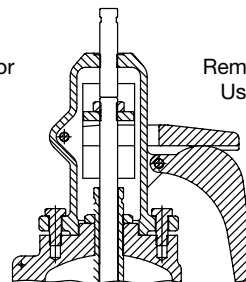
Test Gag Installations



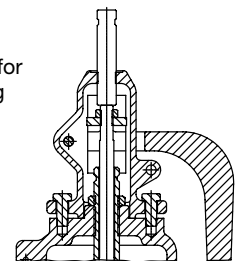
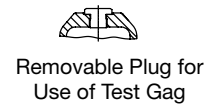
Plain Screwed Cap
2600 Series, All Sizes



Packed Lever
2600 Series, All Sizes



Open Lever
(Double Acting Lever)
2600 Series, Sizes 1x2 Thru
6x10 Except
Types 26()A10, A11
Sizes 8x10, All Types

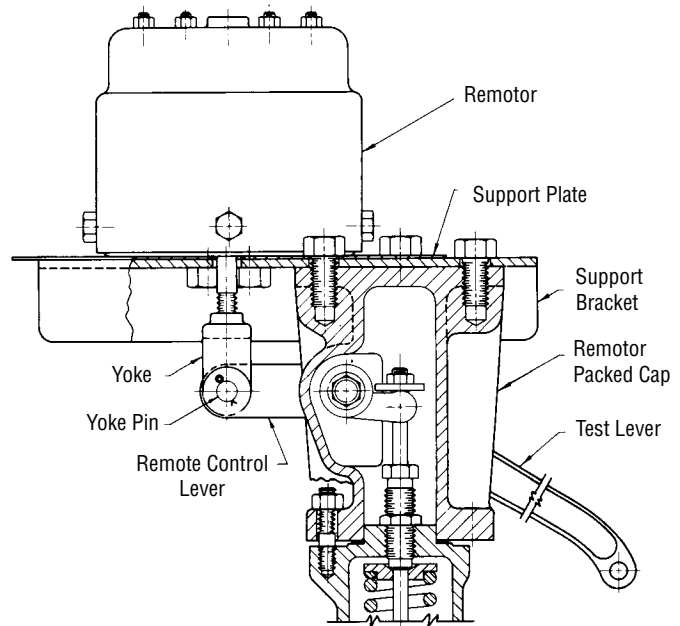


Open Lever
(Single Acting Lever)
2600 Series, Types 26()A10,
A11, A20, A21,
All Sizes Except 8x10

Remotor

The Farris Remotor air operated depressuring unit is an economical way to rapidly depressurize vessels in the event of an emergency, combining pressure relief and drop out service in one installation.

- Operates by air pressure from remote point.
- Rapidly depressurizes vessels in service to predetermined limit or to zero psig.
- Extra power motor affords one regulated power supply for series of valve installations.
- Rolling diaphragm withstands greater pressures at constant effective area.
- Weatherproof and maintenance free.
- Compact design for easy installation.
- Allows normal use of test lever.

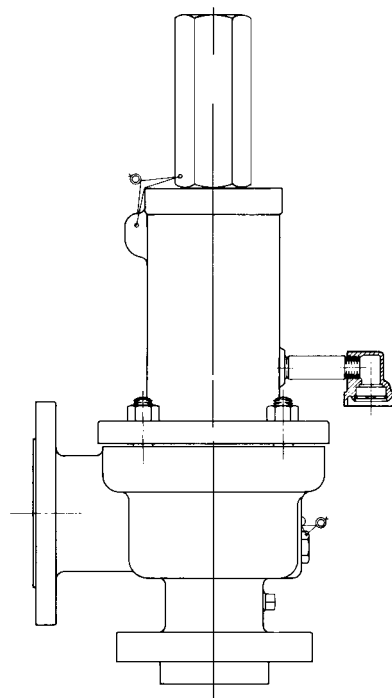


Valve Position Indicators (not shown)

Limit or proximity switch accessories are available. These devices mount on any cap construction and provide a signal locally or to remote locations to indicate the valve has operated. Consult Factory for details.

Bugproof Vent

This option is available for use on all BalanSeal bellows designs.



Steam Jacketing

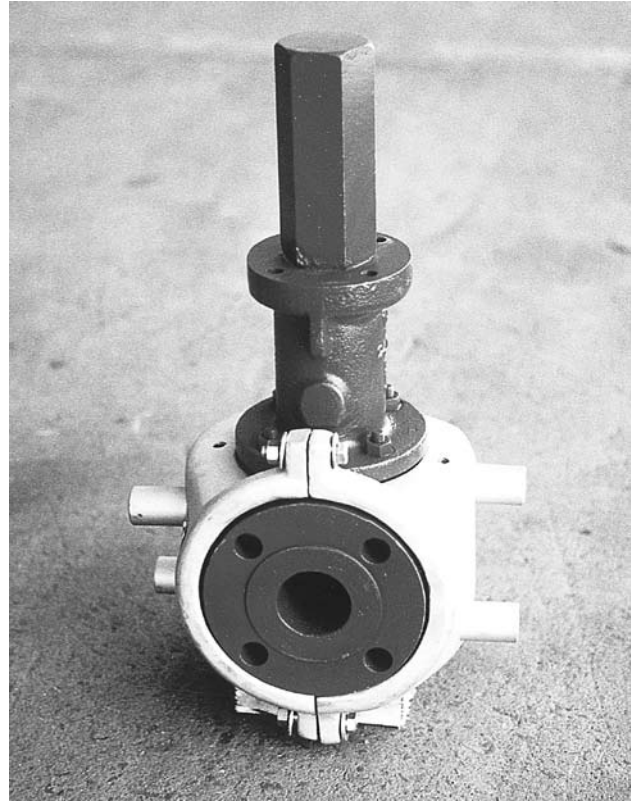
Viscous or heavy residual processes that tend to freeze in relief valve nozzles can create hazardous operating conditions. Jacketing or tracing of adjacent inlet piping and the pipe-away may not be enough to prevent product solidification under the valve seat or even in the valve inlet nozzle. If a pressure surge causes the valve to relieve, some of the solidified material can stick to the seat, preventing the valve from completely re-seating. This usually results in continuous process weepage around the valve seating surface.

The solution is to keep the valve warm enough to prevent build-ups of these high-melting processes.

ControHeat Bolt-On Jacket

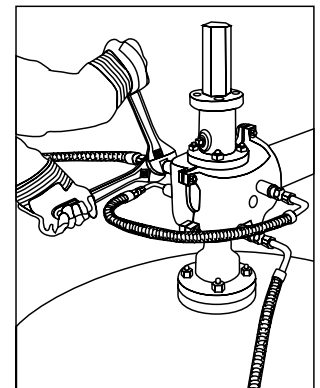
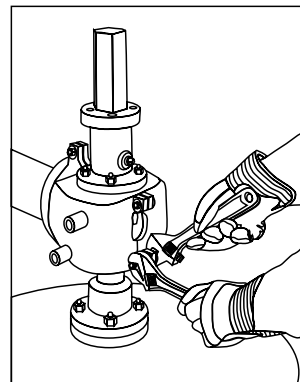
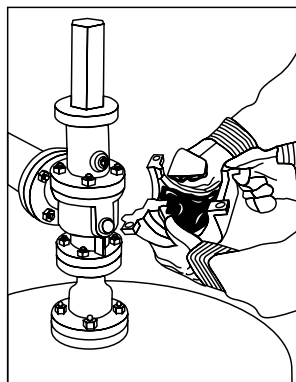
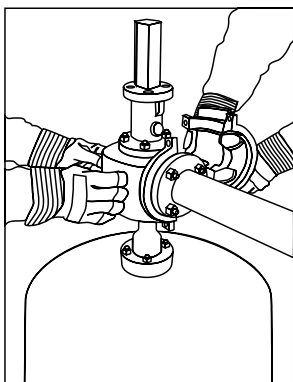
This valve jacket is easy to install and maintain. It covers the valve flange to flange, providing uniform heat to all process wetted surfaces. The jacket consists of two aluminum castings with steel pressure chambers cast into the aluminum. The steel pressure chambers receive the heating fluid (steam, hot water or hot oil) and rapidly transfer the heat through the aluminum to the valve body. The pressure chambers are designed and tested in accordance with ASME BPV Code, Section XIII.

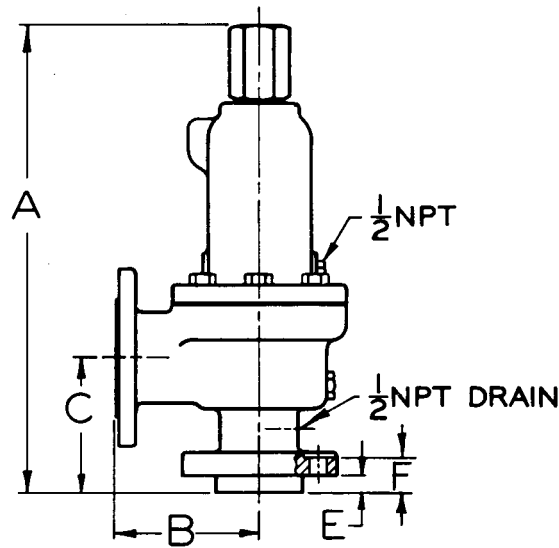
Standard service ratings for the jacket are 150 psig (10 barg) and 500°F (260°C). Higher ratings are available for service to 600 psig (40 barg) and 750°F (400°C). The jacket may be ordered with adjacent flange coverage.



Installation

1. Install the Farris safety relief valve in the line.
2. Verify the fit of the jacket on the valve.
3. Spread heat transfer mastic (HTM) on valve body and surfaces of jacket.
4. Bolt jacket halves onto valve. Clean excess HTM from jacket.
5. Make heating medium connections to jacket.





Size Inlet x Outlet	Type Conventional	U.S. Standard Dimensions (inches)						Approx. Weight Lbs.	Metric Dimensions (millimeters)						Approx. Weight kg
		A		B	C	E	F		A		B	C	E	F	
		Vapor	Liquid						Vapor	Liquid					
1 x 2	26DA10	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 x 2	26DA11	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 x 2	26DA12	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 x 2	26DA13	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 1/2 x 2	26DA14	23 1/2	23 1/2	5 1/2	4 1/8	11/16	1 15/16	50	597	597	140	105	18	50	23
1 1/2 x 2	26DA15	23 1/2	23 1/2	5 1/2	4 1/8	11/16	1 15/16	50	597	597	140	105	18	50	23
1 1/2 x 2 1/2	26DA16	23 1/2	23 1/2	6 1/2	5 1/2	11/16	2 7/16	80	597	597	166	140	18	62	37
1 1/2 x 3	26DA16A	23 1/2	23 1/2	7	5 1/2	11/16	2 5/8	80	597	597	178	140	18	67	37
1 x 2	26DA20	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 x 2	26DA21	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 x 2	26DA22	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 x 2	26DA23	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 1/2 x 2	26DA24	23 1/2	23 1/2	5 1/2	4 1/8	11/16	1 15/16	50	597	597	140	105	18	50	23
1 1/2 x 2	26DA25	23 1/2	23 1/2	5 1/2	4 1/8	11/16	1 15/16	50	597	597	140	105	18	50	23
1 1/2 x 2 1/2	26DA26	23 1/2	23 1/2	6 1/2	5 1/2	11/16	2 7/16	80	597	597	166	140	18	62	37
1 1/2 x 3	26DA26A	23 1/2	23 1/2	7	5 1/2	11/16	2 5/8	80	597	597	178	140	18	67	37
1 x 2	26DA32	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 x 2	26DA33	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 1/2 x 2	26DA34	23 1/2	23 1/2	5 1/2	4 1/8	11/16	1 15/16	50	597	597	140	105	18	50	23
1 1/2 x 2	26DA35	23 1/2	23 1/2	5 1/2	4 1/8	11/16	1 15/16	50	597	597	140	105	18	50	23
1 1/2 x 2 1/2	26DA36	23 1/2	23 1/2	6 1/2	5 1/2	11/16	2 7/16	80	597	597	166	140	18	62	37
1 1/2 x 3	26DA36A	23 1/2	23 1/2	7	5 1/2	11/16	2 5/8	80	597	597	178	140	18	67	37
1 x 2	26EA10	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 x 2	26EA11	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 x 2	26EA12	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 x 2	26EA13	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 1/2 x 2	26EA14	23 1/2	23 1/2	5 1/2	4 1/8	11/16	1 15/16	50	597	597	140	105	18	50	23
1 1/2 x 2	26EA15	23 1/2	23 1/2	5 1/2	4 1/8	11/16	1 15/16	50	597	597	140	105	18	50	23
1 1/2 x 2 1/2	26EA16	23 1/2	23 1/2	6 1/2	5 1/2	11/16	2 7/16	80	597	597	166	140	18	62	37
1 1/2 x 3	26EA16A	23 1/2	23 1/2	7	5 1/2	11/16	2 5/8	80	597	597	178	140	18	67	37
1 x 2	26EA20	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 x 2	26EA21	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 x 2	26EA22	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 x 2	26EA23	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 1/2 x 2	26EA24	23 1/2	23 1/2	5 1/2	4 1/8	11/16	1 15/16	50	597	597	140	105	18	50	23
1 1/2 x 2	26EA25	23 1/2	23 1/2	5 1/2	4 1/8	11/16	1 15/16	50	597	597	140	105	18	50	23
1 1/2 x 2 1/2	26EA26	23 1/2	23 1/2	6 1/2	5 1/2	11/16	2 7/16	80	597	597	166	140	18	62	37
1 1/2 x 3	26EA26A	23 1/2	23 1/2	7	5 1/2	11/16	2 5/8	80	597	597	178	140	18	67	37
1 x 2	26EA32	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 x 2	26EA33	19	19	4 1/2	4 1/8	1/2	1 3/16	42	483	483	115	105	13	31	20
1 1/2 x 2	26EA34	23 1/2	23 1/2	5 1/2	4 1/8	11/16	1 15/16	50	597	597	140	105	18	50	23
1 1/2 x 2	26EA35	23 1/2	23 1/2	5 1/2	4 1/8	11/16	1 15/16	50	597	597	140	105	18	50	23
1 1/2 x 2 1/2	26EA36	23 1/2	23 1/2	6 1/2	5 1/2	11/16	2 7/16	80	597	597	166	140	18	62	37
1 1/2 x 3	26EA36A	23 1/2	23 1/2	7	5 1/2	11/16	2 5/8	80	597	597	178	140	18	67	37



Dimensions & Weights

Inlet x Outlet	Type	U.S. Standard Dimensions (inches)						Approx. Weight Lbs.	Metric Dimensions (millimeters)						Approx. Weight kg
		A		B	C	E	F		A		B	C	E	F	
		Vapor	Liquid						Vapor	Liquid					
1 1/2 x 2	26FA10	19 1/2	19 1/2	4 3/4	4 7/8	11/16	1 1/4	44	496	496	121	124	18	32	20
1 1/2 x 2	26FA11	19 1/2	19 1/2	4 3/4	4 7/8	11/16	1 9/16	44	496	496	121	124	18	40	20
1 1/2 x 2	26FA12	23	23	6	4 7/8	11/16	1 9/16	50	585	585	153	124	18	40	23
1 1/2 x 2	26FA13	23	23	6	4 7/8	11/16	1 9/16	50	585	585	153	124	18	40	23
1 1/2 x 2 1/2	26FA14	23 1/2	23 1/2	6	4 7/8	11/16	1 15/16	70	597	597	153	124	18	50	32
1 1/2 x 3	26FA14A	23 1/2	23 1/2	6 1/2	4 7/8	11/16	1 15/16	70	597	597	166	124	18	50	32
1 1/2 x 2 1/2	26FA15	23 1/2	23 1/2	6	4 7/8	11/16	1 15/16	70	597	597	153	124	18	50	32
1 1/2 x 3	26FA15A	23 1/2	23 1/2	6 1/2	4 7/8	11/16	1 15/16	70	597	597	166	124	18	50	32
1 1/2 x 2 1/2	26FA16	23 1/2	23 1/2	6 1/2	5 1/2	11/16	2 7/16	80	597	597	166	140	18	62	37
1 1/2 x 3	26FA16A	23 1/2	23 1/2	7	5 1/2	11/16	2 7/16	80	597	597	178	140	18	62	37
1 1/2 x 2	26FA20	19 1/2	19 1/2	4 3/4	4 7/8	11/16	1 1/4	44	496	496	121	124	18	32	20
1 1/2 x 2	26FA21	19 1/2	19 1/2	4 3/4	4 7/8	11/16	1 9/16	44	496	496	121	124	18	40	20
1 1/2 x 2	26FA22	23	23	6	4 7/8	11/16	1 9/16	50	585	585	153	124	18	40	23
1 1/2 x 2	26FA23	23	23	6	4 7/8	11/16	1 9/16	50	585	585	153	124	18	40	23
1 1/2 x 2 1/2	26FA24	23 1/2	23 1/2	6	4 7/8	11/16	1 15/16	70	597	597	153	124	18	50	32
1 1/2 x 3	26FA24A	23 1/2	23 1/2	6 1/2	4 7/8	11/16	1 15/16	70	597	597	166	124	18	50	32
1 1/2 x 2 1/2	26FA25	23 1/2	23 1/2	6	4 7/8	11/16	1 15/16	70	597	597	153	124	18	50	32
1 1/2 x 3	26FA25A	23 1/2	23 1/2	6 1/2	4 7/8	11/16	1 15/16	70	597	597	166	124	18	50	32
1 1/2 x 2 1/2	26FA26	23 1/2	23 1/2	6 1/2	5 1/2	11/16	2 7/16	80	597	597	166	140	18	62	37
1 1/2 x 3	26FA26A	23 1/2	23 1/2	7	5 1/2	11/16	2 7/16	80	597	597	178	140	18	62	37
1 1/2 x 2	26FA32	23	23	6	4 7/8	11/16	1 9/16	50	585	585	153	124	18	40	23
1 1/2 x 2	26FA33	23	23	6	4 7/8	11/16	1 9/16	50	585	585	153	124	18	40	23
1 1/2 x 2 1/2	26FA34	23 1/2	23 1/2	6	4 7/8	11/16	1 15/16	70	597	597	153	124	18	50	32
1 1/2 x 3	26FA34A	23 1/2	23 1/2	6 1/2	4 7/8	11/16	1 15/16	70	597	597	166	124	18	50	32
1 1/2 x 2 1/2	26FA35	23 1/2	23 1/2	6	4 7/8	11/16	1 15/16	70	597	597	153	124	18	50	32
1 1/2 x 3	26FA35A	23 1/2	23 1/2	6 1/2	4 7/8	11/16	1 15/16	70	597	597	166	124	18	50	32
1 1/2 x 2 1/2	26FA36	23 1/2	23 1/2	6 1/2	5 1/2	11/16	2 7/16	80	597	597	166	140	18	62	37
1 1/2 x 3	26FA36A	23 1/2	23 1/2	7	5 1/2	11/16	2 7/16	80	597	597	178	140	18	62	37
1 1/2 x 2 1/2	26GA10	19 1/2	19 1/2	4 3/4	4 7/8	11/16	1 1/4	50	496	496	121	124	18	32	23
1 1/2 x 3	26GA10A	19 1/2	19 1/2	4 3/4	4 7/8	11/16	1 1/4	50	496	496	121	124	18	32	23
1 1/2 x 2 1/2	26GA11	19 1/2	19 1/2	4 3/4	4 7/8	11/16	1 9/16	50	496	496	121	124	18	40	23
1 1/2 x 3	26GA11A	19 1/2	19 1/2	4 3/4	4 7/8	11/16	1 9/16	50	496	496	121	124	18	40	23
1 1/2 x 2 1/2	26GA12	23	23	6	4 7/8	11/16	1 9/16	50	585	585	153	124	18	40	23
1 1/2 x 3	26GA12A	23	23	6	4 7/8	11/16	1 9/16	50	585	585	153	124	18	40	23
1 1/2 x 2 1/2	26GA13	23 1/2	23 1/2	6	4 7/8	11/16	1 9/16	50	597	597	153	124	18	40	23
1 1/2 x 3	26GA13A	23 1/2	23 1/2	6	4 7/8	11/16	1 9/16	50	597	597	153	124	18	40	23
1 1/2 x 2 1/2	26GA14	23 1/2	23 1/2	6	4 7/8	11/16	1 15/16	70	597	597	153	124	18	50	32
1 1/2 x 3	26GA14A	23 1/2	23 1/2	6 1/2	4 7/8	11/16	1 15/16	70	597	597	166	124	18	50	32
2 x 3	26GA15	24	24	6 3/4	6 1/8	11/16	2 3/16	85	610	610	172	156	18	56	39
2 x 3	26GA16	24	24	6 3/4	6 1/8	11/16	2 11/16	95	610	610	172	156	18	69	44
1 1/2 x 2 1/2	26GA20	19 1/2	19 1/2	4 3/4	4 7/8	11/16	1 1/4	50	496	496	121	124	18	32	23
1 1/2 x 3	26GA20A	19 1/2	19 1/2	4 3/4	4 7/8	11/16	1 1/4	50	496	496	121	124	18	32	23
1 1/2 x 2 1/2	26GA21	19 1/2	19 1/2	4 3/4	4 7/8	11/16	1 9/16	50	496	496	121	124	18	40	23
1 1/2 x 3	26GA21A	19 1/2	19 1/2	4 3/4	4 7/8	11/16	1 9/16	50	496	496	121	124	18	40	23
1 1/2 x 2 1/2	26GA22	23	23	6	4 7/8	11/16	1 9/16	50	585	585	153	124	18	40	23
1 1/2 x 3	26GA22A	23	23	6	4 7/8	11/16	1 9/16	50	585	585	153	124	18	40	23
1 1/2 x 2 1/2	26GA23	23 1/2	23 1/2	6	4 7/8	11/16	1 9/16	50	597	597	153	124	18	40	23
1 1/2 x 3	26GA23A	23 1/2	23 1/2	6	4 7/8	11/16	1 9/16	50	597	597	153	124	18	40	23
1 1/2 x 2 1/2	26GA24	23 1/2	23 1/2	6	4 7/8	11/16	1 15/16	70	597	597	153	124	18	50	32
1 1/2 x 3	26GA24A	23 1/2	23 1/2	6 1/2	4 7/8	11/16	1 15/16	70	597	597	166	124	18	50	32
2 x 3	26GA25	24	24	6 3/4	6 1/8	11/16	2 3/16	85	610	610	172	156	18	56	39
2 x 3	26GA26	24	24	6 3/4	6 1/8	11/16	2 11/16	95	610	610	172	156	18	69	44
1 1/2 x 2 1/2	26GA32	23	23	6	4 7/8	11/16	1 9/16	50	585	585	153	124	18	40	23
1 1/2 x 3	26GA32A	23	23	6	4 7/8	11/16	1 9/16	50	585	585	153	124	18	40	23
1 1/2 x 2 1/2	26GA33	23 1/2	23 1/2	6	4 7/8	11/16	1 9/16	50	597	597	153	124	18	40	23
1 1/2 x 3	26GA33A	23 1/2	23 1/2	6	4 7/8	11/16	1 9/16	50	597	597	153	124	18	40	23
1 1/2 x 2 1/2	26GA34	23 1/2	23 1/2	6	4 7/8	11/16	1 15/16	70	597	597	153	124	18	50	32
1 1/2 x 3	26GA34A	23 1/2	23 1/2	6 1/2	4 7/8	11/16	1 15/16	70	597	597	166	124	18	50	32
2 x 3	26GA35	24	24	6 3/4	6 1/8	11/16	2 3/16	85	610	610	172	156	18	56	39
2 x 3	26GA36	24	24	6 3/4	6 1/8	11/16	2 11/16	95	610	610	172	156	18	69	44
1 1/2 x 3	26HA10	20	20	4 7/8	5 1/8	11/16	1 1/4	54	508	508	124	131	18	32	25
1 1/2 x 3	26HA11	20	20	4 7/8	5 1/8	11/16	1 1/2	54	508	508	124	131	18	39	25
2 x 3	26HA12	23	23	4 7/8	5 1/8	11/16	1 11/16	70	585	585	124	131	18	43	32
2 x 3	26HA13	24	24	6 3/8	6 1/16	11/16	1 11/16	70	610	610	162	154	18	43	32
2 x 3	26HA14	24	24	6 3/8	6 1/16	11/16	2 3/16	85	610	610	162	154	18	56	39
2 x 3	26HA15	24	24	6 3/8	6 1/16	11/16	2 3/16	85	610	610	162	154	18	56	39

Dimensions & Weights

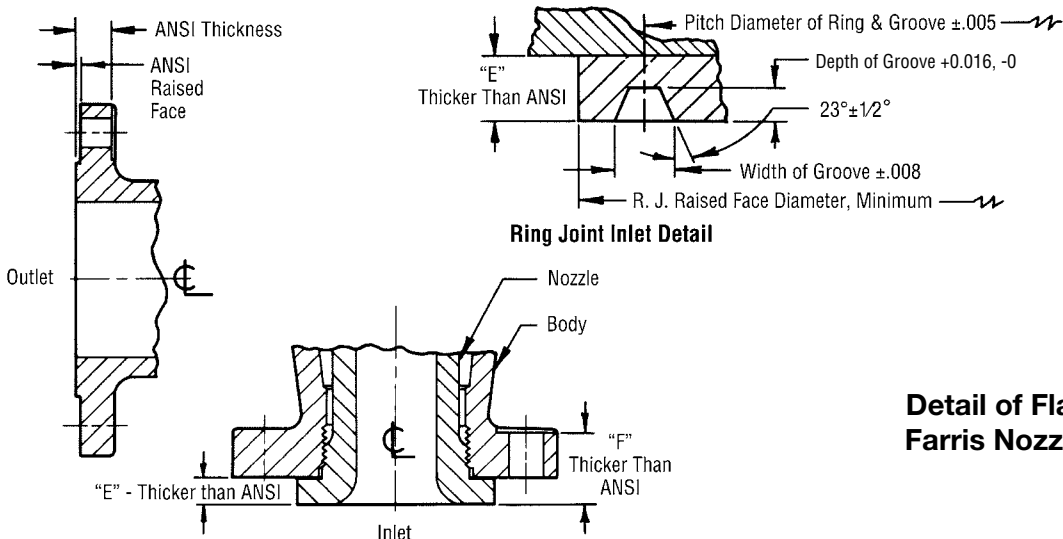


Size Inlet x Outlet	Type Conventional	U.S. Standard Dimensions (inches)						Approx. Weight Lbs.	Metric Dimensions (millimeters)						Approx. Weight kg
		A		B	C	E	F		A		B	C	E	F	
		Vapor	Liquid						Vapor	Liquid					
1 1/2 x 3	26HA20	20	20	4 7/8	5 1/8	11/16	1 1/4	54	508	508	124	131	18	32	25
1 1/2 x 3	26HA21	20	20	4 7/8	5 1/8	11/16	1 1/2	54	508	508	124	131	18	39	25
2 x 3	26HA22	23	23	4 7/8	5 1/8	11/16	1 11/16	70	585	585	124	131	18	43	32
2 x 3	26HA23	24	24	6 3/8	6 1/16	11/16	1 11/16	70	610	610	162	154	18	43	32
2 x 3	26HA24	24	24	6 3/8	6 1/16	11/16	2 3/16	85	610	610	162	154	18	56	39
2 x 3	26HA25	24	24	6 3/8	6 1/16	11/16	2 3/16	85	610	610	162	154	18	56	39
2 x 3	26HA32	23	23	4 7/8	5 1/8	11/16	1 11/16	70	585	585	124	131	18	43	32
2 x 3	26HA33	23	23	6 3/8	6 1/16	11/16	1 11/16	70	585	585	162	154	18	43	32
2 x 3	26HA34	24	24	6 3/8	6 1/16	11/16	2 3/16	85	610	610	162	154	18	56	39
2 x 3	26HA35	24	24	6 3/8	6 1/16	11/16	2 3/16	85	610	610	162	154	18	56	39
2 x 3	26JA10	23	23	4 7/8	5 3/8	11/16	1 5/16	58	585	585	124	137	18	34	27
2 x 3	26JA11	23	23	4 7/8	5 3/8	11/16	1 11/16	58	585	585	124	137	18	43	27
2 1/2 x 4	26JA12	25	27	5 5/8	5 3/8	11/16	1 13/16	150	635	686	143	137	18	47	69
3 x 4	26JA12A	26	28 1/2	7 1/8	7 1/4	11/16	2 1/8	150	661	724	181	185	18	54	69
2 1/2 x 4	26JA13	27 1/2	34 1/2	6 3/4	6 1/8	11/16	1 13/16	150	699	877	172	156	18	47	69
3 x 4	26JA13A	28 1/2	35 1/2	7 1/8	7 1/4	11/16	2 1/8	150	724	902	181	185	18	54	69
3 x 4	26JA14	36	36	7 1/8	7 1/4	11/16	2 3/16	175	915	915	181	185	18	56	80
3 x 4	26JA15	36	36	7 1/8	7 1/4	11/16	2 9/16	175	915	915	181	185	18	66	80
2 x 3	26JA20	23	23	4 7/8	5 3/8	11/16	1 5/16	58	585	585	124	137	18	34	27
2 x 3	26JA21	23	23	4 7/8	5 3/8	11/16	1 11/16	58	585	585	124	137	18	43	27
2 1/2 x 4	26JA22	25	27	5 5/8	5 3/8	11/16	1 13/16	150	635	686	143	137	18	47	69
3 x 4	26JA22A	26	28 1/2	7 1/8	7 1/4	11/16	2 1/8	150	661	724	181	185	18	54	69
2 1/2 x 4	26JA23	27 1/2	34 1/2	6 3/4	6 1/8	11/16	1 13/16	150	699	877	172	156	18	47	69
3 x 4	26JA23A	28 1/2	35 1/2	7 1/8	7 1/4	11/16	2 1/8	150	724	902	181	185	18	54	69
3 x 4	26JA24	36	36	7 1/8	7 1/4	11/16	2 3/16	175	915	915	181	185	18	56	80
3 x 4	26JA25	36	36	7 1/8	7 1/4	11/16	2 3/16	175	915	915	181	185	18	56	80
2 1/2 x 4	26JA32	25	27	5 5/8	5 3/8	11/16	1 13/16	150	635	686	143	137	18	47	69
3 x 4	26JA32A	26	28 1/2	7 1/8	7 1/4	11/16	2 1/8	150	661	724	181	185	18	54	69
2 1/2 x 4	26JA33	27 1/2	34 1/2	5 5/8	5 3/8	11/16	1 13/16	150	699	877	143	137	18	47	69
3 x 4	26JA33A	28 1/2	35 1/2	7 1/8	7 1/4	11/16	2 1/8	150	724	902	181	185	18	54	69
2 1/2 x 4	26JA34	25	25	6 3/4	6 1/8	11/16	2 5/16	175	635	635	172	156	18	59	80
3 x 4	26JA34A	26	26	7 1/8	7 1/4	11/16	2 3/8	175	661	661	181	185	18	61	80
3 x 4	26JA35	36	36	7 1/4	7 1/8	11/16	2 9/16	175	915	915	185	181	18	66	80
3 x 4	26KA10	26 1/2	28 1/2	6 3/8	6 1/8	11/16	1 1/2	145	674	724	162	156	18	39	66
3 x 4	26KA11	26 1/2	28 1/2	6 3/8	6 1/8	11/16	1 15/16	145	674	724	162	156	18	50	66
3 x 4	26KA12	28 1/2	32	6 3/8	6 1/8	11/16	1 15/16	160	724	813	162	156	18	50	73
3 x 4	26KA13	34	34	7 1/8	7 1/4	11/16	1 15/16	160	864	864	181	185	18	50	73
3 x 6	26KA14	37 1/2	37 1/2	8 1/2	7 13/16	11/16	2 3/16	230	953	953	216	199	18	56	105
3 x 6	26KA15	37 1/2	37 1/2	8 1/2	7 3/4	11/16	2 9/16	230	953	953	216	197	18	66	105
3 x 4	26KA20	26 1/2	28 1/2	6 3/8	6 1/8	11/16	1 1/2	145	674	724	162	156	18	39	66
3 x 4	26KA21	26 1/2	28 1/2	6 3/8	6 1/8	11/16	1 15/16	145	674	724	162	156	18	50	66
3 x 4	26KA22	28 1/2	32	6 3/8	6 1/8	11/16	1 15/16	160	724	813	162	156	18	50	73
3 x 4	26KA23	34	34	7 1/8	7 1/4	11/16	1 15/16	160	864	864	181	185	18	50	73
3 x 6	26KA24	37 1/2	37 1/2	8 1/2	7 13/16	11/16	2 3/16	230	953	953	216	199	18	56	105
3 x 6	26KA25	37 1/2	37 1/2	8 1/2	7 3/4	11/16	2 9/16	230	953	953	216	197	18	66	105
3 x 4	26KA32	28 1/2	32	6 3/8	6 1/8	11/16	1 15/16	160	724	813	162	156	18	50	73
3 x 4	26KA33	28 1/2	28 1/2	6 3/8	6 1/8	11/16	1 15/16	160	724	724	162	156	18	50	73
3 x 4	26KA34	34	34	7 1/8	7 1/4	11/16	2 3/16	230	864	864	181	185	18	56	105
3 x 6	26KA34A	34	34	8 1/2	7 13/16	11/16	2 3/8	175	864	864	216	199	18	61	80
3 x 6	26KA35	37 1/2	37 1/2	8 1/2	7 3/4	11/16	2 9/16	230	953	953	216	197	18	66	105
3 x 4	26LA10	26 1/2	28 1/2	6 1/2	6 1/8	11/16	1 1/2	145	674	724	166	156	18	39	66
3 x 4	26LA11	26 1/2	28 1/2	6 1/2	6 1/8	11/16	1 15/16	145	674	724	166	156	18	50	66
4 x 6	26LA12	37 1/2	37 1/2	7 1/8	7 1/16	11/16	1 15/16	230	953	953	181	180	18	50	105
4 x 6	26LA13	37 1/2	37 1/2	8	7 1/16	11/16	2 3/16	230	953	953	204	180	18	56	105
4 x 6	26LA14	43	43	8 3/4	7 3/4	11/16	2 7/16	250	1093	1093	223	197	18	62	114
3 x 4	26LA20	26 1/2	28 1/2	6 1/2	6 1/8	11/16	1 1/2	145	674	724	166	156	18	39	66
3 x 4	26LA21	26 1/2	28 1/2	6 1/2	6 1/8	11/16	1 15/16	145	674	724	166	156	18	50	66
4 x 6	26LA22	37 1/2	37 1/2	7 1/8	7 1/16	11/16	1 15/16	230	953	953	181	180	18	50	105
4 x 6	26LA23	37 1/2	37 1/2	8	7 1/16	11/16	2 3/16	230	953	953	204	180	18	56	105
4 x 6	26LA24	43	43	8 3/4	7 3/4	11/16	2 7/16	250	1093	1093	223	197	18	62	114
4 x 6	26LA25	43	43	8 3/4	7 3/4	11/16	2 13/16	250	1093	1093	223	197	18	72	114
4 x 6	26LA32	37 1/2	37 1/2	7 1/8	7 1/16	11/16	1 15/16	230	953	953	181	180	18	50	105
4 x 6	26LA33	37 1/2	37 1/2	8	7 1/16	11/16	2 3/16	230	953	953	204	180	18	56	105
4 x 6	26LA34	43	43	8 3/4	7 3/4	11/16	2 7/16	250	1093	1093	223	197	18	62	114
4 x 6	26LA35	43	43	8 3/4	7 3/4	11/16	2 13/16	250	1093	1093	223	197	18	72	114



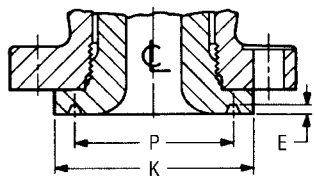
Dimensions & Weights

Size Inlet x Outlet	Type Conventional	U.S. Standard Dimensions (inches)						Approx. Weight Lbs.	Metric Dimensions (millimeters)						Approx. Weight kg
		A		B	C	E	F		A		B	C	E	F	
		Vapor	Liquid						Vapor	Liquid					
4 x 6	26MA10	31 1/2	37 1/2	7 1/4	7	11/16	1 15/16	190	801	953	185	178	18	50	87
4 x 6	26MA11	31 1/2	37 1/2	7 1/4	7	11/16	1 15/16	190	801	953	185	178	18	50	87
4 x 6	26MA12	37 1/2	37 1/2	7 1/4	7	11/16	1 15/16	230	953	953	185	178	18	50	105
4 x 6	26MA13	43	43	8	7	11/16	2 3/16	250	1093	1093	204	178	18	56	114
4 x 6	26MA20	31 1/2	37 1/2	7 1/4	7	11/16	1 15/16	190	801	953	185	178	18	50	87
4 x 6	26MA21	31 1/2	37 1/2	7 1/4	7	11/16	1 15/16	190	801	953	185	178	18	50	87
4 x 6	26MA22	37 1/2	37 1/2	7 1/4	7	11/16	1 15/16	230	953	953	185	178	18	50	105
4 x 6	26MA23	43	43	8	7	11/16	2 3/16	250	1093	1093	204	178	18	56	114
4 x 6	26MA24	43	43	8 3/4	7 3/4	11/16	2 7/16	250	1093	1093	223	197	18	62	114
4 x 6	26MA32	37 1/2	37 1/2	7 1/4	7	11/16	1 15/16	230	953	953	185	178	18	50	105
4 x 6	26MA33	37 1/2	37 1/2	8	7	11/16	2 3/16	250	953	953	204	178	18	56	114
4 x 6	26MA34	43	43	8 3/4	7 3/4	11/16	2 7/16	250	1093	1093	223	197	18	62	114
4 x 6	26NA10	31 1/2	37 1/2	8 1/4	7 3/4	11/16	1 15/16	190	801	953	210	197	18	50	87
4 x 6	26NA11	31 1/2	37 1/2	8 1/4	7 3/4	11/16	1 15/16	190	801	953	210	197	18	50	87
4 x 6	26NA12	37 1/2	37 1/2	8 1/4	7 3/4	11/16	1 15/16	230	953	953	210	197	18	50	105
4 x 6	26NA13	43	43	8 3/4	7 3/4	11/16	2 3/16	250	1093	1093	223	197	18	56	114
4 x 6	26NA14	43	43	8 3/4	7 3/4	11/16	2 7/16	250	1093	1093	223	197	18	62	114
4 x 6	26NA20	31 1/2	37 1/2	8 1/4	7 3/4	11/16	1 15/16	190	801	953	210	197	18	50	87
4 x 6	26NA21	31 1/2	37 1/2	8 1/4	7 3/4	11/16	1 15/16	190	801	953	210	197	18	50	87
4 x 6	26NA22	37 1/2	37 1/2	8 1/4	7 3/4	11/16	1 15/16	230	953	953	210	197	18	50	105
4 x 6	26NA23	43	43	8 3/4	7 3/4	11/16	2 15/16	250	1093	1093	223	197	18	75	114
4 x 6	26NA24	43	43	8 3/4	7 3/4	11/16	2 7/16	250	1093	1093	223	197	18	62	114
4 x 6	26NA32	37 1/2	37 1/2	8 1/4	7 3/4	11/16	1 15/16	230	953	953	210	197	18	50	105
4 x 6	26NA33	37 1/2	43	8 3/4	7 3/4	11/16	2 3/16	250	953	1093	223	197	18	56	114
4 x 6	26NA34	43	43	8 3/4	7 3/4	11/16	2 7/16	250	1093	1093	223	197	18	62	114
4 x 6	26PA10	31 1/2	37 1/2	9	7 1/8	11/16	1 5/8	190	801	953	229	181	18	42	87
4 x 6	26PA11	31 1/2	37 1/2	9	7 1/8	11/16	1 15/16	190	801	953	229	181	18	50	87
4 x 6	26PA12	37 1/2	37 1/2	10	8 7/8	11/16	2 3/16	230	953	953	254	226	18	56	105
4 x 6	26PA13	43	43	10	8 7/8	11/16	2 3/16	250	1093	1093	254	226	18	56	114
4 x 6	26PA14	43	43	10	8 7/8	11/16	2 7/16	250	1093	1093	254	226	18	62	114
4 x 6	26PA20	31 1/2	37 1/2	9	7 1/8	11/16	1 5/8	190	801	953	229	181	18	42	87
4 x 6	26PA21	31 1/2	37 1/2	9	7 1/8	11/16	1 15/16	190	801	953	229	181	18	50	87
4 x 6	26PA22	37 1/2	37 1/2	10	8 7/8	11/16	2 3/16	230	953	953	254	226	18	56	105
4 x 6	26PA23	43	43	10	8 7/8	11/16	2 3/16	250	1093	1093	254	226	18	56	114
4 x 6	26PA24	43	43	10	8 7/8	11/16	2 7/16	250	1093	1093	254	226	18	62	114
4 x 6	26PA32	37 1/2	37 1/2	10	8 7/8	11/16	2 3/16	230	953	953	254	226	18	56	105
4 x 6	26PA33	43	43	10	8 7/8	11/16	2 3/16	250	1093	1093	254	226	18	56	114
4 x 6	26PA34	43	43	10	8 7/8	11/16	2 7/16	250	1093	1093	254	226	18	62	114
6 x 8	26QA10	40 1/2	51	9 1/2	9 7/16	13/16	1 7/8	345	1029	1296	242	240	21	48	157
6 x 8	26QA11	40 1/2	51	9 1/2	9 7/16	13/16	2 1/4	345	1029	1296	242	240	21	58	157
6 x 8	26QA12	45	51	9 1/2	9 7/16	13/16	2 1/4	430	1143	1296	242	240	21	58	196
6 x 8	26QA13	51	51	9 1/2	9 7/16	13/16	2 11/16	430	1296	1296	242	240	21	69	196
6 x 8	26QA20	40 1/2	51	9 1/2	9 7/16	13/16	1 7/8	345	1029	1296	242	240	21	48	157
6 x 8	26QA21	40 1/2	51	9 1/2	9 7/16	13/16	2 1/4	345	1029	1296	242	240	21	58	157
6 x 8	26QA22	45	51	9 1/2	9 7/16	13/16	2 1/4	430	1143	1296	242	240	21	58	196
6 x 8	26QA23	51	51	9 1/2	9 7/16	13/16	2 11/16	430	1296	1296	242	240	21	69	196
6 x 8	26QA32	45	51	9 1/2	9 7/16	13/16	2 1/4	430	1143	1296	242	240	21	58	196
6 x 8	26QA33	51	51	9 1/2	9 7/16	13/16	2 11/16	430	1296	1296	242	240	21	69	196
6 x 8	H26QA13, 23, 33	51	51	9 1/2	9 7/16	13/16	2 11/16	530	1296	1296	242	240	21	69	241
6 x 8	26RA10	40 1/2	51	9 1/2	9 7/16	13/16	1 7/8	345	1029	1296	242	240	21	48	157
6 x 8	26RA11	40 1/2	51	9 1/2	9 7/16	13/16	2 1/4	345	1029	1296	242	240	21	58	157
6 x 10	26RA12	45	51	10 1/2	9 7/16	13/16	2 1/4	500	1143	1296	267	240	21	58	227
6 x 10	26RA13	51	51	10 1/2	9 7/16	13/16	2 11/16	500	1296	1296	267	240	21	69	227
6 x 8	26RA20	40 1/2	51	9 1/2	9 7/16	13/16	1 7/8	345	1029	1296	242	240	21	48	157
6 x 8	26RA21	40 1/2	51	9 1/2	9 7/16	13/16	2 1/4	345	1029	1296	242	240	21	58	157
6 x 10	26RA22	45	51	10 1/2	9 7/16	13/16	2 1/4	500	1143	1296	267	240	21	58	227
6 x 10	26RA23	51	51	10 1/2	9 7/16	13/16	2 11/16	500	1296	1296	267	240	21	69	227
6 x 8	26RA32	45	51	9 1/2	9 7/16	13/16	2 1/4	430	1143	1296	242	240	21	58	196
6 x 10	26RA33	51	51	10 1/2	9 7/16	13/16	2 11/16	500	1296	1296	267	240	21	69	227
6 x 10	H26RA13, 23, 33	51	51	10 1/2	9 7/16	13/16	2 11/16	600	1296	1296	267	240	21	69	273
8 x 10	26TA10	49	54 1/2	11	10 7/8	13/16	2 7/16	600	1245	1385	280	277	21	62	273
8 x 10	26TA11	49	54 1/2	11	10 7/8	13/16	2 7/16	650	1245	1385	280	277	21	62	295
8 x 10	26TA12	49	54 1/2	11	10 7/8	13/16	2 7/16	650	1245	1385	280	277	21	62	295
8 x 10	26TA20	49	54 1/2	11	10 7/8	13/16	2 7/16	600	1245	1385	280	277	21	62	273
8 x 10	26TA21	49	54 1/2	11	10 7/8	13/16	2 7/16	650	1245	1385	280	277	21	62	295
8 x 10	26TA22	49	54 1/2	11	10 7/8	13/16	2 7/16	650	1245	1385	280	277	21	62	295
8 x 10	26TA32	49	54 1/2	11	10 7/8	13/16	2 7/16	650	1245	1385	280	277	21	62	295
8 x 10	H26TA12, 22, 32	54 1/2	54 1/2	11	10 7/8	13/16	2 7/16	750	1385	1385	280	277	21	62	341

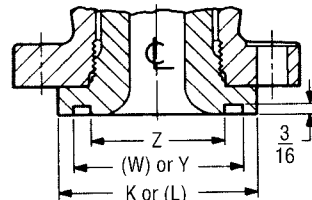


Detail of Flanges on Farris Nozzle Valves

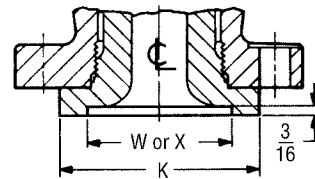
Full Nozzle Inlet Facings (Reference ANSI B16.5)



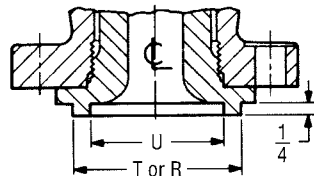
Ring Joint - 9 () ()



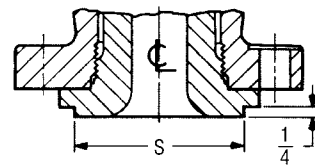
**Large Groove - 6 () ()
Small Groove - 8 () ()**



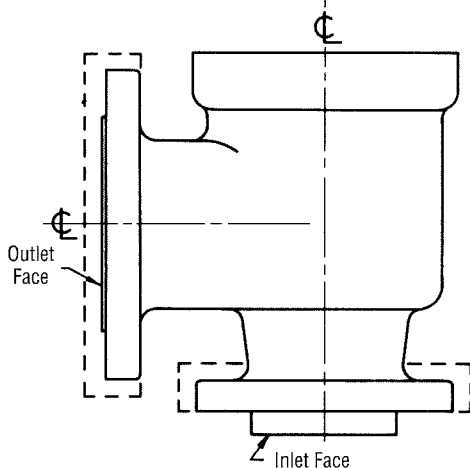
**Large Female - 2 () ()
Small Female - 4 () ()**



**Large Tongue - 5 () ()
Small Tongue - 7 () ()**



Small Male - 3 () ()

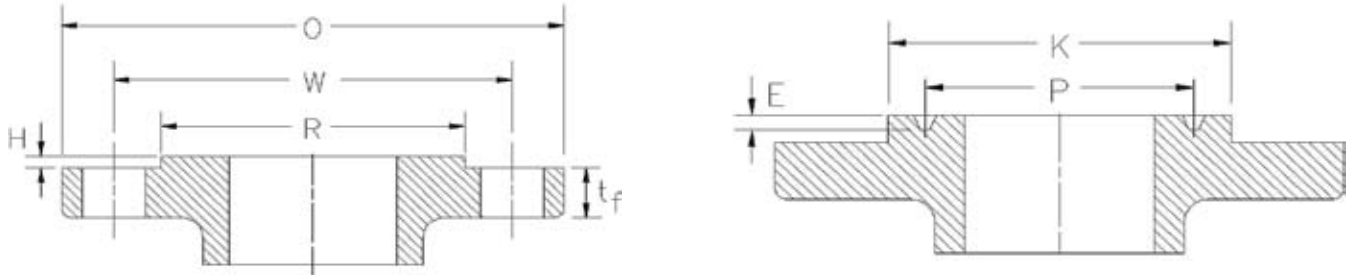


Full Nozzle Valve Flange Changes Altering Center-to-Face Dimensions

1. **Ring Joint Inlet** face and other facings have the same dimension from center line of outlet to face of inlet flange as the raised face inlet flange.
2. **Ring Joint Outlet** face and other facings increase the dimensions from center line of inlet to face of outlet flange by the difference in ANSI total flange thickness.
3. **Heavier Than Standard Outlet** flanges increase the dimension from center line of inlet to face of outlet flange by the difference in ANSI total flange thickness.
4. **Heavier Than Standard Inlet** flanges have the same dimension from center line of outlet to face of inlet flange as the standard inlet flanges.

Note: Optional connections shown may not be available in all sizes. Consult the Factory.

Steel flanges conform to ANSI Standard B16.5-2003.

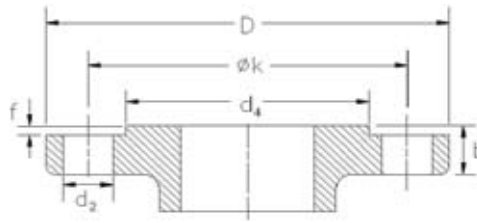


Class	Dimensions of ANSI Raised Face Flange Facings (inches)								Dimensions of Ring Joint Facings (inches)								
	Size	OD of Flange O	Min. Thickness of Flange t_f	Diam. of Bolt Circle W	Diam. of Bolt Holes	Number of Bolts	Diam. of Bolts	Diam. of Raised Face R	Diam. of Raised Face K	Pitch Diam. P	Depth of Groove E	Width of Groove	Ring Number				
CLASS 150 FLANGES	1	4.25	0.56	3.12	0.62	4	1/2	2.00	2.50	1.875	0.250	0.344	R15				
	1½	5.00	0.69	3.88				2.88	3.25	2.562			R19				
	2	6.00	0.75	4.75	5/8		3.62	4.00	3.250	R22							
	2½	7.00	0.88	5.50			4.12	4.75	4.000	R25							
	3	7.50	0.94	6.00	0.75	5.00	5.25	4.500	R29								
	4	9.00		7.50		6.19	6.75	5.875	R36								
	6	11.00	1.00	9.50	0.88	8	3/4	8.50	8.62	7.625			R43				
	8	13.50	1.12	11.75				10.62	10.75	9.750			R48				
	10	16.00	1.19	14.25	1.00	12	7/8	12.75	13.00	12.000			R52				
	CLASS 300 FLANGES	1	4.88	0.69	3.50	0.75	4	5/8	2.00	Use Class 600 dimensions in these sizes							
1½		6.12	0.81	4.50	0.88	3/4		2.88									
2		6.50	0.88	5.00	0.75	8	5/8	3.62									
2½		7.50	1.00	5.88	4.12												
3		8.25	1.12	6.62	0.88		3/4	5.00									
4		10.00	1.25	7.88				6.19									
6		12.50	1.44	10.62	12	7/8	10.62										
8		15.00	1.62	13.00		1.00	1	12.75									
10		17.50	1.88	15.25	1.12	16	1	12.75									
CLASS 600 FLANGES		1	4.88	0.69	3.50	0.75	4	5/8	2.00						2.75	2.000	0.250
	1½	6.12	0.88	4.50	0.88	3/4		2.88	3.56	2.688	R20						
	2	6.50	1.00	5.00	0.75	8	5/8	3.62	4.25	3.250	R23						
	2½	7.50	1.12	5.88	0.88			3/4	4.12	5.00	4.000	R26					
	3	8.25	1.25	6.62			5.00		5.75	4.625	R30						
	4	10.75	1.50	8.50	1.00		7/8	6.19	6.88	5.875	R37						
	6	14.00	1.88	11.50	1.12	12	1	8.50	9.50	8.312	R45						
	8	16.50	2.19	13.75	1.25		1-1/8	10.62	11.88	10.625	R49						
	10	20.00	2.50	17.00	1.38	16	1-1/4	12.75	14.00	12.750	R53						
	CLASS 900 FLANGES	1	Use Class 1500 dimensions in these sizes														
1½																	
2																	
2½																	
3		9.50	1.50	7.50	1.00	8	7/8	5.00	6.12	4.875	0.312	0.469	R31				
4		11.50	1.75	9.25	1.25		12	1-1/8	6.19	7.12			5.875	R37			
6	15.00	2.19	12.50	8.50		9.50			8.312	R45							
CLASS 1500 FLANGES	1	5.88	1.12	4.00	1.00	4	7/8	2.00	2.81	2.000			0.250	0.344	R16		
	1½	7.00	1.25	4.88	1.12		1	2.88	3.62	2.688					R20		
	2	8.50	1.50	6.50	1.00	8	7/8	3.62	4.88	3.750					R24		
	2½	9.62	1.62	7.50	1.12		1	4.12	5.38	4.250	R27						
	3	10.50	1.88	8.00	1.25		1-1/8	5.00	6.62	5.375	R35						
	4	12.25	2.12	9.50	1.38	12	1-1/4	6.19	7.62	6.375	R39						
	6	15.50	3.25	12.50	1.50		1-3/8	8.50	9.75	8.312	0.375	0.531			R46		
CLASS 2500 FLANGES	1	6.25	1.38	4.25	1.00	4	7/8	2.00	3.25	2.375	0.250	0.344	R18				
	1½	8.00	1.75	5.75	1.25		1-1/8	2.88	4.50	3.250			R23				
	2	9.25	2.00	6.75	1.12	8	1	3.62	5.25	4.000			0.312	0.469	R26		
	2½	10.50	2.25	7.75	1.25		1-1/8	4.12	5.88	4.375					R28		
	3	12.00	2.62	9.00	1.38		1-1/4	5.00	6.62	5.000					0.375	0.531	R32

General Notes:

1. Feature C' applies to flange class 600 and above, class 150 and 300 use C.
2. Feature H equals 0.06 inches for class 150 and 300 flanges; 0.25 inches for class 600 and above.
3. Dimensions taken from ASME/ANSI B16.4 for flanged fittings.

DIN Flange Dimensions



Class	Size (DN)	Dimensions of DIN Flange Facings (millimeters)							
		Flange			Raised Face		Bolts		
		OD of Flange D	Min. Thickness of Flange b	Dia. of Bolt Circle k	Dia. of Raised Face d ₄	Raised Face Height f	Number of Bolts	Thread	Dia. of Bolt Holes d ₂
NOMINAL PRESSURE 10	25	Use nominal pressure 16 dimensions for these sizes							
	40								
	50								
	65								
	80								
	100								
	150	Use nominal pressure 16 dimensions for these sizes							
	200								
250	395	26	350	320	12				
NOMINAL PRESSURE 16	25	Use nominal pressure 40 dimensions for these sizes							
	40								
	50								
	65								
	80	200	20	160	138	8			
	100	220	20	180	158	12	M 20	22	
	150	285	22	240	212				
	200	340	24	295	268	M 24	26		
250	405	26	355	320					
NOMINAL PRESSURE 25	25	Use nominal pressure 40 dimensions for these sizes							
	40								
	50								
	65								
	80								
	100								
	150	Use nominal pressure 40 dimensions for these sizes							
	200								
250	425	32	370	335	M 27	30			
NOMINAL PRESSURE 40	25	115	18	85	68	2	4	M 16	18
	40	150	18	110	88				
	50	165	20	125	102	3	8	M 20	22
	65	185	22	145	122				
	80	200	24	160	138				
	100	235	24	190	162				
	150	300	28	250	218	12	M 24	26	
	200	375	34	320	285				
250	450	38	385	345	M 27	30			
NOMINAL PRESSURE 64	25	Use nominal pressure 160 dimensions for these sizes							
	40								
	50	180	26	135	102	3	4	M 20	22
	65	205	26	160	122		8		
	80	215	28	170	138		12	M 24	26
	100	250	30	200	162				
150	345	36	280	218	M 30	33			
NOMINAL PRESSURE 100	25	Use nominal pressure 160 dimensions for these sizes							
	40								
	50								
	65								
	80								
	100								
	150	355	44	290	218	3	12	M 30	33
NOMINAL PRESSURE 160	25	140	24	100	68	2	4	M 16	18
	40	170	28	125	88				
	50	195	30	145	102	3	8	M 24	26
	65	220	34	170	122				
	80	230	36	180	138				
	100	265	40	210	162				
	150	355	50	290	218	12	M 27	30	
						M 30	33		



Austenitic Stainless Steel: ASME SA-351 Grade CF8M¹--316 St. St

Orifice Letter	Valve Size	ANSI Flange Class		Maximum Pressure (psig)						
				Temperature Range					Back Pressure Limit ⁶	
				Inlet	Outlet	-450°F to -76°F	-75°F to 100°F	450°F	800°F	1000°F
D	1D2	150	150	275	275	180	80	20	275	230
	1D2 ²	300	150	275	275	275	275	275	275	230
	1D2	300	150	720	720	495	420	350	275	230
	1D2	600	150	1440	1440	990	845	700	275	230
	1½D2	900	300	2160	2160	1485	1265	1050	600	500
	1½D2	1500	300	3600	3600	2480	2110	1750	600	500
	1½D3	2500	300	4000	6000	4130	3520	2915	720	500
E	1E2	150	150	275	275	180	80	20	275	230
	1E2 ²	300	150	275	275	275	275	275	275	230
	1E2	300	150	720	720	495	420	350	275	230
	1E2	600	150	1440	1440	975	845	700	275	230
	1½E2	900	300	2160	2160	1485	1265	1050	600	500
	1½E2	1500	300	3600	3600	2480	2110	1750	600	500
	1½E3	2500	300	4000	6000	4130	3520	2915	720	500
F	1½F2	150	150	275	275	180	80	20	275	230
	1½F2 ²	300	150	275	275	275	275	275	275	230
	1½F2	300	150	720	720	495	420	350	275	230
	1½F2	600	150	1440	1440	975	845	700	275	230
	1½F3	900	300	2160	2160	1485	1265	1050	600	500
	1½F3	1500	300	2200	3600	2480	2110	1750	600	500
	1½F3	2500	300	3400	5000	4130	3520	2915	720	500
G	1½G3	150	150	275	275	180	80	20	275	230
	1½G3 ²	300	150	275	275	275	275	275	275	230
	1½G3	300	150	720	720	495	420	350	275	230
	1½G3	600	150	1440	1440	975	845	700	275	230
	1½G3	900	300	2160	2160	1485	1265	1050	600	470
	2G3	1500	300	2450	3600	2480	2110	1750	600	470
	2G3	2500	300	2600	3600	3600	3520	2915	720	470
H	1½H3	150	150	275	275	180	80	20	275	230
	1½H3 ²	300	150	275	275	275	275	275	275	230
	2H3	300	150	720	720	495	420	350	275	230
	2H3	600	150	1440	1440	975	845	700	275	230
	2H3	900	150	1485	2160	1485	1265	1050	275	230
	2H3	1500	300	1600	2750	2480	2110	1750	600	415
J	2J3	150	150	275	275	180	80	20	275	230
	2J3 ²	300	150	275	275	275	275	275	275	230
	3J4	300	150	500	720	495	420	350	275	230
	3J4	600	150	625	1440	975	845	700	275	230
	3J4	900	150	800	2160	1485	1265	1050	275	230
	3J4	1500	300	800	2700	2480	2110	1750	600	230

General Notes:

1. Material limited to 1500°F.
2. Pressure less than rating for 300# class flange to designate maximum pressure limit when used on Farris 300# lightweight design valves.
3. High pressure version
4. Material commonly designated as 316 Stainless Steel.
5. Pressures shown represent values shown in API Standard 526 and/or ASME B16.34.
6. Back pressure limits based on temperature of 100°F.

Austenitic Stainless Steel: ASME SA-351 Grade CF8M¹--316 St. St

Orifice Letter	Valve Size	ANSI Flange Class		Maximum Pressure (psig)						
				Temperature Range					Back Pressure Limit ⁶	
				Inlet	Outlet	-450°F to -76°F	-75°F to 100°F	450°F	800°F	1000°F
K	3K4	150	150	275	275	180	80	20	275	150
	3K4 ²	300	150	275	275	275	275	275	275	150
	3K4	300	150	525	720	495	420	350	275	150
	3K4	600	150	600	1440	975	845	700	275	200
	3K6	900	150	600	2160	1485	1265	1050	275	200
	3K6	1500	300	750	2220	2220	2110	1750	600	200
L	3L4	150	150	275	275	180	80	20	275	100
	3L4 ²	300	150	275	275	275	275	275	275	100
	4L6	300	150	535	720	495	420	350	275	170
	4L6	600	150	535	1000	975	845	700	275	170
	4L6	900	150	700	1500	1485	1265	1050	275	170
	4L6	1500	150	700	1500	1500	1500	1500	275	170
M	4M6	150	150	275	275	180	80	20	275	80
	4M6 ²	300	150	275	275	275	275	275	275	80
	4M6	300	150	525	720	495	420	350	275	160
	4M6	600	150	600	1000	975	845	700	275	160
	4M6	900	150	600	1100	1100	1100	1050	275	160
N	4N6	150	150	275	275	180	80	20	275	80
	4N6 ²	300	150	275	275	275	275	275	275	80
	4N6	300	150	450	720	495	420	350	275	160
	4N6	600	150	500	1000	975	845	700	275	160
	4N6	900	150	500	1000	1000	1000	1000	275	160
P	4P6	150	150	175	275	180	80	20	275	80
	4P6 ²	300	150	175	275	275	275	275	275	80
	4P6	300	150	300	525	495	420	350	275	150
	4P6	600	150	480	1000	975	845	700	275	150
	4P6	900	150	480	1000	1000	1000	1000	275	150
Q	6Q8	150	150	165	165	165	80	20	115	70
	6Q8 ²	300	150	165	165	165	165	165	115	70
	6Q8	300	150	250	300	300	300	300	115	115
	6Q8	600	150	300	600	600	600	600	115	115
	6Q8 ³	600	150	300	900	900	845	700	275	200
R	6R8	150	150	55	100	100	80	20	60	60
	6R8 ²	300	150	55	100	100	100	100	60	60
	6R10	300	150	150	230	230	230	230	100	100
	6R10	600	150	200	300	300	300	300	100	100
	6R10 ³	600	150	200	600	600	600	600	275	200
T	8T10	150	150	50	65	65	65	20	30	30
	8T10 ²	300	150	50	65	65	65	65	30	30
	8T10	300	150	65	120	120	120	120	60	60
	8T10 ³	300	150	65	300	300	300	300	100	100

General Notes:

1. Material limited to 1500°F.
2. Pressure less than rating for 300# class flange to designate maximum pressure limit when used on Farris 300# lightweight design valves.
3. High pressure version
4. Material commonly designated as 316 Stainless Steel.
5. Pressures shown represent values shown in API Standard 526 and/or ASME B16.34.
6. Back pressure limits based on temperature of 100°F.



Nickel Alloy: ASME SA-494 Grade CX2MW¹-- Hastelloy C

Orifice Letter	Valve Size Inlet by Orifice by Outlet	ANSI Flange Class Inlet Outlet		Maximum Pressure (psig)				
				Temperature Range			Back Pressure Limit ⁶	
				-20°F to 100°F	450°F	500°F	Conventional Type	BalanSeal Type
D	1D2	150	150	230	180	170	230	230
	1D2 ²	300	150	230	230	230	230	230
	1D2	300	150	600	477	465	230	230
	1D2	600	150	1200	952	925	230	230
	1½D2	900	300	1800	1430	1390	600	500
	1½D2	1500	300	3000	2382	2315	600	500
	1½D3	2500	300	5000	3970	3860	600	500
E	1E2	150	150	230	180	170	230	230
	1E2 ²	300	150	230	230	230	230	230
	1E2	300	150	600	477	465	230	230
	1E2	600	150	1200	952	925	230	230
	1½E2	900	300	1800	1430	1390	600	500
	1½E2	1500	300	3000	2382	2315	600	500
	1½E3	2500	300	5000	3970	3860	600	500
F	1½F2	150	150	230	180	170	230	230
	1½F2 ²	300	150	230	230	230	230	230
	1½F2	300	150	600	477	465	230	230
	1½F2	600	150	1200	952	925	230	230
	1½F3	900	300	1800	1430	1390	600	500
	1½F3	1500	300	3000	2382	2315	600	500
	1½F3	2500	300	5000	3970	3860	600	500
G	1½G3	150	150	230	180	170	230	230
	1½G3 ²	300	150	230	230	230	230	230
	1½G3	300	150	600	477	465	230	230
	1½G3	600	150	1200	952	925	230	230
	1½G3	900	300	1800	1430	1390	600	470
	2G3	1500	300	3000	2382	2315	600	470
	2G3	2500	300	3705	3705	3705	600	470
H	1½H3	150	150	230	180	170	230	230
	1½H3 ²	300	150	230	230	230	230	230
	2H3	300	150	600	477	465	230	230
	2H3	600	150	1200	952	925	230	230
	2H3	900	150	1800	1430	1390	230	230
	2H3	1500	300	2750	2382	2315	600	415
J	2J3	150	150	230	180	170	230	230
	2J3 ²	300	150	230	230	230	230	230
	3J4	300	150	600	477	465	230	230
	3J4	600	150	1200	952	925	230	230
	3J4	900	150	1800	1430	1390	230	230
	3J4	1500	300	2700	2382	2315	600	230

General Notes:

1. Valve limited to 500°F.
2. Pressure less than rating for 300# class flange to designate maximum pressure limit when used on Farris 300# lightweight design valves.
3. High pressure version.
4. Material commonly sold under the trade name of Hastelloy C™.
5. Pressure shown represent the carbon steel valve limits or Hastelloy C flange limit (per ASME B16.34), whichever is lower.
6. Back pressure limits based on temperature of 100°F.

Nickel Alloy: ASME SA-494 Grade CX2MW¹ -- Hastelloy C

Orifice Letter	Valve Size	ANSI Flange Class		Maximum Pressure (psig)				
				Temperature Range			Back Pressure Limit ⁶	
				Inlet by Orifice by Outlet	Inlet	Outlet	-20°F to 100°F	450°F
K	3K4	150	150	230	180	170	230	150
	3K4 ²	300	150	230	230	230	230	150
	3K4	300	150	600	477	465	230	150
	3K4	600	150	1200	952	925	230	200
	3K6	900	150	1800	1430	1390	230	200
	3K6	1500	300	2220	2220	2220	600	200
L	3L4	150	150	230	180	170	230	100
	3L4 ²	300	150	230	230	230	230	100
	4L6	300	150	600	477	465	230	170
	4L6	600	150	1000	952	925	230	170
	4L6	900	150	1500	1430	1390	230	170
	4L6	1500	150	1500	1500	1500	230	170
M	4M6	150	150	230	180	170	230	80
	4M6 ²	300	150	230	230	230	230	80
	4M6	300	150	600	477	465	230	160
	4M6	600	150	1100	952	925	230	160
	4M6	900	150	1100	1100	1100	230	160
N	4N6	150	150	230	180	170	230	80
	4N6 ²	300	150	230	230	230	230	80
	4N6	300	150	600	477	465	230	160
	4N6	600	150	1000	952	925	230	160
	4N6	900	150	1000	1000	1000	230	160
P	4P6	150	150	230	180	170	230	80
	4P6 ²	300	150	230	230	230	230	80
	4P6	300	150	525	477	465	230	150
	4P6	600	150	1000	952	925	230	150
	4P6	900	150	1000	1000	1000	230	150
Q	6Q8	150	150	165	165	140	140	70
	6Q8 ²	300	150	165	165	165	115	70
	6Q8	300	150	300	300	300	115	115
	6Q8	600	150	600	600	600	115	115
	6Q8 ³	600	150	900	900	900	230	200
R	6R8	150	150	100	100	100	100	60
	6R8 ²	300	150	100	100	100	60	60
	6R10	300	150	230	230	230	100	100
	6R10	600	150	300	300	300	100	100
	6R10 ³	600	150	600	600	600	230	200
T	8T10	150	150	65	65	65	65	30
	8T10 ²	300	150	65	65	65	30	30
	8T10	300	150	120	120	120	60	60
	8T10 ³	300	150	300	300	300	100	100

General Notes:

1. Valve limited to 500°F.
2. Pressure less than rating for 300# class flange to designate maximum pressure limit when used on Farris 300# lightweight design valves.
3. High pressure version.
4. Material commonly sold under the trade name of Hastelloy C™.
5. Pressures shown represent the carbon steel valve limits or Hastelloy C flange limit (per ASME B16.34), whichever is lower.
6. Back pressure limits based on temperature of 100°F.



Nickel / Copper Alloy: ASME SA-494 Grade M-35-1¹ – Monel

Orifice Letter	Valve Size Inlet by Orifice by Outlet	ANSI Flange Class Inlet Outlet		Maximum Pressure (psig)					
				Temperature Range				Back Pressure Limit ⁵	
				-20°F to 100°F	450°F	800°F	900°F	Conventional Type	BalanSeal Type
D	1D2	150	150	230	175	80	50	230	230
	1D2 ²	300	150	230	230	230	230	230	230
	1D2	300	150	600	475	460	275	230	230
	1D2	600	150	1200	945	915	550	230	230
E	1E2	150	150	230	175	80	50	230	230
	1E2 ²	300	150	230	230	230	230	230	230
	1E2	300	150	600	475	460	275	230	230
	1E2	600	150	1200	945	915	550	230	230
F	1½F2	150	150	230	175	80	50	230	230
	1½F2 ²	300	150	230	230	230	230	230	230
	1½F2	300	150	600	475	460	275	230	230
	1½F2	600	150	1200	945	915	550	230	230
G	1½G3	150	150	230	175	80	50	230	230
	1½G3 ²	300	150	230	230	230	230	230	230
	1½G3	300	150	600	475	460	275	230	230
	1½G3	600	150	1200	945	915	550	230	230
H	1½H3	150	150	230	175	80	50	230	230
	1½H3 ²	300	150	230	230	230	230	230	230
	2H3	300	150	600	475	460	275	230	230
	2H3	600	150	1200	945	915	550	230	230
J	2J3	150	150	230	175	80	50	230	230
	2J3 ²	300	150	230	230	230	230	230	230
	3J4	300	150	600	475	460	275	230	230
	3J4	600	150	1200	945	915	550	230	230
K	3K4	150	150	230	175	80	50	230	150
	3K4 ²	300	150	230	230	230	230	230	150
	3K4	300	150	600	475	460	275	230	150
	3K4	600	150	1200	945	915	550	230	200
L	3L4	150	150	230	175	80	50	230	100
	3L4 ²	300	150	230	230	230	230	230	100
	4L6	300	150	600	475	460	275	230	170
	4L6	600	150	1200	945	915	550	230	170
M	4M6	150	150	230	175	80	50	230	80
	4M6 ²	300	150	230	230	230	230	230	80
	4M6	300	150	600	475	460	275	230	160
	4M6	600	150	1100	945	915	550	230	160
N	4N6	150	150	230	175	80	50	230	80
	4N6 ²	300	150	230	230	230	230	230	80
	4N6	300	150	600	475	460	275	230	160
	4N6	600	150	1000	945	915	550	230	160
P	4P6	150	150	230	175	80	50	230	80
	4P6 ²	300	150	230	230	230	230	230	80
	4P6	300	150	600	475	460	275	230	160
	4P6	600	150	1000	945	915	550	230	160
Q	6Q8	150	150	140	165	80	50	115	70
	6Q8 ²	300	150	140	165	165	165	115	70
	6Q8	300	150	300	300	300	275	115	115
	6Q8	600	150	600	600	600	550	115	115
R	6R8	150	150	100	100	80	50	60	60
	6R8 ²	300	150	100	100	100	100	60	60
	6R10	300	150	230	230	230	230	100	100
	6R10	600	150	300	300	300	300	100	100
T	8T10	150	150	65	65	65	65	30	30
	8T10 ²	300	150	65	65	65	65	30	30
	8T10	300	150	120	120	120	120	60	60

General Notes:

1. Valve material limited to 900°F.
2. Pressure less than rating for 300# class flange to designate maximum pressure limit when used on Farris 300# lightweight design valves.
3. Material commonly sold under the trade name of Monel™.
4. Pressure and temperature limits per API Standard 526.
5. Back pressure limits based on temperature of 100°F.

General Equations

Before beginning any calculations, it is necessary to establish the general category of the pressure relief valve to be used. This section covers conventional spring-loaded types and BalanSeal spring-loaded types. Pilot-operated valves are covered in a separate catalog.

Given the rate of fluid flow to be relieved, the usual procedure is to first calculate the minimum area required in the valve orifice for the conditions contained in one of the following equations. In the case of steam, air or water, the selection of an orifice may be made directly from the capacity tables.

The second step is to select the specific type of valve that meets the pressure and temperature requirements.

General equations are given first, to identify the basic terms that correlate with ASME Pressure Vessel Code, Section VIII.

Since these equations are conservative, it is recommended that computations of relieving loads avoid cascading of safety factors or multiple contingencies beyond the reasonable flow needed to protect the pressure vessel.

Conventional Valves Constant Back Pressure Only

The conventional valve may be used when the variation in back pressure does not exceed 10% of the set pressure, provided the corresponding variation in set pressure is acceptable.

Orifice Area Calculations

VAPORS or GASES – Lbs./hr. – CONSTANT BACK PRESSURE

$$A = \frac{W \sqrt{T} \sqrt{Z}}{C K_d P \sqrt{M} K_b}$$

$K_b = 1$ when back pressure is below 55% of abs. relieving pressure.

VAPORS or GASES – S.C.F.M. – CONSTANT BACK PRESSURE

$$A = \frac{V \sqrt{G} \sqrt{T} \sqrt{Z}}{1.175 C K_d P K_b}$$

$K_b = 1$ when back pressure is below 55% of abs. relieving pressure.

STEAM – Lbs./hr. – CONSTANT BACK PRESSURE

$$A = \frac{W_s}{51.5 K_d P K_b K_{sh} K_n}$$

$K_b = 1$ when back pressure is below 55% of abs. relieving pressure.
 $K_{sh} = 1$ for Sat. Steam

AIR – S.C.F.M. –

$$A = \frac{V_a \sqrt{T}}{418 K_d P K_b}$$

CONSTANT BACK PRESSURE

 $K_b = 1$ when back pressure is below 55% of abs. relieving pressure.

LIQUIDS – G.P.M – ASME Code (2600L Series)

$$A = \frac{V_L \sqrt{G}}{38.0 K_d \sqrt{\Delta P} K_u}$$

CONSTANT BACK PRESSURE

 $K_p = 1$ at 25% overpressure
 $K_u = 1$ at normal viscosities

Non-ASME Code (2600 Series)

$$A = \frac{V_L \sqrt{G}}{38.0 K_d \sqrt{1.25 P_1 - P_2} K_b K_u}$$

Nomenclature

A = Required orifice area in square inches. This value may be compared with the API effective areas included in this catalog and defined in ANSI/API Standard 526 or the ASME actual area.

W = Required vapor capacity in pounds per hour.

W_s = Required steam capacity in pounds per hour.

V = Required gas capacity in S.C.F.M.

V_a = Required air capacity in S.C.F.M.

V_L = Required liquid capacity in U.S. gallons per minute.

G = Specific gravity of gas (air=1) or specific gravity of liquid (water=1) at actual discharge temperature will obtain a safe valve size.

M = Average molecular weight of vapor.

P = Relieving pressure in pounds per square inch absolute=set pressure+overpressure+14.7. Minimum overpressure is 3 psi.

P₁ = Set pressure at inlet, psig.

P₂ = Back pressure at outlet, psig.

ΔP = Set pressure + overpressure, psig – back pressure, psig. At 10% overpressure ΔP=1.1P₁-P₂. Below 30 psig set, ΔP=P₁+3-P₂.

T = Inlet temperature absolute (°F+460).

Z = Compressibility factor corresponding to T and P (if this factor is not available, compressibility correction can be safely ignored by using a value of Z=1.0).

C = Gas or vapor flow constant. Select from table on page 86 or use the curve and table on page 85.

k = Ratio of specific heats, C_p/C_v. This value is constant for an ideal gas. If this ratio is unknown, the value k=1.001, C=315 will result in a safe valve size. Isentropic coefficient n may be used instead of k. See curve and table on page 85.

K_p = Liquid capacity correction factor for overpressures lower than 25%. See curve on page 89. Non-Code equations only.

K_b = Vapor or gas flow correction factor for constant back pressures above critical pressure. See curve on page 87.

K_v = Vapor or gas flow factor for variable back pressures. See curve on page 87. BalanSeal valves only.

K_w = Liquid flow factor for variable and constant back pressures. See curve on page 89. BalanSeal valves only.

K_u = Liquid viscosity correction factor. See chart on page 90 or curve on page 91.

K_{sh} = Steam superheat correction factor. See table on page 88.

K_n = Napier steam correction factor for set pressures between 1500 and 2900 psig. See table on page 88.

Service Fluid	Coefficient of Discharge When Sizing Using	
	API Effective Areas	ASME Actual Areas
Air, Steam, Vapor & Gas	0.953	0.858
Liquid (2600L, ASME Code)	0.724	0.652
Liquid (2600 Non Code)	0.640	0.576

BalanSeal Valves Variable or Constant Back Pressure

The BalanSeal (balanced bellows) valve is used to prevent corrosion of the guiding surfaces of a pressure relief valve, to confine the lading fluid and prevent contamination, or to make the valve suitable for variable back pressure service. When the BalanSeal valve is under constant or variable back pressure conditions, the valve capacity is affected. Depending on the percentage of maximum back pressure to the flowing pressure of the valve, a factor for the correction of valve capacity is necessary. The effect on valve capacity is different in liquid service than in vapor and gas service, so correction factors vary. In the calculations that follow, use K_v for vapors and gases as shown on page 87 and K_w for liquids as shown on page 89.

When sizing and selecting a BalanSeal valve, follow the same procedures as for conventional valves, but use the following equations that incorporate the correction factors K_v and K_w .

The BalanSeal valve must be used when the variation in back pressure exceeds 10% of set pressure.

Orifice Area Calculations

VAPORS or GASES – Lbs./hr. –

$$A = \frac{W \sqrt{T} \sqrt{Z}}{CK_d P \sqrt{M} K_v}$$

VAPORS or GASES – S.C.F.M. –

$$A = \frac{V \sqrt{G} \sqrt{T} \sqrt{Z}}{1.175 CK_d P K_v}$$

STEAM – Lbs./hr. –

$$A = \frac{W_s}{51.5 K_d P K_v K_{sh} K_n}$$

AIR – S.C.F.M. –

$$A = \frac{V_a \sqrt{T}}{418 K_d P K_v}$$

LIQUIDS – G.P.M –
ASME Code (2600L Series)

$$A = \frac{V_L \sqrt{G}}{38.0 K_d \sqrt{\Delta P} K_w K_u}$$

Non-ASME Code (2600 Series)

$$A = \frac{V_L \sqrt{G}}{38.0 K_d \sqrt{1.25 P_1 - P_2} K_p K_w K_u}$$

Capacity Correction Factors

K_g = Sizing Factor for specific gravity

$$= \frac{1}{\sqrt{G}}$$

$K_g = 1$ for air and water

K_m = Sizing Factor for molecular weight

$$= \sqrt{M}$$

K_t = Sizing Factor for temperature

$$= \frac{\sqrt{520}}{\sqrt{T}}$$

K_c = Sizing Factor for specific heat ratio

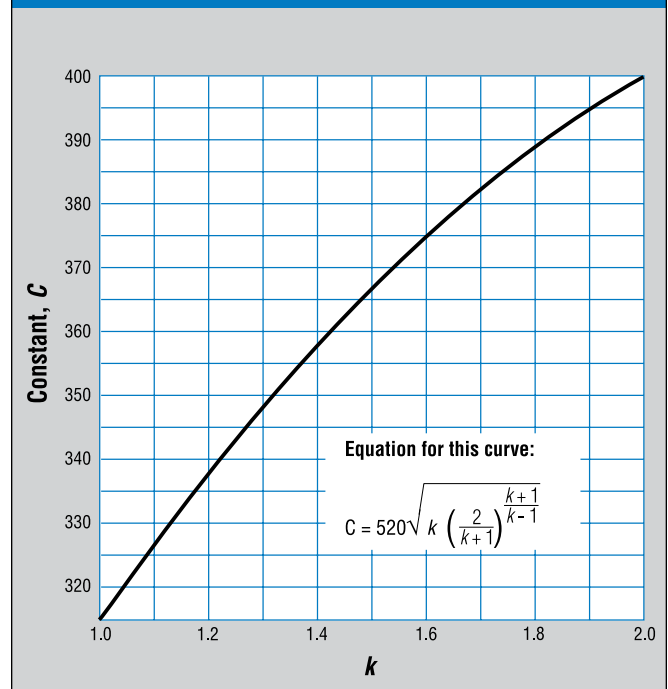
$$= \frac{C}{315}$$

*If specific heat ratio is unknown, use conservative value of $K_c = 1$.

Gas or Vapor Flow Constant C for Gas or Vapor Related to Ratio of Specific Heats ($k = C_p/C_v$)

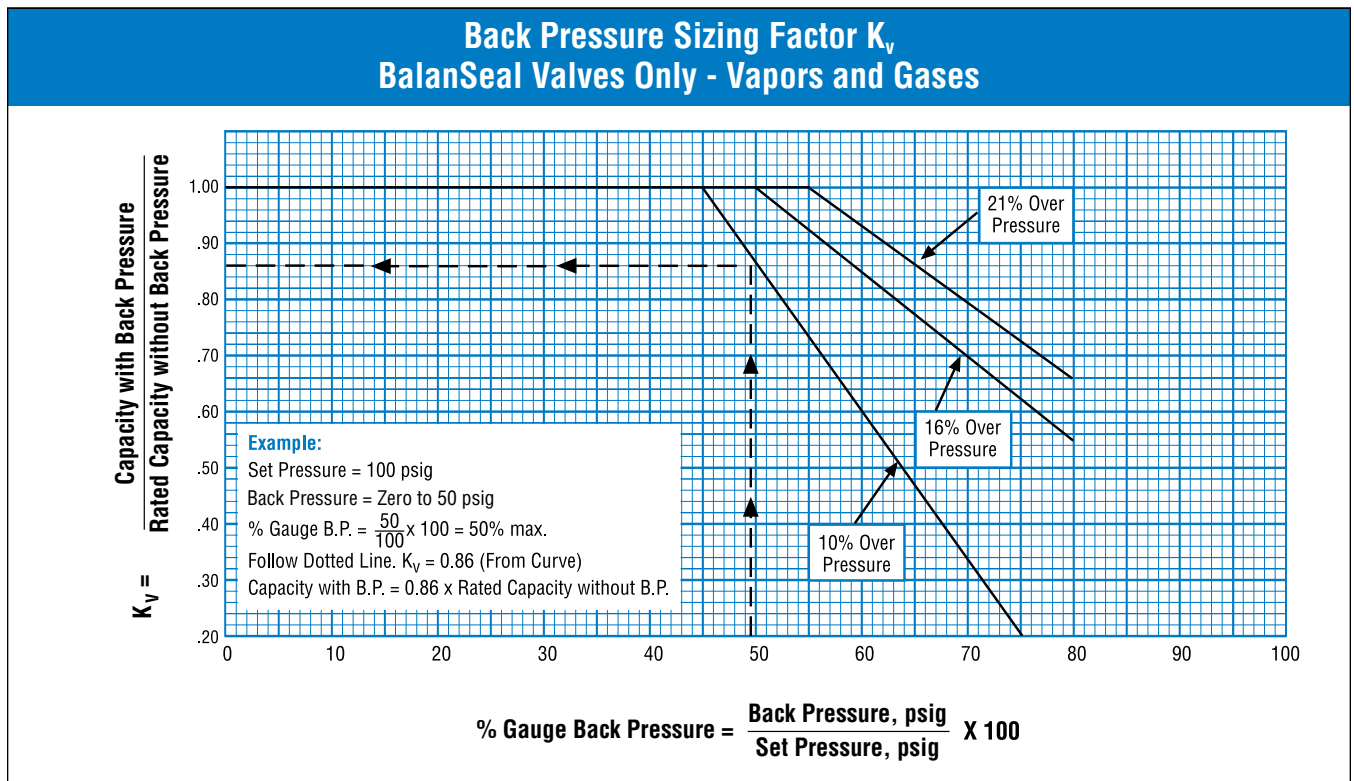
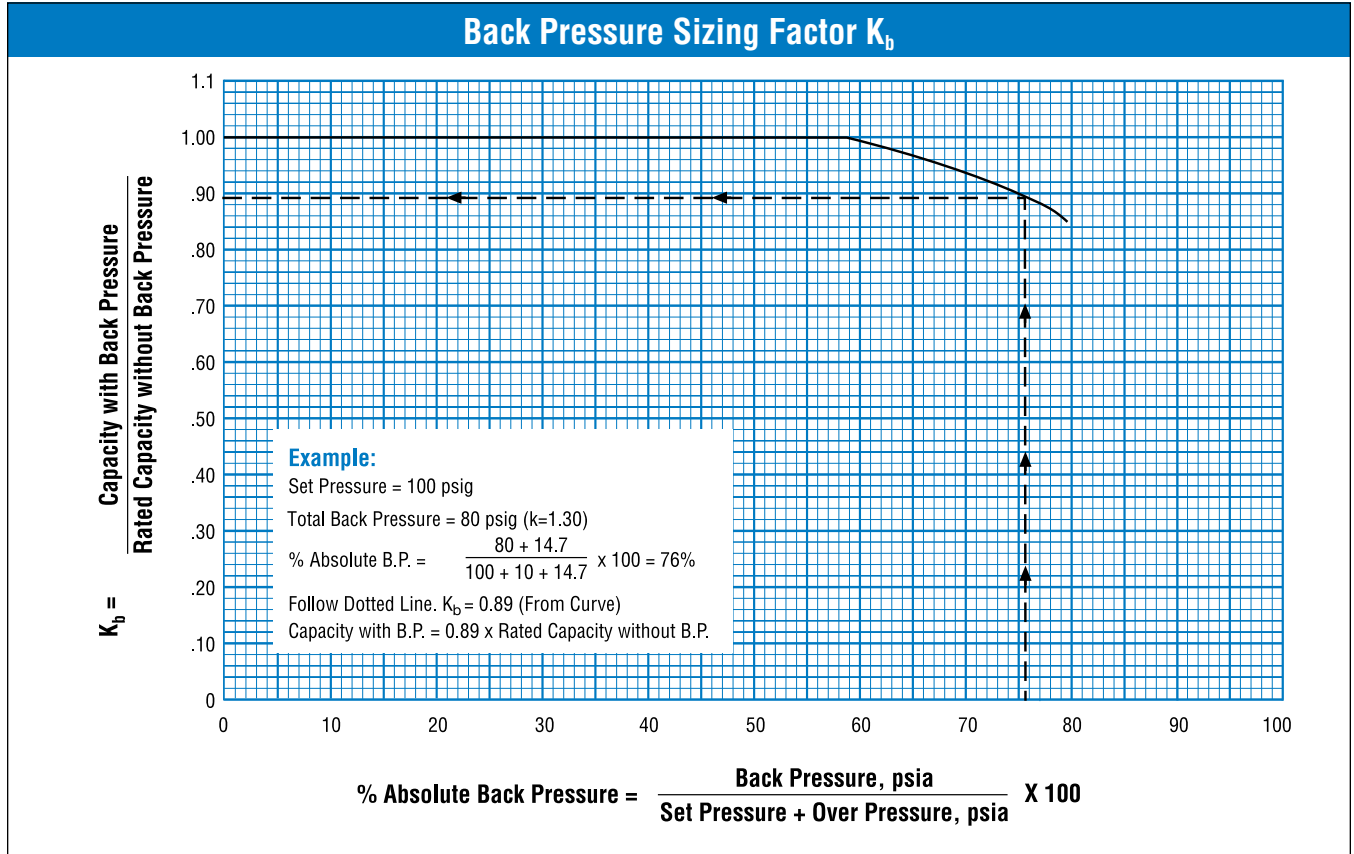
k	Constant C	k	Constant C	k	Constant C
1.00	315	1.26	343	1.52	366
1.02	318	1.28	345	1.54	368
1.04	320	1.30	347	1.56	369
1.06	322	1.32	349	1.58	371
1.08	324	1.34	351	1.60	372
1.10	327	1.36	352	1.62	374
1.12	329	1.38	354	1.64	376
1.14	331	1.40	356	1.66	377
1.16	333	1.42	358	1.68	379
1.18	335	1.44	359	1.70	380
1.20	337	1.46	361	2.00	400
1.22	339	1.48	363	2.20	412
1.24	341	1.50	364	—	—

Constant C for Gas or Vapor Related to Ratio of Specific Heats ($k = C_p/C_v$)

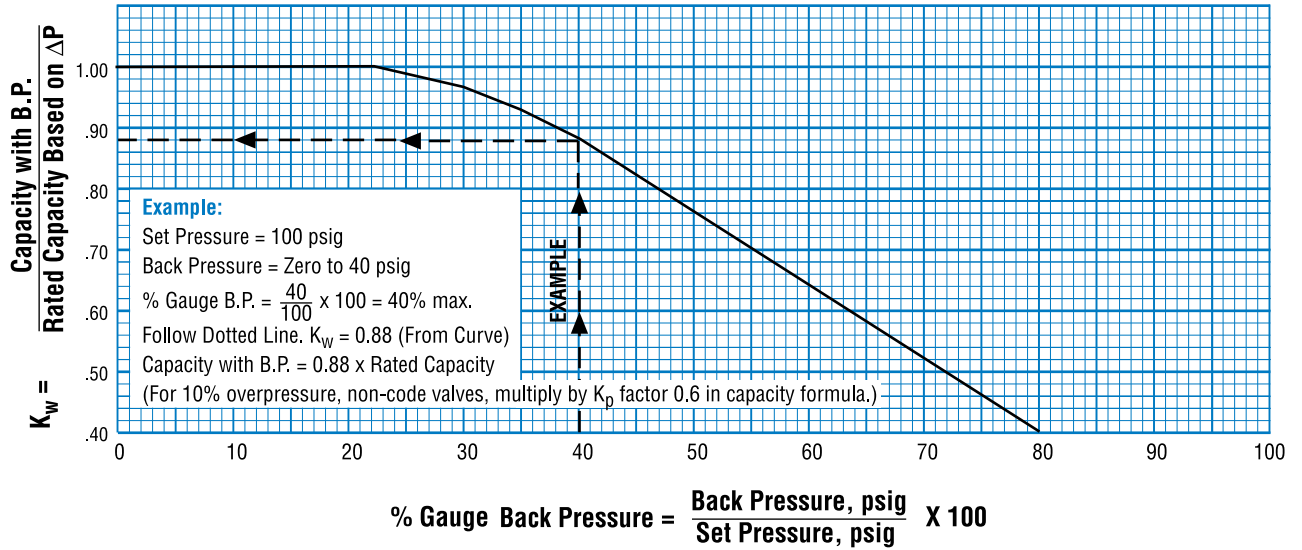


Note: When back pressure P_2 is variable, use the maximum value.

Fluid	Formula	Molecular Weight	Specific Gravity		k (C_p/C_v)	C (Constant)
			Liquid	Gas		
Acetic Acid	HC ₂ H ₃ O ₂	60.05	1.049	2.073	1.15	332
Acetone	C ₃ H ₆ O	58.08	0.791	-	-	-
Acetylene	C ₂ H ₂	26.04	0.62	0.899	1.26	343
Air	-	28.97	0.86	1	1.4	356
Ammonia	NH ₃	17.03	0.817	0.588	1.33	350
Argon	A	39.94	1.65	1.388	1.67	378
Benzene	C ₆ H ₆	78.11	0.879	2.696	1.12	329
Butane/n-Butane	C ₄ H ₁₀	58.12	0.579	2.006	1.094	326
Carbon Dioxide	CO ₂	44.01	1.101	1.519	1.3	347
Carbon Disulfide	CS ₂	76.13	1.263	2.628	1.21	338
Carbon Monoxide	CO	28	0.814	0.966	1.4	356
Chlorine	Cl ₂	70.9	1.58	2.45	1.36	353
Cyclohexane	C ₆ H ₁₂	84.16	0.779	2.905	1.09	326
Dowtherm A	-	165	1.064	-	-	-
Dowtherm J	-	134	0.931	-	-	-
Ethane	C ₂ H ₆	30.07	0.546	1.04	1.22	339
Ethyl Alcohol (Ethanol)	C ₂ H ₆ O	46.07	0.789	1.59	1.13	330
Ethyl Chloride	C ₂ H ₅ Cl	64.52	0.903	2.227	1.19	336
Ethylene (Ethene)	C ₂ H ₄	28.05	0.566	0.968	1.26	343
Freon 12	CCl ₂ F ₂	120.9	1.35	4.17	1.14	331
Helium	He	4	-	0.138	1.66	377
Hexane	C ₆ H ₁₄	86.17	0.659	2.974	1.06	322
Hydrochloric Acid	HCl	36.5	1.64	-	-	-
Hydrofluoric Acid	HF	20.01	0.92	-	-	-
Hydrogen	H ₂	2.016	0.0709	0.069	1.41	357
Hydrogen Sulfide	H ₂ S	34.07	0.79	1.176	1.32	349
Kerosene	C ₉ H ₂ O	128.3	0.815	-	-	-
Methane	CH ₄	16.04	0.415	0.554	1.31	348
Methyl Alcohol	CH ₄ O	32.04	0.792	1.11	1.2	337
Methyl Chloride	CH ₃ Cl	50.49	0.952	1.743	1.2	337
Natural Gas (typical)	-	19	0.45	0.656	1.27	344
Nitric Acid	HNO ₃	63.02	1.502	-	-	-
Nitrogen	N ₂	28	1.026	0.967	1.4	356
Nitrous Oxide	N ₂ O	44	1.226	1.519	1.3	347
Oxygen	O ₂	32	1.426	1.104	1.4	356
Pentane	C ₅ H ₁₂	72.15	0.631	2.49	1.07	323
Propane	C ₃ H ₈	44.09	0.585	1.522	1.13	330
Styrene	C ₈ H ₈	104.14	0.906	3.6	1.07	323
Sulfur Dioxide	SO ₂	64.06	1.434	2.21	1.29	346
Sulfuric Acid	H ₂ SO ₄	98.08	1.83	-	-	-
Therminol D-12	-	162	0.76	-	-	-
Therminol VP-1	-	166	1.061	-	-	-
Toluene	C ₇ H ₈	92.1	0.87	3.18	1.1	327
Water	H ₂ O	18.02	1	0.622	1.31	348

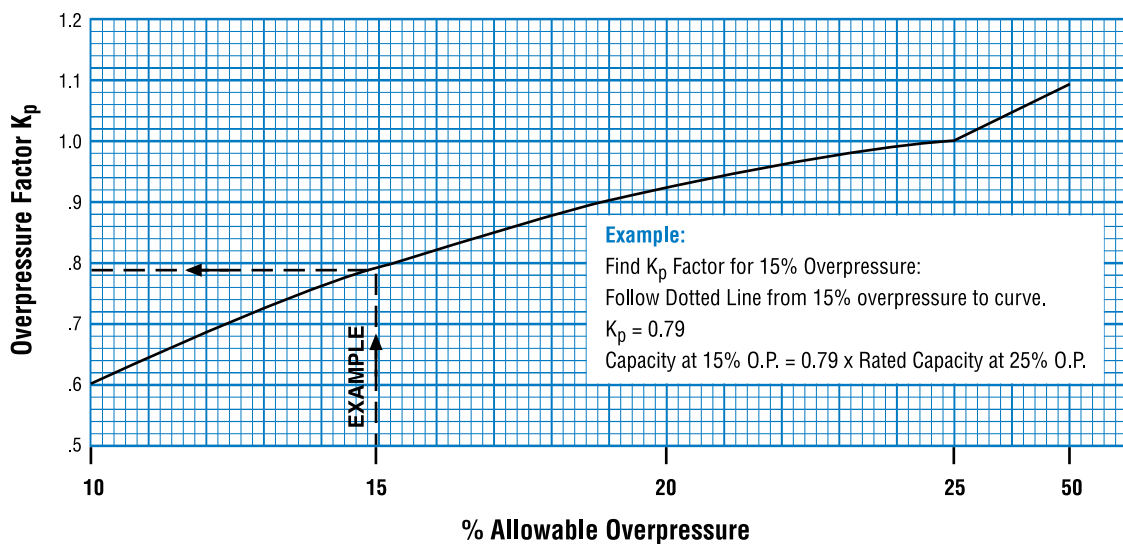


Variable or Constant Back Pressure Sizing Factor K_w (BalanSeal Valves Only)



Overpressure Sizing Factor K_p Other Than 25% Overpressure

Conventional and BalanSeal Valves: Non-Code Liquids Only



Note: Pressure relief valve liquid capacities cannot be predicted by a general curve for overpressures below 10%.

Viscosity Correction Using Chart Method

Sizing Method

Since the viscosity correction factor depends on the actual orifice area, direct solution is not possible and a trial orifice size must be found before the K_u can be determined accurately.

Example (ASME Code liquid application. If non-ASME Code is required, substitute appropriate equation):

Viscosity-Saybolt Universal Secs..... 1250 SSU@100°F
 Capacity Required..... 800 gpm
 Set Pressure 100 psig
 Constant Back pressure 10 psig
 Differential Pressure ($1.25 P_1 - P_2$) 115 psig
 Allowable Overpressure.....25%
 Specific Gravity0.98@100°F
 Relieving Temperature100°F

Step 1 Calculate Trial Orifice: Calculate the trial orifice area from the liquid equation on page 84:

$$A = \frac{V_L \sqrt{G}}{38.0 K_d \sqrt{\Delta P} K_u} = \frac{800 (0.99)}{38.0 (0.652) \sqrt{124.7-10} (1)} = 2.98 \text{ sq. in. Actual Area}$$

If BalanSeal valve construction is used and variable back pressure conditions exist, use the maximum back pressure to determine P_2 in the equation, and correct K_w factor. See curve on page 89. Use the following equation:

$$A = \frac{V_L \sqrt{G}}{38.0 K_d \sqrt{\Delta P} K_w K_u}$$

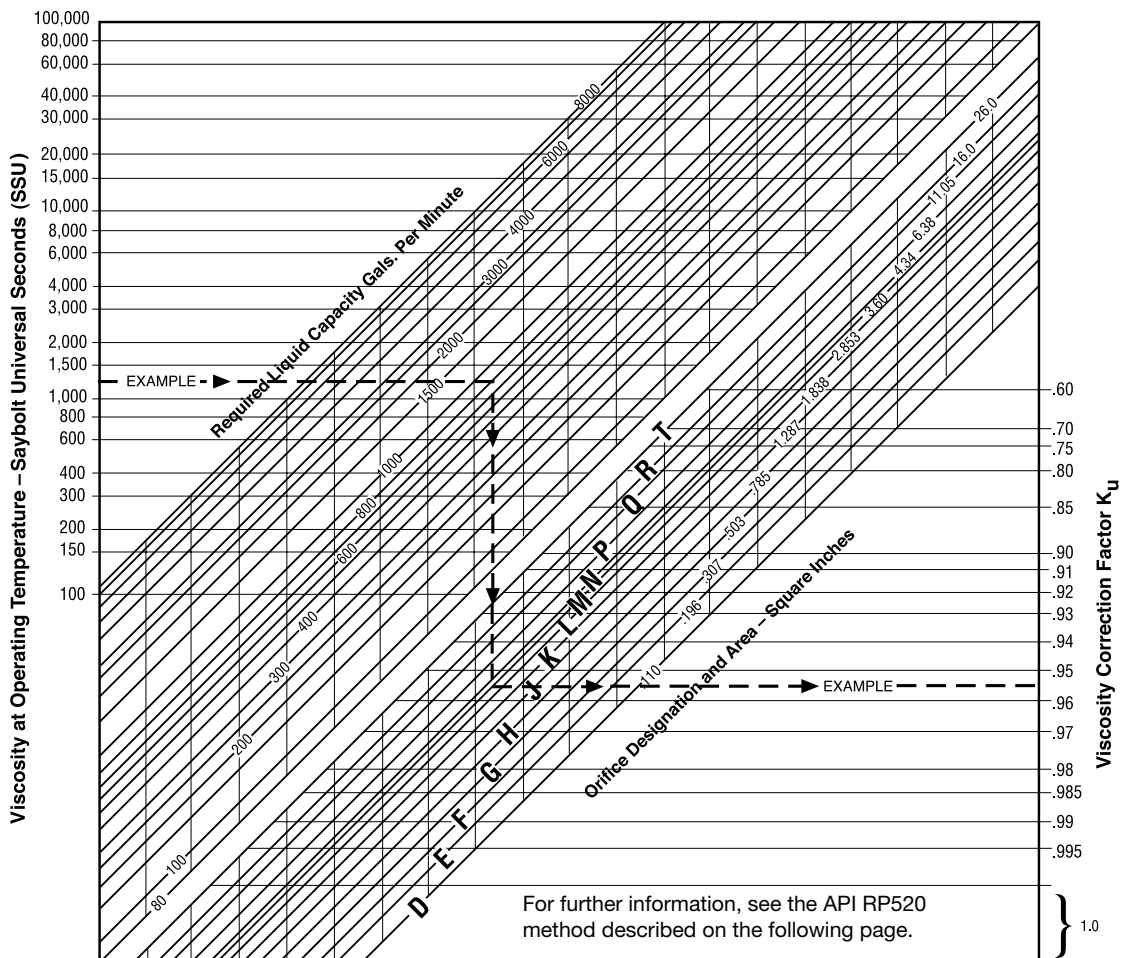
Select the next larger orifice size or an M orifice with 4.0 sq. in. orifice area (this should be about 20% greater than the calculated area to allow for reduction of capacity due to viscosity correction factor K_u).

Step 2 Use Chart to Find K_u : Enter the Viscosity Correction Chart from the left, reading 1250 SSU. Follow the example line horizontally to the required 800 gpm. Drop vertically to the selected trial orifice M, and proceed horizontally right to the K_u scale, reading $K_u = 0.955$.

Step 3 Verify Orifice Selection: This chart is designed to minimize the trial and error required for solution. Note that the exit from the chart is from the orifice line to the K_u scale. By looking vertically, the next larger or smaller orifice show alternate values of the A term and the corresponding K_u term without repeating all the steps.

The viscosity of the liquid may reduce the velocity and capacity enough to require a larger orifice size than the usual liquid service capacity equation would indicate. Use this simplified viscosity chart and the K_u viscosity correction factors obtainable from it to properly size relief valves intended for viscous liquid service. Equations and graphs used in preparing this chart reflect conservative engineering data on this subject.

For viscous liquid service, it is advisable to allow 25% overpressure where permissible, to size conservatively, and to consider the use of the bellows and/or steam jacketed bodies for the purpose of isolating the moving parts and to prevent freezing of the lading fluid.



Viscosity Correction Using Reynold's Number Method of API RP520

As an alternative to the sizing method discussed on the previous page, you may use the method given in API RP520 for sizing viscous liquids.

When a relief valve is sized for viscous liquid services, it is suggested that it be sized first as a nonviscous type application in order to obtain a preliminary required discharge area, A. From manufacturer's standard orifice sizes, the next larger orifice size should be used to determine the Reynold's number R from either one of the following:

$$R = \frac{V_L (2800G)}{\mu \sqrt{A}}$$

or

$$*R = \frac{12700 V_L}{U \sqrt{A}}$$

*Use of this equation is not recommended for viscosities less than 100 SSU.

After the value of R is determined, the factor K_v^{**} is obtained from the graph. Factor K_v is applied to correct the preliminary required discharge area. If the corrected area exceeds the chosen standard orifice area, the calculations should be repeated using the next larger standard orifice size.

** K_v of API = K_v of Farris Engineering

Nomenclature

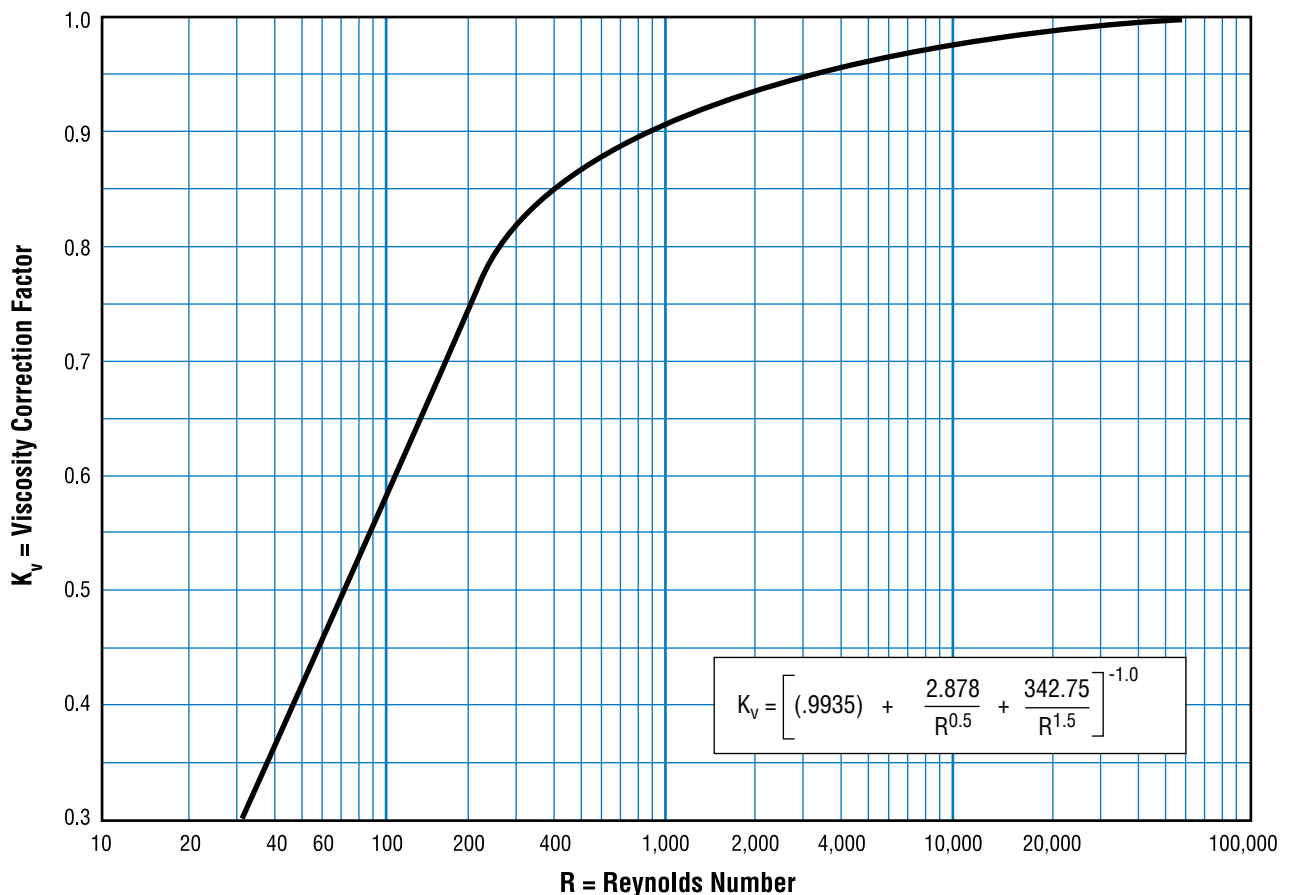
V_L = Flow rate at the flowing temperature in the U.S. gallon per minute.

G = Specific gravity of the liquid at the flowing temperature referred to water = 1.00 at 70°F.

μ = Absolute viscosity at the flowing temperature in centipoises.

A = Discharge area in square inches from manufacturer's standard orifice areas¹.

U = Viscosity at the flowing temperature in Saybolt Universal Seconds.



General Notes:

1. Select using either API effective area or ASME actual area depending on the sizing method being used.

To find desired value, multiply "Given" value by factor below

Pressure Conversion				
Given	psi	kPa	Bar	kg/cm ²
psi	1	6.8948	0.0689	0.0703
kPa	0.145	1	0.01	0.0102
Bar	14.504	100	1	1.0197
kg/cm ²	14.223	97.905	0.9	1

Liquid Flow Rate Conversion				
Given	gpm	bbbl/day	l/min	m ³ /hr
gpm	1	34.29	3.785	0.2271
bbbl/day	0.02917	1	0.1104	0.006624
l/min	0.2642	9.057	1	0.06
m ³ /hr	4.403	151	16.667	1

Mass Conversion				
Given	lb	tons	kg	tonnes
lb	1	0.0005	0.4536	0.00045
tons	2000	1	907.18	0.90718
kg	2.2046	0.0011	1	0.001
tonnes	2204.6	1.102	1000	1

Viscosity Conversion				
Given	cP	g/cm-s	centistoke	SSU
cP	1	0.01	1/G	4.63/G
g/cm-s	100	1	100/G	463/G
centistoke	G	(0.01)G	1	4.63
SSU	(0.216)G	(21.6)G	0.216	1

where G is liquid specific gravity

Volume Conversion				
Given	ft ³	m ³	gal	liter
ft ³	1	0.02832	7.481	28.32
m ³	35.31	1	264.2	1000
gal	0.1337	0.00379	1	3.785
liter	0.03532	0.001	0.2642	1

Density Conversion				
Given	lb/ft ³	kg/m ³	g/cm ³	lb/gal
lb/ft ³	1	16.018	0.016	0.1337
kg/m ³	0.0624	1	0.001	0.0083
g/cm ³	62.428	1000	1	8.345
lb/gal	7.481	119.83	0.1198	1

Area Conversion				
Given	in ²	ft ²	mm ²	cm ²
in ²	1	0.00694	645.16	6.4516
ft ²	144	1	92903	929.03
mm ²	0.00155	1.08E-05	1	0.01
cm ²	0.155	0.0011	100	1

Temperature Conversion	
Fahrenheit (F) =	(1.8 x C) + 32
Celsius (C) =	0.555 x (F - 32)
Rankin (R) =	F + 459.67
Kelvin (K) =	C + 273.15

Length Conversion				
Given	ft	in	mm	m
ft	1	12	304.8	0.3048
in	0.0833	1	25.4	0.0254
mm	0.0033	0.0394	1	0.001
m	3.281	39.37	1000	1

Miscellaneous Conversions		
From	To	Multiply By
Specific Gravity-Gas	Molecular Wt-Gas	28.97
Density-Liq	Specific Gravity-Liq	1/(ρ Water)

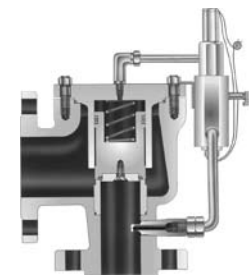


Process Pressure Relief Valves



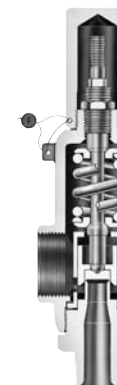
SERIES 2600/2600L

- ASME NB Certified: Air, Steam & Water
- Sizes: 1" x 2" to 20" x 24"
- Pressure Range: 15 psig to 6000 psig
- Temperature Range: -450°F to +1500°F
- Materials: Carbon Steel, Stainless, Monel & Hastelloy C
- Options: Balanced Bellows, O-Ring Seat, Open Bonnet



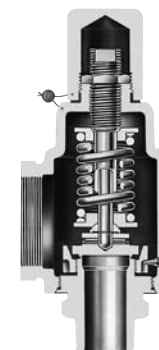
SERIES 3800 Pilot Operated

- ASME NB Certified: Air, Steam & Water
- Sizes: 1" x 2" to 12" x 16"
- Pressure Range: 15 psig to 6170 psig
- Temperature Range: -450°F to +500°F
- Materials: Steel Body & Bonnet, Stainless Steel Trim
- Options: Modulating Pilot Control, Complete 316 Stainless Steel Construction



SERIES 2700

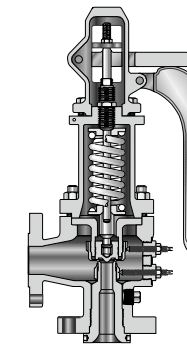
- ASME NB Certified: Air, Steam & Water
- Sizes: 1/2" x 1" to 1-1/2" x 2-1/2"
- Pressure Range: 15 psig to 6500 psig
- Temperature Range: -450°F to +750°F
- Materials: Stainless Steel Body & Trim, Carbon Steel Bonnet
- Options: Stainless Steel, Monel & Hastelloy Materials, O-Ring Seats, Flanged, Socket Weld, Welding Nipple, & Sanitary Connections



SERIES 2850/2856

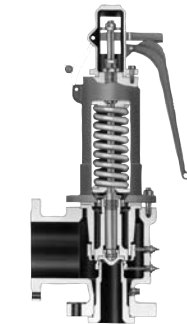
- ASME NB Certified: Air & Steam
- Sizes: 3/4" x 1" to 1-1/2" x 2" (2850)
3/4" x 1-1/4" to 2" x 3" (2856)
- Pressure Range: 15 psig to 300 psig
- Temperature Range:
-20° F to +750°F (2850)
-450° F to +400°F (2856)
- Materials: Stainless Steel Body & Trim Steel Bonnet (2850)
Brass Body & Trim, Bronze Bonnet (2856)

Steam Safety Valves



SERIES 4200

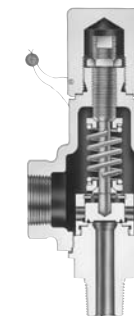
- ASME NB Section I & VIII Certified: Steam & Air
- Sizes 1 1/4" x 1 1/2" to 6" x 8"
- Pressure Range: 15 psig to 1000 psig
- Temperature Range: -20°F to +1000°F
- Materials: Carbon / Alloy St. & Stainless Steel.



SERIES 6400/6600

- ASME NB Section I & VIII Certified: Steam & Air
- Sizes: 1" x 2" to 4" x 6"
- Pressure Range: 15 psig to 1500 psig
- Temperature Range: -20°F to +1000°F
- Materials: Carbon and Stainless Steel
- Options: Exposed Spring & Closed Bonnet

Special Purpose Pressure Relief Valves



SERIES 1890/1896M

- ASME NB Certified: Air, Steam & Water
- Sizes: 1/2" x 1" & 3/4" x 1" (1890)
1/2" x 3/4" & 3/4" x 3/4" (1896M)
- Pressure Range:
15 psig to 800 psig (1890)
15 psig to 300 psig (1896M)
- Temperature Range:
-20°F to +750°F (1890)
-450°F to +400°F (1896M)
- Materials:
Stainless Steel Body & Trim (1890)
Brass Body & Trim, Bronze Bonnet (1896M)

Test Stands



MODELS T1500 & T6000

- Air & Water Testing
- Maximum Pressures of 1500 psig and 6000 psig
- Test Valves to 8" Inlet Size
- Stainless Steel Test Drum & Test Table
- Digital Test Gauge

**CURTISS
WRIGHT**
Flow Control Corporation

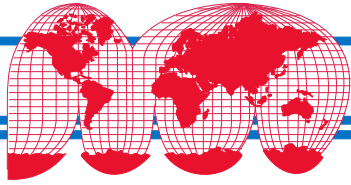


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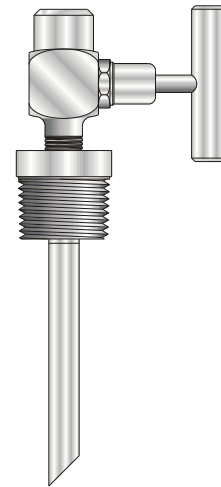
WELKER®

Engineering Company

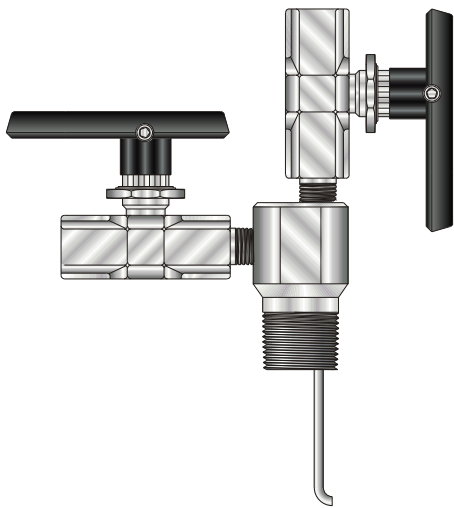


SP-2 Standard Probe

- Permanently fixed probe (specify length desired)
- 316 stainless steel construction
- 1/2", 3/4", or 1" NPT pipeline connection standard, other sizes available
- Complete with large port outlet valve
- Available without outlet valve (model SP-1)
- 1/4" NPT outlet standard, other sizes available



PP-2 Pitot Probe



- Outlet and return ports provided for hot loop operation
- Permanently fixed probe (specify length desired)
- 316 stainless steel construction
- 1" NPT pipeline connection standard, other sizes available
- Complete with full open outlet and return valves
- Available without valves (model PP-1)
- 1/4" NPT outlet and return standard, other sizes available

Master-Temp 200 / 300 Bimetal Thermometers

Specifications

Case Material
303 stainless steel

Dial
White aluminum black lettering

Pointer
Black aluminum

Dial
Dished white aluminum with black lettering

Accuracy
± 1% full scale

Connection
1/4", 1/2" NPT Center back mount or
1/2" adjustable angle

Window
Glass

Stem
1/4" 304 stainless steel 2 1/2" - 36"

Dial Size
2" & 3"

External Reset
Stainless steel hex located on rear of case



WL51 / WL33

Dial Size	2" Dial							
Connection	1/4" NPT Center Back Mount				1/2" NPT Center Back Mount			
Stem Length	2 1/2"	4"	6"	9"	2 1/2"	4"	6"	9"
Range								
-40°F to 160°F (-40°C to 70°C)	WL11102	WL11202	WL11302	n/s	n/s	WL21202	WL21302	
0°F to 250°F (-20°C to 120°C)	WL11105	WL11205	WL11305	n/s	n/s	n/s	WL21305	WL21405
50°F to 500°F (10°C to 260°C)	WL11108	WL11208	WL11306	n/s	n/s	n/s	n/s	n/s
List Price	\$50.00	\$50.00	\$50.00	\$50.00	\$50.00	\$50.00	\$50.00	\$50.00
Dial Size	3" Dial							
Connection	1/2" NPT Center Back Mount							
Stem Length	2 1/2"	4"	6"	9"	12"	15"	18"	
Range								
-40°F to 160°F (-40°C to 70°C)	WL31102	WL31202	WL31302	WL31402	WL31502	WL31602	WL31702	
0°F to 250°F (-20°C to 120°C)	WL31105	WL31205	WL31305	WL31405	WL31505	WL31605	WL31705	
50°F to 300°F (10°C to 150°C)	WL31106	WL31206	WL31306	WL31406	WL31506	WL31606	WL31706	
50°F to 500°F (10°C to 260°C)	WL31108	WL31208	WL31308	WL31408	WL31508	WL31608	WL31708	
150° to 750°F (50°C to 400°C)	WL31110	WL31210	WL31310	WL31410	WL31510	WL31610	WL31710	
200° to 1000°F (100° to 550°C)	WL31111	WL31211	WL31311	WL31411	WL31511	WL31611	WL31711	
List Price	\$50.00	\$50.00	\$50.00	\$79.15	\$89.20	\$99.15	\$122.50	
Dial Size	3" Dial							
Connection	1/2" NPT Center Back Mount Adjustable Angle							
Stem Length	2 1/2"	4"	6"	9"	12"	15"	18"	
Range								
-40°F to 160°F (-40°C to 70°C)	WL33102	WL33202	WL33302	WL33402	WL33502	WL33602	WL33702	
0°F to 250°F (-20°C to 120°C)	WL33105	WL33205	WL33305	WL33405	WL33505	WL33605	WL33705	
50°F to 300°F (10°C to 150°C)	WL33106	WL33206	WL33306	WL33406	WL33506	WL33606	WL33706	
50°F to 500°F (10°C to 260°C)	WL33108	WL33208	WL33308	WL33408	WL33508	WL33608	WL33708	
150° to 750°F (50°C to 400°C)	WL33110	WL33210	WL33310	WL33410	WL33510	WL33610	WL33710	
200° to 1000°F (100° to 550°C)	WL33111	WL33211	WL33311	WL33411	WL33511	WL33611	WL33711	
List Price	\$200.00	\$200.00	\$200.00	\$215.00	\$227.85	\$235.50	\$246.00	

See Discount Line # 21

Master-temp 500 Bimetal Thermometers

Specifications

Case Material
303 stainless steel

Dial
White aluminum black lettering

Pointer
Black aluminum

Dial
Dished white aluminum with black lettering

Accuracy
± 1% full scale

Connection
1/2" NPT Center back mount or
1/2" adjustable angle

Window
Glass

Stem
1/4" 304 stainless steel 2 1/2" - 36"

Dial Size
5"

External Reset
Stainless steel hex located on rear of case



WL51 / WL33

Dial Size	5" Dial						
Connection	1/2" NPT Center Back Mount						
Stem Length	2 1/2"	4"	6"	9"	12"	15"	18"
Range							
-40°F to 160°F (-40°C to 70°C)	WL51102	WL51202	WL51302	WL51402	WL51502	WL51602	WL51702
0°F to 250°F (-20°C to 120°C)	WL51105	WL51205	WL51305	WL51405	WL51505	WL51605	WL51705
50°F to 300°F (10°C to 150°C)	WL51106	WL51206	WL51306	WL51406	WL51506	WL51606	WL51706
50°F to 500°F (10°C to 260°C)	WL51108	WL51208	WL51308	WL51408	WL51508	WL51608	WL51708
150° to 750°F (50°C to 400°C)	WL51110	WL51210	WL51310	WL51410	WL51510	WL51610	WL51710
200° to 1000°F (100° to 550°C)	WL51111	WL51211	WL51311	WL51411	WL51511	WL51611	WL51711
List Price	\$103.65	\$103.65	\$103.65	\$120.00	\$144.50	\$155.65	\$167.00
Dial Size	5" Dial						
Connection	1/2" NPT Center Back Mount Adjustable Angle						
Stem Length	2 1/2"	4"	6"	9"	12"	15"	18"
Range							
-40°F to 160°F (-40°C to 70°C)	WL53102	WL53202	WL53302	WL53402	WL53502	WL53602	WL53702
0°F to 250°F (-20°C to 120°C)	WL53105	WL53205	WL53305	WL53405	WL53505	WL53605	WL53705
50°F to 300°F (10°C to 150°C)	WL53106	WL53206	WL53306	WL53406	WL53506	WL53606	WL53706
50°F to 500°F (10°C to 260°C)	WL53108	WL53208	WL53308	WL53408	WL53508	WL53608	WL53708
150° to 750°F (50°C to 400°C)	WL53110	WL53210	WL53310	WL53410	WL53510	WL53610	WL53710
200° to 1000°F (100° to 550°C)	WL53111	WL53211	WL53311	WL53411	WL53511	WL53611	WL53711
List Price	\$240.00	\$240.00	\$240.00	\$266.70	\$274.15	\$285.85	\$298.35

See Discount Line# 22

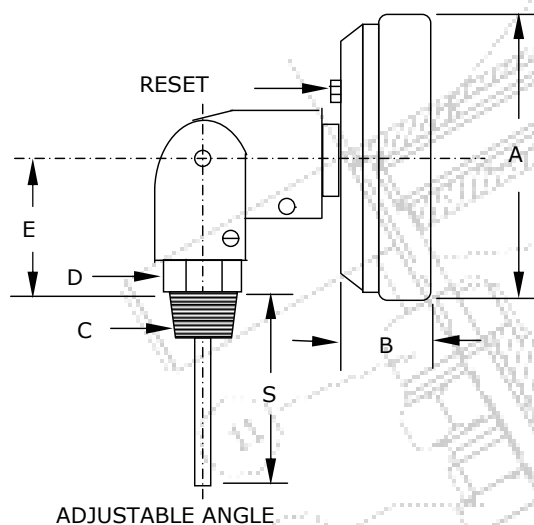
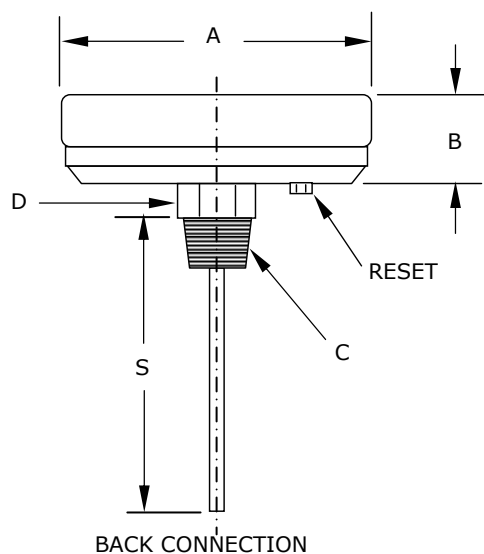
Master-temp Bimetal Thermometers

Stocked Ranges

Range	Major Divisions		Minor Divisions	
	°F	°C	°F	°C
-40°F to 160°F (-40°C to 70°C)	10	10	2	2
0°F to 250°F (-20°C to 120°C)	10	10	2	2
50°F to 300°F (10°C to 150°C)	10	10	2	2
50°F to 500°F (10°C to 260°C)	25	10	5	5
150° to 750°F (50°C to 400°C)	50	10	10	5
200° to 1000°F (100° to 550°C)	50	10	10	5

Dimensions

Series	Dial Size	A	B	C	D (Hex)	E	S
WL11000	2"	2.13"	0.425"	1/4" NPT	0.546"	n/a	See Nominal Lengths On Part Number Charts
WL21000	2"	2.13"	0.425"	1/2" NPT	0.822"	n/a	
WL31000	3"	3.27"	0.835"	1/2" NPT	0.822"	1.75"	
WL33000	3"	3.27"	0.835"	1/2" NPT	0.822"	1.75"	
WL51000	5"	5.26"	0.910"	1/2" NPT	0.822"	n/a	
WL53000	5"	5.26"	0.910"	1/2" NPT	0.822"	1.75"	



WGI Thermowells

This device is used to protect a thermometer / thermocouple / rtd from any pressure in the process, and allows replacement of the instrument without shutting down the system.

Specifications

Standard Bore Sizes
0.260", 0.385" & 0.702"

Process Connections
NPT threaded or Flanged (RF, FF & RTJ)

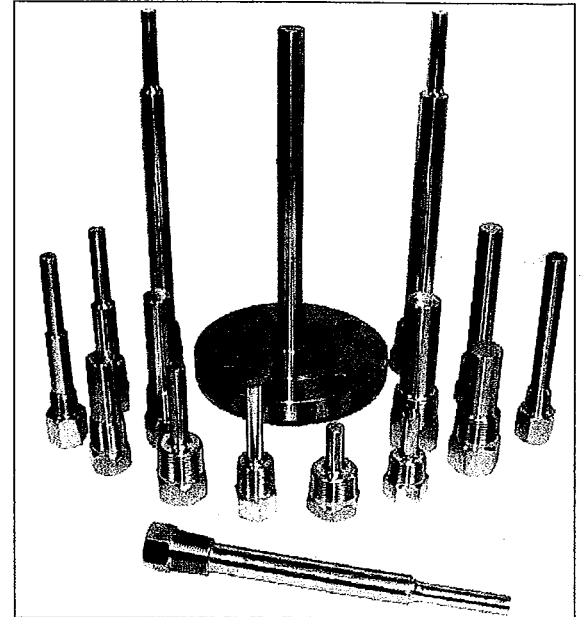
Standard Materials
316SS

Optional Materials
Brass or naval brass, aluminum, carbon steel, Chrome-moly, 304SS, 316LSS, alloy-20, inconel, Monel, nickel, titanium, hastelloy B or C & Teflon

Optional
Stainless steel plug and chain, full penetration weld on flange, Teflon or Kynar coating, MTR test reports & hydrostatic internal testing

Available Stem Lengths
2 1/2" through 36"

Process Connections
1/2", 3/4" & 1" threaded NPT, 150#, 300# & 600# flanged
900# RTJ & 150# RTJ



Process Connection	Part Number	Stem Length	Insertion	Bore Size	Overall Length	List Price
1/2" Male NPT	1/2-025-316	2 1/2"	1 3/8"	.260	2 3/4"	\$33.70
	1/2-040-316	4"	2 1/2"	.260	4 1/4"	\$42.66
	1/2-060-316	6"	4 1/2"	.260	6 1/4"	\$53.08
Process Connection	Part Number	Stem Length	Insertion	Bore Size	Overall Length	List Price
3/4" Male NPT	3/4-025-316	2 1/2"	1 3/8"	.260	2 3/4"	\$33.70
	3/4-025-316-385	2 1/2"	1 3/8"	.385	2 3/4"	\$49.90
	3/4-025-316-702	2 1/2"	1 3/8"	.702	2 3/4"	\$162.00
	3/4-035-316-702	2 1/2"	2"	.702	2 3/4"	\$162.00
	3/4-040-316	4"	2 1/2"	.260	4 1/4"	\$42.66
	3/4-040-316-385	4"	2 1/2"	.385	4 1/4"	\$59.78
	3/4-040-316-702	4"	2 1/2"	.702	4 1/4"	\$162.00
	3/4-045-316-702	4 1/4"	3"	.702	4 1/4"	\$162.00
	3/4-050-316-702	5"	3 1/2"	.702	5 1/4"	\$183.60
	3/4-060-316	6"	4 1/2"	.260	6 1/4"	\$53.08
	3/4-060-316-385	6"	4 1/2"	.385	6 1/4"	\$109.27
	3/4-060-316-702	6"	4 1/2"	.702	6 1/4"	\$205.20
	3/4-090-316	9"	7 1/2"	.260	9 1/4"	\$87.75
3/4-120-316	12"	10 1/2"	.260	12 1/4"	\$103.14	
Process Connection	Part Number	Stem Length	Insertion	Bore Size	Overall Length	List Price
1" Male NPT	1-025-316	2 1/2"	1 3/8"	.260	2 3/4"	\$55.67
	1-025-316-702	2 1/2"	1 3/8"	.702	2 3/4"	\$172.80
	1-035-316-702	2 1/2"	2"	.702	2 3/4"	\$172.80
	1-045-316-702	4 1/4"	3"	.702	4 1/4"	\$172.80
	1-040-316	4"	2 1/2"	.260	4 1/4"	\$67.77
	1-060-316	6"	4 1/2"	.260	6 1/4"	\$86.67
	1-090-316	9"	7 1/2"	.260	9 1/4"	\$129.60
	1-120-316	12"	10 1/2"	.260	12 1/4"	\$173.88

See Discount Line# 35
CRN# CSA-OF4271.26