MASTER FLO VALVE INC.
Head Office
4611 - 74 Avenue
Edmonton, Alberta
Canada, T6B 2H5

CUSTOMER:	MASTER FLO VALVE (USA) INC. NEWFIELD EXPLORATION
PROJECT NAME:	NEWFIELD MC506
P.O. #:	MC506-281
P.O. LINE ITEM #:	1
TRANSPORT BODY SERIAL #:	CIXB-234
HRV SERIAL #:	HRV-865
ACTUATOR SERIAL#:	ROT-3873
W.O. #:	53749, 53750, 53751
D.S. #:	65746, 65747, 65748

MASTER FLO VALVE INC.
Head Office
4611 - 74 Avenue
Edmonton, Alberta
Canada, T6B 2H5

MASTER FLO VALVE (USA) INC. / NEWFIELD EXPLORATION COMPANY
NEWFIELD MC506
MC506-281

MANUFACTURING RECORD BOOK
CONTENTS

QA DOCUMENTS

1. STATEMENT OF CONFORMANCE

2. TRACEABILITY RECORD, MATERIAL TEST REPORTS, NDE TEST REPORTS, HARDNESS TEST REPORTS

3. FABRICATION TEST REPORT

4. PAINTING PROCEDURE

5. PAINT CERTIFICATION

6. STORAGE PROCEDURE

7. MAINTENANCE MANUAL

SHIPPING DOCUMENTS

8. PACKING LIST

9. COMMERCIAL DOCUMENT LIST

MASTER FLO VALVE INC.
Head Office
4611 - 74 Avenue
Edmonton, Alberta
Canada, T6B 2H5

STATEMENT OF CONFORMANCE

MASTER FLO VALVE INC.
Head Office
4611 - 74 Avenue
Edmonton, Alberta
Canada, T6B 2H5

STATEMENT OF CONFORMANCE

MASTER FLO VALVE INC. CERTIFIES THAT THE MATERIALS, PROCESSES, FINISHES AND TESTING OF THE PRODUCTS LISTED BELOW CONFORM TO SUPPLIED CONTRACT SPECIFICATIONS, MASTER FLO ENGINEERING STANDARDS AND API 6A AND 17D LATEST EDITION, PSL 3, MEETING SPECIFICATIONS SET FORTH IN NACE MR-01-75, 2003, WHICH INCLUDES HARDNESS OF MATERIALS USED IN CONSTRUCTION UNDER SPECIFICATION.

CUSTOMER:	MASTER FLO VALVE (USA) INC. / NEWFIELD EXPLORATION COMPANY
PROJECT NAME:	NEWFIELD MC506
P.O.. #:	MC506-281
MFV PART NO#:	42005-011-1
P.O. LINE ITEM #:	1
DESCRIPTION:	P35 15K HRV INSERT FOR 42005-011 P35 15K HRV CANISTER FOR VALVE 42005-011 SUBSEA SL SERIES II ACTUATOR, DOUBLE ACTING HYDRAULIC CYLINDERS COMPLETE WITH LVDT SUITED FOR P35, TRONIC BROV-10-G001-BQ-MC04P, CONNECTOR 3/8" JIC HYDRAULIC, FITTINGS OVERRIDE BUCKET CLASS 4, ADAPTER 5000 PSI HYDRAULIC, CYLINDERS HRV SETUP, DUAL KEY DRIVESHAFT.
TRANSPORT BODY S/N:	CIXB-234
HRV S/N:	HRV-865
ACTUATOR S/N:	ROT-3873

DATE: October 04, 2010

SIGNED BY: Mercedes Montes

TITLE: Q.A. REPRESENTATIVE

MASTER FLO VALVE INC.
Head Office
4611 - 74 Avenue
Edmonton, Alberta
Canada, T6B 2H5

TRACEABILITY RECORD, MATERIAL TEST REPORTS, NDE REPORTS, HARDNESS TEST REPORT

SUBSEA VALVE TRACEABILITY RECORD

MASTER FLO W.O. NO:	53749 / 53750 / 53751	SERIAL NO. P / HRV / ROT :	HRV-865 / ROT-3873
VALVE BODY SERIAL NO:		VALVE BODY HEAT NO.	

	2.2	BONNET ASSY PART NO.	23290-703-01	2.7	BONNET SEAL PART NO.	23290-209-01
		SERIAL NO.	1028047-1		HEAT NO.	C66C-1
		HEAT NO.	D090002	2.8	BEAN SEAL PART NO.	23290-328-01
		BONNET INSERT	N/A		HEAT NO.	D24J-2
		HEAT NO.	N/A	2.9	STEM SEAL PART NO.	21309-001
		CANNISTER SERIAL NO.	1027628-1		HEAT NO.	LT3G36EY11
		HEAT NO.	04870	2.10	BONNET BOLTING PART NO.	N/A
	2.3	STEM PART NO.	23290-706-06		HEAT NO.	N/A
		SERIAL NO.	193391-1-1		HEAT NO.	N/A
		HEAT NO.	LT08L4EY111	2.11	ACTUATOR TO BONNET BOLTING PN.	01031-006
	2.4	FLOW RING PART NO.	23290-250-03		HEAT NO.	CDE
		SERIAL NO.	191385-2-5		ACTUATOR TO BONNET BOLTING PN.	01031-008
		HEAT NO.	HT0613LY16		HEAT NO.	~~CDE~~ CC1
	2.5	BALANCE SLEEVE PART NO.	23290-431-02			
		SERIAL NO.	186268-01-05	2.12	NOZZLE PART NO.	23290-243-01
		HEAT NO.	04684		SERIAL NO.	188654-1-1
	2.6	STEM STUD PART NO.	N/A			
		SERIAL NO.	N/A	2.13	SEAT PART NO.	23290-341-03
		HEAT NO.	N/A		SERIAL NO.	191147-1-1

3.0	CLAMP ASSEMBLY TRACEABILITY: PN: 23290-073-10		WO: 53750		
	3.1	LARGE SEGMENT HT NO.	D	3.3	CLAMP PINS
		SMALL SEGMENT HT NO.	B		HEAT NO. A090577
		SMALL SEGMENT HT NO.	E		HEAT NO. 5650
	3.1	CLAMP STEM HEAT NO.	X30037		

4.0	ACUTATOR TRACEABILITY					
	4.1	ACTUATOR HOUSING PN	27389	4.4	CYLINDER BARREL PN	27390-101
		HEAT NO.	VD1		HEAT NO.	14312
	4.2	BEARING HOUSING PN	27270	4.5	CYLINDER CAP PART NO.	27391
		HEAT NO.	19513		HEAT NO.	16814
	4.3	PISTON PART NO.	27362-003	4.6	LVDT PART NO.	01286-108
		HEAT NO.	334065		SERIAL NO.	128023A / B

White copy - to QA for databook

Yellow copy - to W.O. folder

~~Bolen~~ Bonnet

Cert #: 1031717
Date: 11/ 6/2009
Page 1 of 3

STEEL INDUSTRIES INC.

R8.2.4.7 (9/09)

QUALITY CERTIFICATION

HOWCO WHITHAM LTD
10022 29 AVENUE
EDMONTON AB T6N 1A2

Cust PO#: CAN-7168
Job #:
Part #:

Grade: A182F51 **Heat:** D090002 **SII Order #:** 106808

Qty: 6 Pieces **Description:** P4 FORGING BONNET

Specifications:
ES 02-007-004, REV E

Chemical Analysis: ***(Ladle)***

C	Mn	P	S	Si	Ni	Cr	Mo
0.0140	1.2800	0.0250	0.0010	0.3100	5.8400	22.3600	3.3000

V	Al	N	Cu	Cb	Ca	Cb+Ta
		0.1750				

MTR APPROVED
BY CHRIS DATE 05/10/10

PO 185453
WO /
PN 81021-002
HT D090002
SN /

HOWCO METALS MANAGEMENT
CERTIFIED TRUE COPY
HEAT No. D090002 SO No. 35668
P.O. No. 185453
AUTH SIGNATORY CS DATE April 23/10
FOR HOWCO METALS MANAGEMENT PAGE 1 OF 14

HOWCO METALS MANAGEMENT
Mill Certificate Verified
NOV 17 2009
Quality Assurance Dept.
LRQA REG. No. 882242

No welding was performed on this material. Material is free from mercury contamination. We hereby certify that the above item(s) has been inspected and tested in accordance with the listed specifications and is in conformance with all requirements as modified by the Purchase Order and/or Steel Industries Inc. Quote.

By: Laura Speier

LAURA SPEIER
Q. C. CERTIFICATION SPECIALIST
COMPLIES WITH EN10204:2004_3.1

FORGED PRODUCT SOLUTIONS
AEROSPACE • POWER GENERATION • OIL & GAS • TRANSPORTATION • INDUSTRIAL
12600 Beech Daly Road, Redford Township, MI 48239-2455
(313) 535-8505 • Fax (313) 534-2165 • (877) 783-3599 (STEEL99)
Web Site • www.ameriforge.com • E Mail • silsales@ameriforge.com

X-R-I
DIVISION OF X-RAY INDUSTRIES, INC.

QA APPROVED 11/17/09

Ultrasonic Field Service Report

Certification # 2215

Bill to Address:
STEEL INDUSTRIES, INC.
12600 BEECH DALY ROAD
REDFORD, MI. 48239

Inspection Performed at Address:
STEEL INDUSTRIES, INC.
12600 BEECH DALY ROAD
REDFORD, MI. 48239

Customer PO#: 34510

Part Number / Description: DWG # 81021 Rev. K
Job Number: 106898
Quantity: 20
Lot / Serial Number: 02, 06, 08, 10, 11, 12
Heat Number: D096082

Make: Panametrics	Manufacture: MEGASONICS
Model: EPOCH 4 PLUS	Serial Number: F0706
Calibration Due Date: 12/02/2009	Lateral Indent: N/A
Couplant: Echogel Gr. 14	Frequency: 2.25 MHz
Method: Contact	Size: 1.0" Angle °:
Cable Length: 6 FT Coaxial	Set up Db: 40.0/51.0
Calibration Standard Used: 064F, 065F 066F	Range: 32.0/ 10.0/12.0 INCH

Inspection performed in accordance with: QAS-03-007 Rev. G Straight Beam Only.
Process Specification: QAS-03-007 Rev. G Straight Beam Only.
Acceptance Criteria: QAS-03-007 Rev. G Straight Beam Only.
Marking Requirement: N/A
Material Type: A182F51

Quantity Inspected: 6	Quantity Accepted: 6	Quantity Rejected: 0

Cause for rejection/comments: 6 Pieces accepted to Standard, no reportable indications present during time of inspection. Inspected Piece numbers 02, 06, 08, 10, 11 & 12 only.

Inspector: _____ Level: II Stamp: TESTING TROY MI UT NOV 13 Date Tested: 11-05-09

XRI Quality Manual Rev. 3.0 Dated 7/17/2009

X-R-I
DIVISION OF X-RAY INDUSTRIES, INC.

Q.A. APPROVED 11/12/09

Ultrasonic Field Service Report

Certification # 2221

Bill to Address:
STEEL INDUSTRIES, INC.
12000 BEECH DALY ROAD
REDFORD, MI. 48239

Inspection Performed at Address:
STEEL INDUSTRIES, INC.
12000 BEECH DALY ROAD
REDFORD, MI. 48239

Customer PO#: 34510

Part Number / Description: DWG # 81021 Rev. K
Job Number: 196808
Quantity: 20
Lot / Serial Number: 01, 03, 04, 05, 07, 09, 13, 14, 15, 16, 17, 18, 19, 20
Heat Number: D090002

Make: Panametrics	Manufacture: MEGASONICS
Model: EPOCH 4 PLUS	Serial Number: F0706
Calibration Due Date: 12/02/2009	Lateral Indent: N/A
Couplant: Echogel Gr. 14	Frequency: 2.25 MHz
Method: Contact	Size: 1.0" Angle °:
Cable Length: 6 FT Coaxial	Set up Db: 40.0/51.0
Calibration Standard Used: 064F, 065F 066F	Range: 32.0/ 10.0/12.0 INCH

Inspection performed in accordance with: QAS-03-007 Rev. G Straight Beam Only.
Process Specification: QAS-03-007 Rev. G Straight Beam Only.
Acceptance Criteria: QAS-03-007 Rev. G Straight Beam Only.
Marking Requirement: N/A
Material Type: A182F51

Quantity Inspected: 14	Quantity Accepted: 14	Quantity Rejected: 0

Cause for rejection/comments: 14 Pieces accepted to Standard, no reportable indications present during time of inspection. Inspected Piece numbers 02, 06, 08, 10, 11 & 12 on 11/5/09 cert# 2215. Order quantity complete.

Inspector: _____ Level: II Stamp: TESTING TROY UT 13 Date Tested: 11-11-09

XRI Quality Manual Rev. 3.0 Dated 7/17/2009

FORONI S.p.A.

21055 Gorla Minore (VA)
Italia

Brand

CERTIFIED MATERIAL TEST REPORT

Inspection certificate EN 10204-3.1

Cert. n° 2009/0277
Rev. 1
Date 23/2/2009

Customer FORONI METALS OF TEXAS,INC. **Order n°:** 08 086 + Order confirmation **Item:** 9

Material: UNS S39277; AF.918 Gr.2. **Delivery condition:** Forged, solution annealed and peeled.

Specifications: 918-TDS Rev.1; ASTM A182-06a, A479-06a; ASME/07 SA182a, SA479; NACE MR0175/ISO 15156-3:2003/Cor.1:2005/Cor.2:2005/Clr.1:2007. (*Chemical and mechanical properties only)

AOD / VIDP n° 04870
VAR / ESR n°
Steel making process: E.A.F./A.O.D.

Heat Treatment: Lot n°: CTT n°:
- Solution annealing at 2048°F x 30'/inch - W.Q..
- Furnace calibration and survey in accordance with AMS 2750D.

Description: R.P. Bars
Size 7,00 inches
Length inches
[3] **N° of pieces** 6
[3] **Weight** 14793 Lbs
[3] **Bar identification:** 27 to 32
Forging ratio: 12,5

Chemical analysis

% w	Heat	Product
C	0,018	0,018
MN	0,48	0,48
SI	0,49	0,49
CR	25,51	25,50
NI	6,95	6,84
MO	3,84	3,82
S	0,0002	0,0002
P	0,0240	0,0240
CU	1,59	1,59
AL	0,009	0,009
N	0,264	0,265
W	0,91	0,91
FE	Bal.	Bal.
PRE	42,41	42,35
[2] PREN	43,91	43,85

Mechanical properties

			Test n°	7569	7569
	Type			[1] See remarks	[1] See remarks
Tensile properties	Position			M.R.	1"½ B.S.
	Direction			LNG	LNG
	Temperature	°F		68	68
	Y.S. 0,2%	Ksi		88,0	88,6
	Y.S. 1%	Ksi			
	U.T.S.	Ksi		118,0	118,1
	Elongation	%		4D 41,5	4D 42,2
	Red. of Area	%		69,3	68,9
Impact properties	Hardness	HB			
		HRC		20	20
	as delivered	HRC		26 to 28	
	Position			M.R.	1"½ B.S.
	Direction			LNG	LNG
	Temperature	°F		14	-50
	Charpy A	Ft.Lbs		82	51
				76	36
				101	54
	Lateral expansion	Inches		0,043	0,028
				0,040	0,020
				0,051	0,028
	Shear	%		66	49
				60	36
				76	51
Stress-rupt.	Temperature	°F			
	Load	Ksi			
	Load increm.				
	Duration	hours			
	Elongation	%			

Other properties

	Specification:	Description:	Results:
Grain size to	ASTM E112-96	Comparison method	5
Ferrite content		Fischer ferritoscope	53 %
Corrosion test to	ASTM G48-03 Method A	(50°C x 24 hrs)	Passed
Macro examination			
Microstructure test			
Inclusional content			
UT to	API 6A 19th Ed.	PSL3 (Par. 7.4.2.3.15)	Passed
Visual check			Passed
Dimensional check			Passed
P.M.I. check			Passed
Fatigue testing			

PO 1924145 WO 1227626 PN 81177-205 HT 04870

Remarks: ***Material not intended for use in aerospace/aircraft applications.***
- [1] Mechanical testing performed from bar prolongation; tensile test on standard 0,500 inch diameter specimen.
- [2] PREN (according to NACE MR0175/ISO 15156-3)= Cr+3,3(Mo+½W)+16N.
- [3] 1st delivery: N° of pieces= 1; Weight= 2502 Lbs; Bar identification= 28;
  2nd delivery: N° of pieces= 5; Weight= 12291 Lbs; Bar identification= 27, 29 to 32.

Material made in Italy. **No welds, no mercury and radioactive contamination.**

The material is in compliance with the mentioned specifications. Material produced according to the Quality System described in the FORONI S.p.A. MSQ Manual.

Quality System Manual: MSQ Ed. 2003 Rev. 1

S.C.Q. Department: M.Gallina — M. Gallina

R.S.Q. Inspector

HOWCO METALS MANAGEMENT
Mill Certificate Verified
APR 0 8 2009
Quality Assurance Dept.

HOWCO METALS MANAGEMENT
CERTIFIED TRUE COPY
HEAT No. 04870
SO No. 39366
P.O. No. 187554
AUTH SIGNATORY
DATE June 16/10
FOR HOWCO METALS MANGEMENT PAGE 3 OF 3

CANISTER

CANISTER

APPROVED

NORTECH ADVANCED NDT LTD.

PO 192450
WO 1027626 L-030332
PN 23290-206-03
HT 04870
SN 1027626-1

Q.C. APPROVED
JL 07/23/10

160 Portage Close, Sherwood Park, Alberta, T8H 2W2
Phone: 780-449-5013 Fax: 780-449-5036
www.nortechadvanced.com

Liquid Penetrant Examination Report

Client: Master Flo Valve Inc.	Date: 22-Jul-2010	WO #:	1027626
4611- 74 Avenue	Location: Nortech Advanced Sherwood Park	Job #:	NORTECH NS10-0728
Edmonton, Alberta T6B 2H5	Project:	PO #:	192450
		Invoice #:	

TECHNIQUE DETAILS

Examination Type: Liquid Penetrant Examination, Visible, Water-washable

Test Method: QAS-03-008 REV. J 06/10 Accept Std: API 6A 19th ED. PSL 3/QAS-03-008 REV. J 06/10 Procedure #: PTP-01 Type II Method A Rev.1, Mar. 24, 2010

Materials Consumed:

Manufacturer:	MAGNAFLUX	Type: SKL WP2	Batch: 09K01K	Dwell Time: 20 Minutes	
Manufacturer:	MAGNAFLUX	Type: SKD S2	Batch: 09L04K	Dwell Time: 20 Minutes	
Manufacturer:	MAGNAFLUX	Type: SKC-S	Batch: 10C01K	Dwell Time:	
Manufacturer:		Type: H2O	Batch:	Dwell Time:	
Manufacturer:	NLS(PRODUCTS)	Type: FLUID FILM	Batch: 0C07282	Dwell Time:	

Surface Condition x Clean/Bare ___ As Ground x Machined ___ Sandblasted ___ Painted ___ Welded ___ Scale Rmvd

Source of Light ___ Halogen 250W ___ Incandescent 100W x Maglight 6 Volt 20.6°C Surface Temp

Examination Results & Comments

VISIBLE WATER WASHABLE LIQUID PENETRANT EXAMINATION WAS PERFOMED ON THE COMPLETE ASSEMBLY ON ALL ACCESSIBLE SURFACES:

Description: 1) P35-15K CARTRIDGE

Part Description	WO ID	Serial #	Work Order	Heat #	Part #	Material Type
P35-15K CARTRIDGE	1027626-1	192448-1-1	NOT APPLICABLE	04870	23290-206-03 REV. C	UNS39277 (SUPER DUPLEX)

NO RELEVANT INDICATIONS WERE DETECTED AT TIME OF EXAMINATION IN COMPLIANCE WITH QAS-03-008 REV. J 06/10 AND API 6A PSL 3.

POST EXAMINATION CLEANING APPLICABLE

Signatures

Technician (Sign): _____

Technician: Carreiro, Mike CGSB Lvl: CGSB Reg: SNT-TC-1A Lvl: II

Assistant: CGSB Lvl: CGSB Reg: SNT-TC-1A Lvl:

Client Signature

Client Representative: Kim Mungall _____

*Client Representative's Signature indicates acceptance of reports and results. Nortech Advanced NDT Ltd. is liable for examination costs only.

FORONI S.p.A. 21055 Gorla Minore (VA) Italia	**ULTRASONIC TEST CERTIFICATE**	Cert. n° 2009/0277 Rev. 1 Date 23/2/2009 Annex B

Order n°: 08 086

Customer: FORONI METALS OF TEXAS,INC.

Material identification: UNS S39277; AF.918 Gr.2.

Heat n° 04870 VAR n° Lot n° Bar Ident.: 27 to 32

Material condition: Forged, solution annealed and peeled.

Material description: n° 6 R.P. Bars diameter 7 inches.

Specification: API 6A 19th Ed. PSL3 (Par. 7.4.2.3.15).

Technique of examination: contact.

Apparatus: Gilardoni RDG500

Couplant: paste.

Calibration:

Probe				Calibration	Scanning [1]	Reference defect	Scanning Gain dB	Evaluation Gain dB
Type	Section	MHz	Wedge					
Straight beam	D. 25 mm	2	No	D.A.C.	A	FBH 3,2 mm	76	70

[1] A= cylindrical surface; B= cylindrical surface axial test; C= axial test; D= cylindrical surface circumferential test.

Results: - in accordance with specification.

Remarks: - test performed in compliance with ASTM A388-07 / ASME/07 SA388.

Operator (Level II - SNT TC 1A + EN 473)	N.D.E. Chief	R.S.Q. Inspector
F.Monti	F.Monti	C.Malara

MASTER FLO

PSL 3 HARDNESS TEST RECORD

P/N: 23290-701-01	PART DESCRIPTION: CART Assy P35-15K	
W.O. 1028047	DS# –	P.O. 193463

	MATERIAL / E.S.	TOLERANCE
1 Bonnet	UNS 31803	MIN – MAX 271 Bnd
2 Canister	UNS S39277	MIN 93 – MAX 31 HRC

EQUIPMENT USED	VERSITRON	STARRETT	KING	KING	KING
SERIAL NUMBER	7240 ✓	6791	VS-49	VS-34	UG-53 ✓

SERIAL NUMBER	HEAT #	RESULT	NOTES
1028047-1	D090002	217 Bnd	BONNET
	04870	27 HRC	Canister
			Q.C. APPROVED BY [signature] DATE 27Aug'10
			PO 193463
			WO 1028047
			PN 23290-701-01
			HT D090002 / 04870
			SN 1028047-1

COMPLETED BY [signature]   DATE 27Aug'10   PAGE 1 OF 1

718 inc 1 3/4 ø LTO814EY 111
Good for Thunderhorse

REV. 6/04

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

SOUTHERN U.S.

SHIP TO
ATT: ALAN BAILEY
HOWCO METALS MANAGEMENT LP
9611 TELGE RD
HOUSTON, TX 77095

INVOICE TO
HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

CERTIFIED MATERIAL TEST REPORT No. 28499

HA ORDER NO./ITEM	DATE	PAGE OF
300013971 1	08/31/06	1 8
QUANTITY	INSPECTED BY	
3250 LBS	HA/SMC	
CHARGE ORDER NO.	MARK ORDER NO.	
HOU-600503-12	HOU-600503-12	

DESCRIPTION OF MATERIAL SHIPPED: INCONEL ALLOY 718 HOT FIN RND ROUGH GRD OR ROUGH T SOL ANN & AGE HD
1.7500 IN 144-288 IN NOM

THIS IS TO CERTIFY THAT ALL REQUIRED SAMPLINGS INSPECTIONS AND TESTS HAVE BEEN PERFORMED IN ACCORDANCE WITH THE ORDER AND SPECIFICATION REQUIREMENTS. THE TEST REPORT REPRESENTS THE ACTUAL ATTRIBUTES OF THE MATERIAL FURNISHED AND THE VALUES SHOWN ARE CORRECT AND TRUE. THE MATERIAL DESCRIBED BY THIS CERTIFICATE IS IN FULL COMPLIANCE WITH ALL ORDER AND INSPECTION REQUIREMENTS. WE HEREBY CERTIFY THAT THE BELOW FIGURES ARE IN ACCORDANCE WITH THE SPECIFIED CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

**********THIS REPORT RELATES ONLY TO THE ITEM(S) TESTED AND MAY NOT BE REPRODUCED EXCEPT IN FULL.**********

SPECIFICATIONS: HOWCO PURCHASE SPECIFICATION HC 718 BAR REV 4 (GRADE 125)\ UNS:N07718
SMC HA 79 REV 6 (GRADE 125)\NACE MR0175-ISO 15156-3 1ST EDITION/
API 6A718 1ST EDITION (MAR 2004)\SMC QCP 285 REV 2.\
SMC QCP 332 REV 1.\
QUALITY SYSTEM CERTIFICATION: ISO 9001:2000 (ABS-QE CERT. 30125);
EN 10 204/DIN 50049 (CERT.3.1.B)

HOWCO QA 9/18/06

STEM

STEM

CHEMICAL ANALYSIS (WT. %)

HEAT#	C	MN	FE	S	SI	CU	NI	CR	AL
	TI	MG	CO	MO	NB	TA	P	B	CA
	PB/PPM	SN/PPM	BI/PPM	SE/PPM	NB+TA				
LT0814EY	0.017	0.04	18.25	0.0003	0.05	0.08	53.44	18.44	0.51
	1.03	0.001	0.07	3.03	5.02	0.01	0.007	0.003	0.001
	0.1	9.5	<0.1	<0.1	5.03				

TESTED BY HUNTINGTON ALLOYS, 3200 RIVERSIDE DR., HUNTINGTON, WV 25705, ACCREDITED FOR FASTENER QUALITY ACT VIA PRI CERT 113115 (EXPIRES 10/31/2006).
TO CONVERT PPM TO WT.%, MOVE DECIMAL POINT FOUR PLACES TO THE LEFT.
MELT METHOD: DUVAC (VIM ELECTRODE; VAR INGOT)

MECHANICAL PROPERTIES

HEAT/LOT	QUANTITY	HARD NESS	GRAIN SIZE	YIELD .2%PSI K 100	TENSILE PSI K 100	%ELG 2"	R/A %	DEG F	
LT0814EY 111	18 PCS								
ROOM TEMP-	-AS SHIPPED	0.0		1304	1790	27.0	44.3		LONG
HARDNESS -HRC	-AS SHIPPED	36.3							
HARDNESS -HRC	-AS SHIPPED	36.9							
HARDNESS -HRC	-AS SHIPPED	37.0							
HARDNESS -HRC	-AS SHIPPED	37.5							
HARDNESS -HRC	-AS SHIPPED	37.5							
HARDNESS -HRC	-AS SHIPPED	37.7							

HOWCO METALS MANAGEMENT Mill Certificate Verified DEC 08 2006 Quality Assurance Dept. LP HOU, TX 77252

PO 193391
WO 1028064
PN 23290-706-06
HT LT0814EY111
SN 193391-1-1

MTR APPROVED
BY CHRIS DATE 12/5/06

REV. 6/04

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

ISO 9002

SOUTHERN U.S.

ATT: ALAN BAILEY
HOWCO METALS MANAGEMENT LP
9611 TELGE RD
HOUSTON, TX 77095

HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

CERTIFIED MATERIAL TEST REPORT No. 28499

HA ORDER NO./ITEM	DATE	PAGE OF
300013971 1	08/31/06	2 8
QUANTITY	INSPECTED BY	
3250 LBS	HA/SMC	
CHARGE ORDER NO.	MARK ORDER NO.	
HOU-600503-12	HOU-600503-12	

DESCRIPTION OF MATERIAL SHIPPED: INCONEL ALLOY 718 HOT FIN RND ROUGH GRD OR ROUGH T SOL ANN & AGE HD
1.7500 IN 144-288 IN NOM

THIS IS TO CERTIFY THAT ALL REQUIRED SAMPLINGS INSPECTIONS AND TESTS HAVE BEEN PERFORMED IN ACCORDANCE WITH THE ORDER AND SPECIFICATION REQUIREMENTS. THE TEST REPORT REPRESENTS THE ACTUAL ATTRIBUTES OF THE MATERIAL FURNISHED AND THE VALUES SHOWN ARE CORRECT AND TRUE. THE MATERIAL DESCRIBED BY THIS CERTIFICATE IS IN FULL COMPLIANCE WITH ALL ORDER AND INSPECTION REQUIREMENTS. WE HEREBY CERTIFY THAT THE BELOW RESULTS ARE IN ACCORDANCE WITH THE SPECIFIED CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

HARDNESS -HRC	-AS SHIPPED	38.4
HARDNESS -HRC	-AS SHIPPED	37.3
HARDNESS -HRC	-AS SHIPPED	37.7
HARDNESS -HRC	-AS SHIPPED	37.7
HARDNESS -HRC	-AS SHIPPED	37.9
HARDNESS -HRC	-AS SHIPPED	36.5
HARDNESS -HRC	-AS SHIPPED	35.3
HARDNESS -HRC	-AS SHIPPED	38.1
HARDNESS -HRC	-AS SHIPPED	37.3
HARDNESS -HRC	-AS SHIPPED	36.2
HARDNESS -HRC	-AS SHIPPED	38.4
HARDNESS -HRC	-AS SHIPPED	36.6
HARDNESS -HRC	-AS SHIPPED	38.1
HARDNESS -HRC	-AS SHIPPED	36.7
HARDNESS -HRC	-AS SHIPPED	38.1
HARDNESS -HRC	-AS SHIPPED	36.6
HARDNESS -HRC	-AS SHIPPED	36.9
HARDNESS -HRC	-AS SHIPPED	35.3
HARDNESS -HRC	-AS SHIPPED	37.3
HARDNESS -HRC	-AS SHIPPED	37.7
HARDNESS -HRC	-AS SHIPPED	37.1
HARDNESS -HRC	-AS SHIPPED	37.6
HARDNESS -HRC	-AS SHIPPED	37.9
HARDNESS -HRC	-AS SHIPPED	38.0
HARDNESS -HRC	-AS SHIPPED	37.6
HARDNESS -HRC	-AS SHIPPED	37.0

HARDNESS-HRC-AS SHIPPED	02 O'CLOCK			06 O'CLOCK		10 O'CLOCK	
	OD	MR	CEN	OD	MR	OD	MR
	36.1	38.7	38.5	38.2	38.8	39.4	38.8

GRAIN SIZE-AS SHIPPED AGS ASTM NO. 4. (PHOTOS ATTACHED) SUR LONG
NORMAL - LONG

REV. 8/04

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

SOUTHERN U.S. P

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

ISO 9001

SOLD TO:
ATT: ALAN BAILEY
HOWCO METALS MANAGEMENT LP
9611 TELGE RD
HOUSTON, TX 77095

SHIP TO:
HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

CERTIFIED MATERIAL TEST REPORT No. 28499

HA ORDER NO./ITEM	DATE	PAGE	OF
300013971 1	08/31/06	3	8
QUANTITY	INSPECTED BY		
3250 LBS	HA/SMC		
CHARGE ORDER NO.	MARK ORDER NO.		
HOU-600503-12	HOU-600503-12		

DESCRIPTION OF MATERIAL SHIPPED: INCONEL ALLOY 718 HOT FIN RND ROUGH GRD OR ROUGH T SOL ANN & AGE
1.7500 IN 144-288 IN NOM

THIS IS TO CERTIFY THAT ALL REQUIRED SAMPLING INSPECTIONS AND TESTS HAVE BEEN PERFORMED IN ACCORDANCE WITH THE ORDER AND SPECIFICATION REQUIREMENTS. THE TEST REPORT REPRESENTS THE ACTUAL ATTRIBUTES OF THE MATERIAL FURNISHED AND THE VALUES SHOWN ARE CORRECT AND TRUE. THE MATERIAL DESCRIBED BY THIS CERTIFICATE IS IN FULL COMPLIANCE WITH ALL ORDER AND INSPECTION REQUIREMENTS. WE HEREBY CERTIFY THAT THE BELOW ENGINEER ARE IN ACCORDANCE WITH THE SPECIFIED CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

GRAIN SIZE-AS SHIPPED AGS ASTM NO. 4. " " MR LONG
NORMAL - LONG
GRAIN SIZE-AS SHIPPED AGS ASTM NO. 4. " " CEN LONG
NORMAL - LONG

IMPACT RESULTS-AS SHIPPED DEG F- 75 069.00 FT/LBS LATERAL EXPANSION 0.035 IN 35%SHEAR LONG
SPECIMEN SIZE 10MM X 10MM
IMPACT RESULTS-AS SHIPPED DEG F- 75 071.00 FT/LBS LATERAL EXPANSION 0.036 IN 35%SHEAR LONG
SPECIMEN SIZE 10MM X 10MM
IMPACT RESULTS-AS SHIPPED DEG F- 75 069.00 FT/LBS LATERAL EXPANSION 0.037 IN 35%SHEAR LONG
SPECIMEN SIZE 10MM X 10MM 69.70 IMPACT AVG.

YIELD STRENGTH WAS DETERMINED USING A STRESS STRAIN CURVE

MACROETCH GRADED PER ASTM A604 AND RATED AS FOLLOWS:

		HEAD & TOE RATING
CLASS 1	SEVERITY	A
CLASS 2	SEVERITY	A
CLASS 3	SEVERITY	A
CLASS 4	SEVERITY	A

MICROSTRUCTURE TEST(S):SATISFACTORY (PHOTOS ATTACHED)

REV. 6/04

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

SOUTHERN U.S.

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

ISO 9001

ATT: ALAN BAILEY
HOWCO METALS MANAGEMENT LP
9611 TELGE RD
HOUSTON, TX 77095

HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

CERTIFIED MATERIAL TEST REPORT No. 26499

HA ORDER NO./ITEM	DATE	PAGE	OF
300013971 1	08/31/06	4	8

QUANTITY	INSPECTED BY
3250 LBS	HA/SMC

CHARGE ORDER NO.	MARK ORDER NO.
HOU-600503-12	HOU-600503-12

DESCRIPTION OF MATERIAL SHIPPED: INCONEL ALLOY 718 HOT FIN RND ROUGH GRD OR ROUGH T SOL ANN & AGE HD 1.7500 IN 144-268 IN NOM

THIS IS TO CERTIFY THAT ALL REQUIRED SAMPLINGS INSPECTIONS AND TESTS HAVE BEEN PERFORMED IN ACCORDANCE WITH THE ORDER AND SPECIFICATION REQUIREMENTS. THE TEST REPORT REPRESENTS THE ACTUAL ATTRIBUTES OF THE MATERIAL FURNISHED AND THE VALUES SHOWN ARE CORRECT AND TRUE. THE MATERIAL DESCRIBED BY THIS CERTIFICATE IS IN FULL COMPLIANCE WITH ALL ORDER AND INSPECTION REQUIREMENTS. WE HEREBY CERTIFY THAT THE BELOW FIGURES ARE IN ACCORDANCE WITH THE SPECIFIED CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

FORM H-2245 INCO ALLOYS INTERNATIONAL,INC.
ULTRASONIC TEST REPORT

FORM H2245 IS COMPOSED OF THREE SECTIONS FOR EACH HEAT/LOT REPORTED.
SECTION I IS PRINTED ONE TIME FOR EACH HEAT AND LOT
SECTION II MAY BE PRINTED MULTIPLE TIMES FOR EACH HEAT AND LOT.
SECTION III IS PRINTED ONE TIME FOR EACH HEAT AND LOT.

SECTION <<I>> HEAT/LOT:LT0814EY111 MATERIAL TESTED 08/25/06 BY TED PETTIT
SERIAL #: N/A
PIECE #: N/A

1. IAII IDENTIFICATION: (A) SNT-TC-1A-LEVEL: II
(B) MIL-STD-2132: INSPECTOR

2. TESTED MATERIAL 31 PIECE(S) WERE TESTED PRIOR TO CUT LGTH/WDTH AT FINAL CROSS SECTION
YIELDING 18 PIECE(S) FOR SHIPMENT AFTER CUTTING

3. PROCEDURE
APPROVED PROCEDURE NUMBER, REVISION NUMBER, APPLICABLE SPECIFICATIONS
AND/OR CONTRACTUAL REQUIREMENTS WHICH WERE USED FOR THE EXAMINATION ARE
FOUND IN THE SPECIFICATION BLOCK AND REMARKS SECTION OF THE MATERIAL TEST REPORT.
QCP #:332 QCP-REV:1 DATED:12/08/03

4. EXAMINATION CONDITIONS:
TEST METHOD: AUTOMATIC IMMERSION
COUPLANT: WATER
SCANNING EQUIPMENT: TUBE, BAR, OR PLATE FOLLOWER STUFFING-BOX
SCANNING SPEED(INCHES PER SECOND):30

SECTION <<II>> HEAT/LOT:LT0814EY111 PART:01 OF 02.

5. (A) TEST MODE: LONGITUDINAL
(B) WAVE PROPOGATION: NORMAL
(C) INSTRUMENT MANUFACTURER: SONIC MODEL:137
(D) SERIAL NUMBER: 137P-332PB
(E) LINEARITY CALIBRATION DATE: 06/29/06
(F) SEARCH UNIT MANUFACTURER/SERIAL NUMBER: HARISONIC/L12138
(G) FREQUENCY (MHZ): 5.0

REV. 6/04

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

SOUTHERN U.S.

SHIP TO
ATT: ALAN BAILEY
HOWCO METALS MANAGEMENT LP
9611 TELGE RD
HOUSTON, TX 77095

SOLD TO
HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

CERTIFIED MATERIAL TEST REPORT No. 28499

HA ORDER NO./ITEM	DATE	PAGE	OF
300013971 1	08/31/06	5	8

QUANTITY	INSPECTED BY
3250 LBS	HA/SMC

CHARGE ORDER NO.	MARK ORDER NO.
HOU-600503-12	HOU-600503-12

DESCRIPTION OF MATERIAL SHIPPED: INCONEL ALLOY 718 HOT FIN RND ROUGH GRD OR ROUGH T SOL ANN & AGE HD
1.7500 IN 144-288 IN NOM

THIS IS TO CERTIFY THAT ALL REQUIRED SAMPLINGS INSPECTIONS AND TESTS HAVE BEEN PERFORMED IN ACCORDANCE WITH THE ORDER AND SPECIFICATION REQUIREMENTS. THE TEST REPORT REPRESENTS THE ACTUAL ATTRIBUTES OF THE MATERIAL FURNISHED AND THE VALUES SHOWN ARE CORRECT AND TRUE. THE MATERIAL DESCRIBED BY THIS CERTIFICATE IS IN FULL COMPLIANCE WITH ALL ORDER AND INSPECTION REQUIREMENTS. WE HEREBY CERTIFY THAT THE BELOW FIGURES ARE IN ACCORDANCE WITH THE SPECIFIC CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

(H) SIZE (INCHES): .500
(I) TYPE: SINGLE FOCUSED CYLINDRICAL
(J) FOCAL LENGTH (IN): 2.0
(K) CABLE LENGTH (FT): 6
(L) ATTENUATION CORRECTION DB:000
(M) REFERENCE AMPLITUDE: %FS:80
(N) ALARM/EVAL LEVEL %CAL:50 % BR LOSS:50
(O) REJECT: OFF
(P) DISTANCE AMPLITUDE CORRECTION: YES
(Q) AREA GATED:
FRONT SURFACE TO BACK REFLECTION
BACK REFLECTION
(R) CALIBRATION STANDARD(S):
(A) V855
(S) FLAT BOTTOM HOLE(S):
(A) DIAMETER:.1260 TEST METAL DISTANCE:0.468 DEPTH:
(B) DIAMETER:.1260 TEST METAL DISTANCE:0.898 DEPTH:
(C) DIAMETER:.1265 TEST METAL DISTANCE:1.013 DEPTH
(T) NOTCH(ES):
NOT APPLICABLE

SECTION <<II>> HEAT/LOT:LT0814EY111 PART:02 OF 02.

5. (A) TEST MODE: SHEAR
(B) WAVE PROPOGATION: CIRCUMFERENTIAL ONE-DIRECTION
(C) INSTRUMENT MANUFACTURER: KB MODEL:2100
(D) SERIAL NUMBER: 04239702
(E) LINEARITY CALIBRATION DATE: 08/04/06
(F) SEARCH UNIT MANUFACTURER/SERIAL NUMBER: AEROTECH/007PPM
(G) FREQUENCY (MHZ): 2.25
(H) SIZE (INCHES): .750
(I) TYPE: SINGLE FOCUSED CYLINDRICAL
(J) FOCAL LENGTH (IN): 3
(K) CABLE LENGTH (FT): 6
(L) ATTENUATION CORRECTION DB:000
(M) REFERENCE AMPLITUDE: %FS:80

REV. 6/04

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

SOUTHERN U.S.

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

SOLD TO:
ATT: ALAN BAILEY
HOWCO METALS MANAGEMENT LP
9611 TELGE RD
HOUSTON, TX 77095

SHIP TO:
HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

CERTIFIED MATERIAL TEST REPORT No. 28499

HA ORDER NO./ITEM	DATE	PAGE	OF
300013971 1	08/31/06	6	8

QUANTITY	INSPECTED BY
3250 LBS	HA/SNC

CHARGE ORDER NO.	MARK ORDER NO.
HOU-600503-12	HOU-600503-12

DESCRIPTION OF MATERIAL SHIPPED: INCONEL ALLOY 718 HOT FIN RND ROUGH GRD OR ROUGH T SOL ANN & AGE HD
1.7500 IN 144-288 IN NOM

THIS IS TO CERTIFY THAT ALL REQUIRED SAMPLINGS INSPECTIONS AND TESTS HAVE BEEN PERFORMED IN ACCORDANCE WITH THE ORDER AND SPECIFICATION REQUIREMENTS. THE TEST REPORT REPRESENTS THE ACTUAL ATTRIBUTES OF THE MATERIAL FURNISHED AND THE VALUES SHOWN ARE CORRECT AND TRUE. THE MATERIAL DESCRIBED BY THIS CERTIFICATE IS IN FULL COMPLIANCE WITH ALL ORDER AND INSPECTION REQUIREMENTS. WE HEREBY CERTIFY THAT THE BELOW FIGURES ARE IN ACCORDANCE WITH THE SPECIFIED CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

(N) ALARM/EVAL LEVEL XCAL:50
(O) REJECT: OFF
(P) DISTANCE AMPLITUDE CORRECTION: NONE
(Q) AREA GATED:
FRONT SURFACE TO 1.25 NODE TMD
(R) CALIBRATION STANDARD(S):
NOT APPLICABLE
(S) FLAT BOTTOM HOLE(S):
NOT APPLICABLE
(T) NOTCH(ES):
NOT APPLICABLE

SECTION <<III>> HEAT/LOT:LT0814EY111

6. SURFACE FINISH CALIBRATION STANDARD: NO SMOOTHER THAN MATERIAL
SURFACE FINISH MATERIAL: LESS THAN 250 RHR
7. ULTRASONIC EVALUATION OF WALL THICKNESS:N/A
8. INSPECTED MATERIAL ACCEPTED:YES
REPORTABLE INDICATIONS: NONE
9. REMARKS:
TRANSDUCER S/N-L12138, MODAEL 13-0508-R, GAIN 46.0 DB.
TRANSDUCER S/N-007PPM, MODEL- ALPHA, ANGLE- 45, GAIN 67.6DB
CALIBRATION FOR CIRCUMFERENTIAL SHEAR WAVE TEST WAS
ESTABLISHED ON A NOTCH LESS THAN 1% OF THE ROD DIAMETER.
THE ULTRASONIC TESTING PERFORMED IN ACCORDANCE WITH QCP-
332 REFERENCED ABOVE AND DETAILED IN THIS REPORT MEETS AND
FULLY SATISFIES ALL ULTRASONIC TEST REQUIREMENTS OF QCP 285
REVISION 2 AS WELL.
10. PITCH DATA:PITCH VALUE: 0.1875 IN

HEAT TREATMENT FURNANCES ARE CALIBRATED TO AMS 2750, AS REQUIRED BY MIL-H-6875.
NO WELD REPAIR HAS BEEN PERFORMED ON THIS MATERIAL.
ACTUAL HOT WORKING REDUCTION RATIO: 131:1
REMELTED INGOT SIZE: 20" DIAMETER

QUALIFICATION TEST COUPON WAS A PROLONGATION CUT FROM PRODUCTION MATERIAL AFTER HEAT TREATMENT.

REV. 6/04

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

SOUTHERN U.S.

ATT: ALAN BAILEY
HOWCO METALS MANAGEMENT LP
9611 TELGE RD
HOUSTON, TX 77095

HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

CERTIFIED MATERIAL TEST REPORT No. 28499

HA ORDER NO./ITEM	DATE	PAGE	OF
300013971 1	08/31/06	7	8

QUANTITY	INSPECTED BY
3250 LBS	HA/SNC

CHARGE ORDER NO.	MARK ORDER NO.
HOU-600503-12	HOU-600503-12

DESCRIPTION OF MATERIAL SHIPPED: INCONEL ALLOY 718 HOT FIN RND ROUGH GRD OR ROUGH T SOL ANN & AGE HD
1.7500 IN 144-288 IN NOM

THIS IS TO CERTIFY THAT ALL REQUIRED SAMPLINGS INSPECTIONS AND TESTS HAVE BEEN PERFORMED IN ACCORDANCE WITH THE ORDER AND SPECIFICATION REQUIREMENTS. THE TEST REPORT REPRESENTS THE ACTUAL ATTRIBUTES OF THE MATERIAL FURNISHED AND THE VALUES SHOWN ARE CORRECT AND TRUE. THE MATERIAL DESCRIBED BY THIS CERTIFICATE IS IN FULL COMPLIANCE WITH ALL ORDER AND INSPECTION REQUIREMENTS. WE HEREBY CERTIFY THAT THE BELOW FIGURES ARE IN ACCORDANCE WITH THE REQUIRED CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

HEAT TREAT FURNANCE WAS MONITORED BY HEAT SINK THERMOCOUPLES.
HEAT SINK REQUIREMENTS OF API 6A INCLUDING EQUIVALENT ROUND WERE SATISFIED.
FOR ALL PRODUCTS 3/4" DIA & OVER, TENSILE TEST SPECIMENS WERE .500 GA. DIA. X 2" GA. LENGTH STANDARD ASTM E8 SPECIMENS.
CHEMISTRY IS REPORTED FROM REMELTED INGOT.

MATERIAL HEAT TREAT: SOL ANN 1885 DEG. F. FOR 1 HOUR 5 MINUTES, WATER QUENCHED.
QUENCH TEMP: IN 88 DEG. F.; END 95 DEG. F.
~~AGED AT 1450 DEG F 7 HOURS, AIR COOLED.~~
HEAT TREAT CHARTS ATTACHED.

MATERIAL CAPABLE OF MEETING THE LIQUID PENETRANT REQUIREMENTS OF THE ORDER AFTER ADEQUATE SURFACE PREPARATION BY THE CUSTOMER TO PERFORM A VALID TEST.

ULTRASONICALLY TESTED AND ACCEPTABLE TO API 6A CLAUSES 7.4.2.3.1S AND 7.4.2.4.11 AND SATISFACTORY PER IAII QCP 285.

MICROSTRUCTURE SPECIMENS HAVE BEEN REMOVED FROM BAR PROLONGATIONS OBTAINED FROM EVERY HEAT TREAT LOT AFTER FINAL HEAT TREATMENT. A HEAT TREAT LOT CONSIST OF BARS FROM THE SAME REMELT INGOT, OF THE SAME SIZE (EXCEPT LENGTH), AND PROCESSED IN THE SAME FURNACE LOADS FOR BOTH ANNEALING AND AGING.

MICROSTRUCTURE SPECIMENS HAVE BEEN EXAMINED FROM LOCATIONS OF BAR PROLONGATION REPRESENTING NEAR SURFACE, MID-RADIUS AND CENTER LOCATIONS AND CONFIRMS:ABSENCE OF TOPOLOGICAL DUPLEX GRAIN SIZE (I.E.CROSS-SECTION CONDITION, NECKLACE CONDITION AND BANDING) PER ASTM E1181; MATERIAL IS FREE FROM LAVES PHASE; MATERIAL IS FREE OF CONTINUOUS GRAIN BOUNDARY NETWORKS OF SECONDARY PHASES (E.G. DELTA PHASE, CARBIDES); ASSESSMENT OF DELTA PHASE CONTENT EQUAL TO OR BETTER THAN LEVEL 2/D2; NO INDIVIDUAL GRAINS FOUND TO BE COMPLETELY SURROUNDED WITH ACICULAR DELTA; INDIVIDUAL OR ISOLATED GRAINS CONTAINING ACICULAR DELTA NOT REPRESENTATIVE OF THE BULK MICROSTRUCTURE IS NOT A CAUSE FOR REJECTION;

REV. 6/04

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

SOUTHERN U.S. P

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

SHIP TO
ATT: ALAN BAILEY
HOWCO METALS MANAGEMENT LP
9611 TELGE RD
HOUSTON, TX 77095

CHARGE TO
HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

CERTIFIED MATERIAL TEST REPORT No. 26499

HA ORDER NO./ITEM	DATE	PAGE	OF
300013971 1	08/31/06	8	8

QUANTITY	INSPECTED BY
3250 LBS	HA/SMC

CHARGE ORDER NO.	MARK ORDER NO.
HOU-600503-12	HOU-600503-12

DESCRIPTION OF MATERIAL SHIPPED: INCONEL ALLOY 718 HOT FIN RND ROUGH GRD OR ROUGH T SOL ANN & AGE H
1.7500 IN 144-288 IN NOM

THIS IS TO CERTIFY THAT ALL REQUIRED SAMPLINGS INSPECTIONS AND TESTS HAVE BEEN PERFORMED IN ACCORDANCE WITH THE ORDER AND SPECIFICATION REQUIREMENTS. THE TEST REPORT REPRESENTS THE ACTUAL ATTRIBUTES OF THE MATERIAL FURNISHED AND THE VALUES SHOWN ARE CORRECT AND TRUE. THE MATERIAL DESCRIBED BY THIS CERTIFICATE IS IN FULL COMPLIANCE WITH ALL ORDER AND INSPECTION REQUIREMENTS. WE HEREBY CERTIFY THAT THE BELOW FIGURES ARE IN ACCORDANCE WITH THE SPECIFIED CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

ISOLATED AREAS NOT REPRESENTATIVE OF THE BULK MICROSTRUCTURE IS NOT A CAUSE FOR REJECTION.

TOTAL OF ALL CHEMICAL ELEMENTS NOT REPORTED IS CONSIDERED RESIDUAL, AND DOES NOT EXCEED. 0.50%.

CALCIUM AND MAGNESIUM WERE INTENTIONALLY ADDED.

~~COLUMBIUM (CB) EQUALS NIOBIUM (NB).~~

THE MAXIMUM AND MINIMUM DIAMETERS IN THE HEAT TREAT BATCH ARE WITHIN 2 INCHES.

SMC-HA WAS THE MELTING SOURCE AND TESTING FACILITY.

COUNTRY OF ORIGIN: MELTED AND MANUFACTURED IN THE USA

VISUAL AND DIMENSIONAL EXAMINATION SATISFACTORY.,
MATERIAL, WHEN SHIPPED, IS FREE FROM CONTAMINATION BY MERCURY, RADIUM, ALPHA SOURCE, & LOW MELTING ELEMENT:

"CHEMICAL ANALYSIS AS REQUIRED FOR CARBON,SULFUR,NITROGEN OR OXYGEN IS PERFORMED BY COMBUSTION TECHNIQUES. ALL OTHER REPORTED ELEMENTS ARE ANALYZED BY X-RAY AND/OR EMISSION SPECTROSCOPY."

QUALITY SYSTEM MEETS REQUIREMENTS OF DIRECTIVE 97/23/EC,ANNEX I, CHAPTER 4.3 PER TUV CERTIFICATE 20674928 (EXPIRES MAY 2008).

AUTHORIZED QUALITY CERTIFICATION REPRESENTATIVES :
W.E. BOLEN, P.D. CUSTER, H.A. MORRISON, D.L. SMITH, P.P. WAUGH

NORTECH ADVANCED NDT LTD.

L-030368

160 Portage Close, Sherwood Park, Alberta, T8H 2W2
Phone: 780-449-5013 Fax: 780-449-5036
www.nortechadvanced.com

Liquid Penetrant Examination Report

Client: Master Flo Valve Inc.
4611- 74 Avenue
Edmonton, Alberta T6B 2H5

Date: 06-Aug-2010
Location: Nortech Advanced Sherwood Park
Project:

WO #: 1028064
Job #: NORTECH NS10-0815
PO #: 193456
Invoice #:

TECHNIQUE DETAILS

Examination Type: Liquid Penetrant Examination, Visible, Water-washable

Test Method: QAS-03-008 REV. J 06/10 Accept Std: API 6A 19th ED. PSL 3/QAS-03-008 REV. J 06/10 Procedure #: PTP-01 Type II Method A Rev.1, Mar. 24, 2010

Materials Consumed:

Manufacturer: MAGNAFLUX	Type: SKL WP2	Batch: 09K01K	Dwell Time: 20 Minutes	
Manufacturer: MAGNAFLUX	Type: SKD S2	Batch: 09L04K	Dwell Time: 20 Minutes	
Manufacturer: MAGNAFLUX	Type: SKC-S	Batch: 10C01K	Dwell Time:	
Manufacturer: NLS(PRODUCTS)	Type: FLUID FILM	Batch: 0C07282	Dwell Time:	
Manufacturer:	Type: H2O	Batch:	Dwell Time:	

Surface Condition: ___ Clean/Bare ___ As Ground x Machined ___ Sandblasted ___ Painted ___ Welded ___ Scale Rmvd

Source of Light: ___ Halogen 250W ___ Incandescent 100W x Maglight 6 Volt 20.5°C Surface Temp

Examination Results & Comments

VISIBLE WATER WASHABLE LIQUID PENETRANT EXAMINATION WAS PERFORMED ON THE FOLLOWING AT (INCONEL 718) WETTED ENDS ONLY OF THE FOLLOWING:

Description: 1) P35-15K STEM

Part Description	WO ID	Serial #	Work Order	Heat #	Part #	Material Type
P35-15K STEM	NOT APPLICABLE	193391-1-1	NOT APPLICABLE	52211 / LT0814EY111	23290-706-06 REV. 0	WETTED END INCONEL 718

NO RELEVANT INDICATIONS WERE DETECTED AT TIME OF EXAMINATION IN COMPLIANCE WITH QAS-03-008 REV. J 06/10 AND API 6A PSL 3.

POST EXAMINATION CLEANING APPLICABLE

AISI 4130 THREADED END TO BE DONE ON FINAL NDE

Signatures

Technician (Sign): _____

Technician: Carreiro, Mike CGSB Lvl: CGSB Reg: SNT-TC-1A Lvl: II

Assistant: CGSB Lvl: CGSB Reg: SNT-TC-1A Lvl:

Client Signature

Client Representative: Kim Mungall _____

*Client Representative's Signature indicates acceptance of reports and results. Nortech Advanced NDT Ltd. is liable for examination costs only.

Q.C. APPROVED
BY _____ DATE 08/09/10

PO 193456
WO
PN 23290-706-06
HT LT0814EY111

MASTER FLO™

PSL 3 HARDNESS TEST RECORD

P/N: 23290-706-06	PART DESCRIPTION: STEM P35	
W.O. 1028064	DS# —	P.O. 193456.

	MATERIAL / E.S.	TOLERANCE
1	INCONEL 718	MIN 32 — MAX 40 HRC
2		MIN — MAX

EQUIPMENT USED	VERSITRON	STARRETT	KING	KING	KING
SERIAL NUMBER	✓7240	6791	VS-49	VS-34	UG-53

SERIAL NUMBER	HEAT #	RESULT	NOTES
193391-1-1	L70814E4111	39 HRC	

Q.C. APPROVED
BY URMIL/NS DATE 08/10/10

193456
PO
1028064
WO
23290-706-06
PN
L70814E4111
HT
193391-1-1
SN

COMPLETED BY URMIL/NS DATE 08/10/10 PAGE 1 OF 1

FLOW RING

COPY FROM 2005
SG

REV. 6/04

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

SOUTHERN U.S.

ATTN: ALAN BAILEY
HOWCO METALS MANAGEMENT LP
9611 TELGE RD
HOUSTON, TX 77095

HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

CERTIFIED MATERIAL TEST REPORT

No. 01055

HA ORDER NO./ITEM	DATE	PAGE	OF
100022716 1	04/25/05	1	5

QUANTITY	INSPECTED BY
4425 LBS	HA/SMC

CHARGE ORDER NO.	MARK ORDER NO.
HOU-30431-02	HOU-30431-02

DESCRIPTION OF MATERIAL SHIPPED: INCONEL ALLOY 725 HOT FIN RND ROUGH T SOL ANN & AGE HD 6.5000 IN 216-288 IN RDM

THIS IS TO CERTIFY THAT ALL REQUIRED SAMPLINGS, INSPECTIONS AND TESTS HAVE BEEN PERFORMED IN ACCORDANCE WITH THE TERMS AND SPECIFICATIONS [illegible]

QUALITY CERTIFICATION REPRESENTATIVE

********THIS REPORT RELATES ONLY TO THE ITEM(S) TESTED AND MAY NOT BE REPRODUCED EXCEPT IN FULL.********

UNS:N07725

SPECIFICATIONS: IAII HA 91 REV 5\ANSI\ASME SPPE-1-1982\NACE MR0175-2002\
IAII QCP 285 REV 1,\
QUALITY SYSTEM CERTIFICATION: ISO 9001:2000 (ABS-QE CERT. 30125);
EN 10 204/DIN 50049 (CERT.3.1.B)

Q.C. APPROVED
BY SG DATE 01/30/0[illegible]

CHEMICAL ANALYSIS (WT. %)

HEAT#	C / TI	MN / MG	FE / CO	S / MO	SI / NB	CU / TA	NI / P	CR / CA	AL / NB+TA
HT0613LY	0.01 / 1.53	0.07 / 0.0039	7.74 / 0.02	0.0001 / 8.04	0.02 / 3.46	0.02 / <0.01	57.79 / 0.003	21.04 / 0.001	0.25 / 3.46

TESTED BY HUNTINGTON ALLOYS, 3200 RIVERSIDE DR., HUNTINGTON, WV 25705, ACCREDITED FOR FASTENER QUALITY AC
VIA PRI CERT 0029 (EXPIRES 10/31/2005).
MELT METHOD: DUVAC (VIM ELECTRODE; VAR INGOT)

PO 141788
WO
PN 81319-14-06500
HT 0613LY16
SN

MECHANICAL PROPERTIES

HEAT/LOT	QUANTITY	HARDNESS	GRAIN SIZE	YIELD .2%PSI X 100	TENSILE PSI X 100	%ELG 2"	R/A %	DEG F
HT0613LY 16	2 PCS							
ROOM TEMP-HRC	-AS SHIPPED	35.2		1235	1723	34.6	49.2	
PC.# 2-1 & 2-2								

HARDNESS-HRC-AS SHIPPED

02 O'CLOCK OD	02 O'CLOCK MR	CEN	06 O'CLOCK OD	06 O'CLOCK MR	10 O'CLOCK OD	10 O'CLOCK MR
36.1	37.2	37.9	38.3	36.8	39.2	37.4

GRAIN SIZE-AS SHIPPED AGS ASTM NO. 3.5 (PHOTOS ATTCHED) LONG
NORMAL - LONG

IMPACT RESULTS-AS SHIPPED DEG F- 75 106.00 FT/LBS LATERAL EXPANSION 0.047 IN 50

HOWCO QA 28

MS 050[illegible]

PO 192385
WO 83290-202-02
PN TRANS
HT HO6132416
SN 191385-1-1-05

FLOW RING

REV. 8/04

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

SOUTHERN U.S.

HUNTINGTON ALLOYS...
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

ATTN: ALAN BAILEY
HOWCO METALS MANAGEMENT LP
9611 TELGE RD
HOUSTON, TX 77095

HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

CERTIFIED MATERIAL TEST REPORT No. 01055

HA ORDER NO./ITEM: 100022718 1	DATE: 04/25/05	PAGE 2 OF 5
QUANTITY: 4425 LBS	INSPECTED BY: HA/SMC	
CHANGE ORDER NO.: HOU-30431-02	MARK ORDER NO.: HOU-30431-02	

DESCRIPTION OF MATERIAL SHIPPED: INCONEL ALLOY 725 HOT FIN RND ROUGH T SOL ANN & AGE HD
6.5000 IN 216-288 IN RDM

THIS IS TO CERTIFY THAT ALL REQUIRED SAMPLING INSPECTION AND TESTING HAVE BEEN PERFORMED IN ACCORDANCE WITH THE ORDER AND ENGINEERING REQUIREMENTS. THE TEST RESULTS REFLECTED IN THE ACTUAL ATTRIBUTES OF THE MATERIAL NUMBERED AND THE VALUES SHOWN ARE CORRECT AND THAT THE MATERIAL DESCRIBED BY THIS CERTIFICATE IS IN FULL COMPLIANCE WITH ALL ORDER AND INSPECTION REQUIREMENTS. WE HEREBY CERTIFY THAT ALL DELIVERIES ARE IN ACCORDANCE WITH THE SPECIFIED CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

SPECIMEN SIZE 10MM X 10MM
IMPACT RESULTS-AS SHIPPED DEG F- 75 112.00 FT/LBS LATERAL EXPANSION 0.051 IN 50 TRANS
SPECIMEN SIZE 10MM X 10MM.
IMPACT RESULTS-AS SHIPPED DEG F- 75 116.00 FT/LBS LATERAL EXPANSION 0.049 IN 50 TRANS
SPECIMEN SIZE 10MM X 10MM 111.00 IMPACT AVG.

YIELD STRENGTH WAS DETERMINED USING A STRESS STRAIN CURVE

MACROETCH TEST(S):SATISFACTORY

FORM H-2245 INCO ALLOYS INTERNATIONAL,INC.
ULTRASONIC TEST REPORT
FORM H2245 IS COMPOSED OF THREE SECTIONS FOR EACH HEAT/LOT REPORTED.
SECTION I IS PRINTED ONE TIME FOR EACH HEAT AND LOT
SECTION II MAY BE PRINTED MULTIPLE TIMES FOR EACH HEAT AND LOT.
SECTION III IS PRINTED ONE TIME FOR EACH HEAT AND LOT.

SECTION <<I>> HEAT/LOT:HT0613LY16 MATERIAL TESTED 04/14/05 BY JIM BOOTH
SERIAL #: N/A
PIECE #:2-1,2-2

1. IAXI IDENTIFICATION: (A) SNT-TC-1A-LEVEL: II
(B) MIL-STD-2132; INSPECTOR

2. TESTED MATERIAL 2 PIECE(S) WERE TESTED PRIOR TO CUT LGTH/WDTH AT FINAL CROSS SECTION
YIELDING 2 PIECE(S) FOR SHIPMENT AFTER CUTTING

3. PROCEDURE
APPROVED PROCEDURE NUMBER, REVISION NUMBER, APPLICABLE SPECIFICATIONS
AND/OR CONTRACTUAL REQUIREMENTS WHICH WERE USED FOR THE EXAMINATION ARE
FOUND IN THE SPECIFICATION BLOCK AND REMARKS SECTION OF THE MATERIAL TEST REPORT.
QCP #:285 QCP-REV:1 DATED:02/05/93

4. EXAMINATION CONDITIONS:
TEST METHOD: AUTOMATIC IMMERSION

REV.-6/04

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

SOUTHERN U.S.

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

ISO 9001

CERTIFIED MATERIAL TEST REPORT No. 01065

ATTN: ALAN BAILEY
HOWCO METALS MANAGEMENT LP
3611 TELGE RD
HOUSTON, TX 77095

HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

HA ORDER NO./ITEM	100022718 1
DATE	04/25/05
PAGE	3 OF 5
QUANTITY	4425 LBS
INSPECTED BY	HA/SMC
CHARGE ORDER NO.	HOU-30431-02
MARK ORDER NO.	HOU-30431-02
DESCRIPTION OF MATERIAL SHIPPED	INCONEL ALLOY 725 HOT FIN RND ROUGH T SOL ANN & AGE: HD 6.5000 IN 216-288 IN RDM

THIS IS TO CERTIFY THAT ALL REQUIRED EXAMINATIONS INSPECTIONS AND TESTS HAVE BEEN PERFORMED IN ACCORDANCE WITH THE ORDER AND SPECIFICATION REQUIREMENTS. THE TEST REPORT REPRESENTS THE ACTUAL ATTRIBUTES THE MATERIAL FURNISHED AND THE VALUES SHOWN ARE CORRECT AND TRUE THE MATERIAL DESCRIBED BY THIS CERTIFICATE IS IN FULL COMPLIANCE WITH ALL ORDER AND CONTRACTUAL REQUIREMENTS. WE HEREBY CERTIFY THAT BELOW FIGURES ARE IN ACCORDANCE WITH THE SHIPPED CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

COUPLANT: WATER
SCANNING EQUIPMENT: TANK BRIDGE SCANNER TUBE, BAR, OR PLATE FOLLOWER
SCANNING SPEED(INCHES PER SECOND): 17

SECTION <<II>> HEAT/LOT:HT0613LY16 PART:01 OF 01

5. (A) TEST MODE: LONGITUDINAL
(B) WAVE PROPOGATION: NORMAL
(C) INSTRUMENT MANUFACTURER: SONIC MODEL:237
(D) SERIAL NUMBER: 158SA
(E) LINEARITY CALIBRATION DATE: 02/03/05
(F) SEARCH UNIT MANUFACTURER/SERIAL NUMBER: MEGASONICS/L0865
(G) FREQUENCY (MHZ): 3.50
(H) SIZE (INCHES): .75" X 1"
(I) TYPE: SINGLE FOCUSED CYLINDRICAL
(J) FOCAL LENGTH (IN): 9.5
(K) CABLE LENGTH (FT): 6
(L) ATTENUATION CORRECTION DB:000
(M) REFERENCE AMPLITUDE: %FS:80
(N) ALARM/EVAL LEVEL %CAL:50 % DB LOSS:50
(O) REJECT: OFF
(P) DISTANCE AMPLITUDE CORRECTION: YES
(Q) AREA GATED:
FRONT SURFACE TO BACK REFLECTION
BACK: REFLECTION
(R) CALIBRATION STANDARD(S):
(A) K302
(S) FLAT BOTTOM HOLE(S):
(A) DIAMETER:.2490 TEST METAL DISTANCE:N/A DEPTH:.74700
(B) DIAMETER:.2490 TEST METAL DISTANCE:N/A DEPTH:3.2450
(C) DIAMETER:.2490 TEST METAL DISTANCE:N/A DEPTH 4.8475
(T) NOTCH(ES):
NOT APPLICABLE

REV. 8/04

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

SOUTHERN U.S.

ATTN: ALAN BAILEY
HOWCO METALS MANAGEMENT LP
9611 TELGE RD
HOUSTON, TX 77095

HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

CERTIFIED MATERIAL TEST REPORT No. 01056

HA ORDER NO/ITEM	DATE	PAGE	OF
100022716 1	04/25/05	4	5

QUANTITY	INSPECTED BY
4425 LBS	HA/SMC

CHARGE ORDER NO.	MARK ORDER NO.
HOU-30431-02	HOU-30431-02

DESCRIPTION OF MATERIAL SHIPPED: INCONEL ALLOY 725 HOT FIN END ROUGH T SOL.ANN.& AGE RD
6.5000 IN 216-288 IN RDM

THIS IS TO CERTIFY THAT ALL REQUIRED SAMPLINGS INSPECTIONS AND TESTS HAVE BEEN PERFORMED IN ACCORDANCE WITH THE ORDER AND SPECIFICATIONS REFERENCED. THE TEST REPORT REPRESENTS THE ACTUAL ATTRIBUTES OF THE MATERIAL FURNISHED AND THE VALUES SHOWN ARE CORRECT AND THIS THE MATERIAL DESCRIBED BY THIS CERTIFICATE IS IN FULL COMPLIANCE WITH ALL ORDER AND INSPECTION REQUIREMENTS. WE HEREBY CERTIFY THAT THE BELOW FIGURES ARE IN ACCORDANCE WITH THE SPECIFIED CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

SECTION <<III>> HEAT/LOT:HT0613LY16

6. SURFACE FINISH CALIBRATION STANDARD: NO SMOOTHER THAN MATERIAL
   SURFACE FINISH MATERIAL: LESS THAN 250 RHR
7. ULTRASONIC EVALUATION OF WALL THICKNESS:N/A
8. INSPECTED MATERIAL ACCEPTED:YES
   NO REPORTABLE INDICATIONS
9. REMARKS:
   TRANSDUCER S/N L0865, MODEL- IPM, GAIN 37.8 DB
10. PITCH DATA:PITCH VALUE: 0.2000 IN

HEAT TREATMENT FURNANCES ARE CALIBRATED TO AMS 2750, AS REQUIRED BY MIL-H-6875.

NO WELD REPAIR HAS BEEN PERFORMED ON THIS MATERIAL.

ACTUAL HOT WORKING REDUCTION RATIO: 9:1

QUALIFICATION TEST COUPON WAS A PROLONGATION CUT FROM PRODUCTION MATERIAL AFTER HEAT TREATMENT.
HEAT TREAT FURNANCE WAS MONITORED BY HEAT SINK THERMOCOUPLES.
HEAT SINK REQUIREMENTS OF API 6A INCLUDING EQUIVALENT ROUND WERE SATISFIED,
FOR ALL PRODUCTS 3/4" DIA & OVER, TENSILE TEST SPECIMENS WERE .500 GA. DIA. X 2" GA. LENGTH STANDARD
ASTM E8 SPECIMENS.

CHEMISTRY IS REPORTED FROM REMELTED INGOT.

MATERIAL HEAT TREAT: SOL ANN 1900 DEG. F. FOR 2 HOURS, AIR COOLED.

AGED:HEATED 6 HOURS AND 32 MINUTES AT 1350 DEG F FURNACE COOLED 100 DEG F PER HOUR TO 1150 DEG F
AND HELD AT 1150 DEG F FOR 5 HOURS, AND 33 MINUTES, AIR COOLED.
TOTAL AGING TIME 13 HOURS AND 6 MINUTES.

HEAT TREAT CHARTS ATTACHED.

TOTAL OF ALL CHEMICAL ELEMENTS NOT REPORTED IS CONSIDERED RESIDUAL, AND DOES NOT EXCEED 0.50%.

REV. 6/04

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

CERTIFIED MATERIAL TEST REPORT No. 01055

SOUTHERN U.S.
ATTN: ALAN BAILEY
HOWCO METALS MANAGEMENT LP
9611 TELGE RD
HOUSTON, TX 77095

HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

HA ORDER NO./ITEM	100022718 1
DATE	04/25/05
PAGE	5 OF 5
QUANTITY	4425 LBS
INSPECTED BY	HA/SMC
CHARGE ORDER NO.	HOU-30431-02
MARK ORDER NO.	HOU-30431-02
DESCRIPTION OF MATERIAL SHIPPED	INCONEL ALLOY 725. HOT FIN RND. ROUGH T SOL ANN & AGE HD 6.5000 IN 216-286 IN RDM

THIS IS TO CERTIFY THAT ALL REQUIRED EXAMINATIONS AND TESTING HAVE BEEN PERFORMED IN ACCORDANCE WITH THIS ORDER AND SPECIFICATION REQUIREMENTS. THE TEST REPORT REPRESENTS THE ACTUAL ESTIMATES CONCERNING THE MATERIAL FURNISHED AND THE VALUES SHOWN ARE CORRECT AND TRUNCATED. THE MATERIAL DESCRIBED BY THIS CERTIFICATE IS IN FULL COMPLIANCE WITH ALL ORDER AND INSPECTION REQUIREMENTS. THE MEMORY CLAUSE THAT IS BELOW PROVES JOINT IN ACCORDANCE WITH THE SPECIFIED CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

CALCUIN AND MAGNESIUM WERE INTENTIONALLY ADDED.

ASME QUALITY SYSTEMS CERTIFICATE QSC-328-1 EXPIRES 3/25/2008, AND AS APPLICABLE, ASME QUALITY SYSTEMS CERTIFICATE QSC-328-3. EXPIRES 3/25/2008.

ANY SUBCONTRACTED WORK ALSO COMPLIES WITH CUSTOMER & ASME SECTION III, NCA 3800 REQUIREMENTS.

THIS CERTIFICATION AFFIRMS THAT THE CONTENTS OF THIS REPORT ARE CORRECT AND ACCURATE AND THAT ALL TEST RESULTS AND OPERATIONS PERFORMED BY INCO ALLOYS INTERNATIONAL, INC. OR ITS SUBCONTRACTORS ARE IN COMPLIANCE WITH THE MATERIAL SPECIFICATIONS AND THE SPECIFIC APPLICABLE MATERIAL REQUIREMENTS OF ASME SECTION III.

VISUAL AND DIMENSIONAL EXAMINATION SATISFACTORY.

MATERIAL, WHEN SHIPPED, IS FREE FROM CONTAMINATION BY MERCURY, RADIUM, ALPHA SOURCE, & LOW MELTING ELEMENT.

"CHEMICAL ANALYSIS AS REQUIRED FOR CARBON, SULFUR, NITROGEN OR OXYGEN IS PERFORMED BY COMBUSTION TECHNIQUES. ALL OTHER REPORTED ELEMENTS ARE ANALYZED BY X-RAY AND/OR EMISSION SPECTROSCOPY."

AUTHORIZED QUALITY CERTIFICATION REPRESENTATIVES :
W.E. BOLEN, P.D. CUSTER, M.A. MORRISON, D.L. SMITH, P.P. WAUGH

Borza Inspections Ltd.
140 Portage Close
Sherwood Park, Alberta T8H 2W2
Business: (780) 416-0999 / Fax: (780) 416-0966
24 Hour Service

U108672

ISO 9001:2000
REGISTERED (Alberta)

Ultrasonic Inspection Report

Customer: Masterflo Valve Inc.
4910 - 74 Avenue
Edmonton, Alberta
T6B 2H6

Report Notes:
Test Method: QAS-03-007, rev.C
Acceptance Standard:
QAS-03-007, rev.C / API 6A, 19th Ed. PSL-3
Location: Borza shop - Sherwood Park, AB

Date: 12/17/2007 Invoice No.:
P.O. Number: 165752 Job Number: 1016593

Technique Details

BI Procedure # : UT-7, rev.0

Ultrasonic Instrument: Manufacturer: Panametrics Type : Epoch 4
Serial Number: 050300702 Last Calibration Date: 10/01/2007
Manufacturer: Sonotech Type : UT-X

Surface Condition: ✓ Clean Bare Metal As Ground Machined Sand Blasted Painted Loose Scale Removed

Calibration Blocks: IIW s/n 15816 / ASTM FBH s/n BI-001

Item	Scan Type (Degree)	Probe Type	Frequency (MHz)	Crystal Size	Primary Reference Response (dB) (%)	Scanning Sensitivity (dB)	Range Calibration
1	0	single	2.25 MHz	25.4mm	24.8dB 80% FBH	+12 db	500mm

Items Examined

Test Description:
Ultrasonic volumetric testing was performed on the following on the entire volume, as far as practical.

Item Examined	Serial Number	Rig Number	Company #	Part Number	Heat Number
Qty 1 - Bar stock, 6.50" OD x 134.50" OAL, 725 Inconel material (tag: w/o 1016593)				81319-14-0650 .0	0613LY16

Test Results:
No relevant indications were detected at time of test.

Q.C. APPROVED
BY [signature] DATE 12/18/07

PO 165752
WO 1016593.
PN 81319-14-06500.
HT 0613L416.
SN

SIGNATURES
Client Representative Tom Zinyk
Technician (Sign) [signature]
Technician (Print) Murray Nethery#9638 CGSB Level II SNT-TC-1A Level III
Assistant (Print)
* Client Representative's Signature indicates acceptance of report and results.

NORTECH ADVANCED NDT LTD.

L-030353

160 Portage Close, Sherwood Park, Alberta, T8H 2W2
Phone: 780-449-5013 Fax: 780-449-5036
www.nortechadvanced.com

Liquid Penetrant Examination Report

Client: Penn United Technologies Inc.	Date: 29-Jul-2010	WO #:	
Box 399	Location: Nortech Advanced Sherwood Park	Job #:	NORTECH NS10-0760
Saxonburg, PA, USA 16056	Project:	PO #:	162794
		Invoice #:	

TECHNIQUE DETAILS

Examination Type: Liquid Penetrant Examination, Fluorescent, Water-washable

Test Method: QAS-03-008 REV. J 06/10 Accept Std: API 6A 19th ED. PSL 3/QAS-03-008 REV. J 06/10 Procedure #: PTP-01 Type I Method A Rev.1, Mar. 24, 2010

Equipment Used:

Manufacturer: Spectroline Type: SB-100 Serial #: 1715755 Last Calibration: 15-Apr-2010

Materials Consumed:

Manufacturer: MAGANFLUX	Type: ZL 60D	Batch: 10B104	Dwell Time: 20 Minutes
Manufacturer: MAGANFLUX	Type: ZP 9F	Batch: 09E08K	Dwell Time: 20 Minutes
Manufacturer: MAGANFLUX	Type: SKC-S	Batch: 10C01K	Dwell Time:
Manufacturer:	Type: H2O	Batch:	Dwell Time:
Manufacturer: NLS(PRODUCTS)	Type: FLUID FILM	Batch: 0C07282	Dwell Time:

Surface Condition x Clean/Bare ___ As Ground x Machined ___ Sandblasted ___ Painted ___ Welded ___ Scale Rmvd

Source of Light ___ Halogen 250W ___ Incandescent 100W x Maglight 6 Volt 21.2°C Surface Temp

Examination Results & Comments

FLUORESCENT WATER WASHABLE LIQUID PENETRANT EXAMINATION WAS PERFORMED ON ALL ACCESSIBLE SURFACES OF THE FOLLOWING:

Description: 5) P35-15K FLOW RING

Part Description	WO ID	Serial #	Work Order	Heat #	Part #	Material Type
P35-15K FLOW RING	NOT APPLICABLE	191385 LN2-1	W1015961/1	HT0613LY16	23290-250-02 REV.E	(COLLAR) INCONEL 725/ (INSERT/ WEAR RING) TC
P35-15K FLOW RING	NOT APPLICABLE	191385 LN2-2	W1015981/1	HT0613LY16	23290-250-02 REV.E	(COLLAR) INCONEL 725/ (INSERT/ WEAR RING) TC
P35-15K FLOW RING	NOT APPLICABLE	191385 LN2-3	W1015981/1	HT0613LY16	23290-250-02 REV.E	(COLLAR) INCONEL 725/ (INSERT/ WEAR RING) TC
P35-15K FLOW RING	NOT APPLICABLE	191385 LN2-4	W1015981/1	HT0613LY16	23290-250-02 REV.E	(COLLAR) INCONEL 725/ (INSERT/ WEAR RING) TC

Q.C. APPROVED PO 162794 WO PN 23290-250-02 HT 11 0613LY16 SN 191385-LN2-1 thru 4
DATE 8/6/10

NORTECH ADVANCED NDT LTD.

P35-15K FLOW RING	NOT APPLICABLE	191385 LN2-5	W1015981/1	HT0613LY16	23290-250-02 REV.E	(COLLAR) INCONEL 725/ (INSERT/ WEAR RING) TC

NO RELEVANT INDICATIONS WERE DETECTED AT TIME OF EXAMINATION IN COMPLIANCE WITH QAS-03-008 REV. J 06/10 AND API 6A PSL 3.

POST EXAMINATION CLEANING APPLICABLE

Signatures

Technician (Sign): _____

Technician:	Carreiro, Mike	CGSB Lvl:	CGSB Reg:	SNT-TC-1A Lvl: II
Assistant:		CGSB Lvl:	CGSB Reg:	SNT-TC-1A Lvl:

Client Signature

Client Representative: Michael Hite _____

Client Representative: Michael Day _____

*Client Representative's Signature indicates acceptance of reports and results. Nortech Advanced NDT Ltd. is liable for examination costs only.

MASTER FLO

PSL 3 HARDNESS TEST RECORD

P/N: 23290-250-02	PART DESCRIPTION: Flow Ring 135-154		
W.O. 1027143	DS# —	P.O. 191385	

	MATERIAL / E.S.	TOLERANCE
1	INCONEL 725	MIN 32 - MAX 40 HRC
2		MIN MAX

EQUIPMENT USED	VERSITRON	STARRETT	KING	KING	KING
SERIAL NUMBER	7240	6791	VS-49	VS-34	UG-53

SERIAL NUMBER	HEAT #	RESULT HRC	NOTES
191385-2-1	HT0613L416	36	
2		36	
3		34	
4		37	
191385-2-5	HT0613L416	35	

Q.C. APPROVED
BY NS DATE 3/8/10

PO 191385
WO ~~23290-250-02~~ 1027143
PN 23290-250-02
HT HT0613L416
SN 191385-2-1 to 5

COMPLETED BY NS

DATE 3/8/10

PAGE 1 OF 1

BALANCE SLEEVE

BALANCE SLEEVE

FORONI S.p.A.

21055 Gorla Minore (VA)
Italia

Brand

CERTIFIED MATERIAL TEST REPORT

Inspection certificate EN 10204-3.1

Cert. n° 2008/1764
Rev. 0
Date 9/10/2008

Customer FORONI METALS OF TEXAS,INC.
Material: UNS S39277; AF.918 Gr.2.

Order n°: 08 056 + Order confirmation
Item: 2
Delivery condition: Forged, solution annealed and peeled.

Specifications: 918-TDS Rev.1; ASTM A182-08a*, A479-06a; ASME/07 SA182*, SA479; NACE MR0175/ISO 15156-3:2003/Cor.1:2005/Cor.2:2005/Cir.1:2007. (*Chemical and mechanical properties only)

AOD / VIDP n° 04684
VAR / ESR n°
Steel making process: E.A.F./A.O.D.

Heat Treatment: **Lot n°:** **CTT n°:**
- Solution annealing at 2048°F x 30'/inch - W.Q..
- Furnace calibration in accordance with AMS-H-6875A.

Description: R.P. Bars
Size 5,25 inches
Length inches
N° of pieces 8
Weight 12070 Lbs
Bar identification: 19 to 26
Forging ratio: 16,5

Chemical analysis

% w	Heat	Product
C	0,017	0,017
MN	0,50	0,49
SI	0,50	0,49
CR	25,57	25,54
NI	7,06	7,00
MO	3,85	3,82
S	0,0003	0,0003
P	0,0210	0,0210
CU	1,61	1,56
AL	0,009	0,008
N	0,259	0,260
W	0,90	0,93
FE	Bal.	Bal.
PRE	42,42	42,31
[2] PREN	43,90	43,84

Mechanical properties

	Type		Test n°	7096	7096
Tensile properties				[1] See remarks	[1] See remarks
	Position			M.R.	
	Direction			LNG	
	Temperature	°F		68	
	Y.S. 0,2%	Ksi		87,6	
	Y.S. 1%	Ksi			
	U.T.S.	Ksi		118,6	
	Elongation	%	4D	42,1	
	Red. of Area	%		71,5	
	Hardness	HB			
		HRC		20	
	as delivered	HRC		20 to 22	
Impact properties	Position			M.R.	M.R.
	Direction			LNG	LNG
	Temperature	°F		14	-50
	Charpy A	Ft.Lbs		111	36
				84	37
				97	38
	Lateral expansion	inches		0,055	0,018
				0,044	0,019
				0,053	0,020
	Shear	%		78	43
				63	43
				70	44
Stress-rupt.	Temperature	°F			
	Load	Ksi			
	Load Increm.				
	Duration	hours			
	Elongation	%			

Other properties

	Specification:	Description:	Results:
Grain size to	ASTM E112-96	Comparison method	5
Ferrite content		Fischer ferritoscope	54 %
Corrosion test to	ASTM G48-03 Method A	(50°C - 24 hrs)	Passed
Macro examination			
Microstructure test			
Inclusional content			
UT to	API 6A 19th Ed.	PSL3 (Par. 7.4.2.3.15)	Passed
Visual check			Passed
Dimensional check			Passed
P.M.I. check			Passed
Fatigue testing			

PO 180263
WO
PN 23290-431-02
HT 04634
SN 186268-1-1 to 12

Remarks: ***Material not intended for use in aerospace/aircraft applications.***
- [1] Mechanical testing performed from bar prolongation; tensile test on standard 0,500 inch diameter specimen.
- [2] PREN (according to NACE MR0175/ISO 15156-3)= Cr+3,3(Mo+½W)+16N.

MTR APPROVED
BY
DATE 12/4/09

Material made in Italy. ***No welds, no mercury and radioactive contamination.***

The material is in compliance with the mentioned specifications. Material produced according to the Quality System described in the FORONI S.p.A. MSQ Manual.

Quality System Manual	S.C.Q. Department	R.S.Q. Inspector
MSQ Ed. 2003 Rev. 0	M.Gallina M. Gallina	C.Malara

Mod. 48 Rev. 7

NORTECH ADVANCED NDT LTD.
160 Portage Close
Sherwood Park, Alberta T8H 2W2

ULTRASONIC EXAMINATION REPORT

FIELD REPORT NUMBER U - Nº 000448

Page: 1 of 1

Date: OCTOBER 29, 2009

Client: SPIRIT MACHINE

P.O. #: 186240-MF

Job #:

Location: EDMONTON, AB

ITEM EXAMINED AS LISTED BELOW

TEST METHOD ASME VART 23 | QAS-03-007 REV G.

ACCEPTANCE STANDARD QAS-03-007 REV G | API 6A 19TH ED PSL 3

TECHNIQUE DETAILS

1. PROCEDURE NO. UTP-04 REV.0
2. ULTRASONIC INSTRUMENT
   - Manufacturer: PANAMETRICS — Type: A104S # 677295 / C106 # 676894
   - Manufacturer: ↓ — Type: 6' BNC TO BNC / BNC TO MICRODOT
   - Manufacturer: ↓ — Type: EPOCH XT
   - Serial No.: 091276307 — Last Calibration: 7/21/2009
3. COUPLANT: SONOTECH UT-X
4. SURFACE CONDITION: ✓ Clean Bare Metal ___ As Ground ✓ Machined ___ Sandblasted ___ Painted ___ Loose Scale Removed
5. CALIBRATION BLOCK (S): MINI IIW # M292 / ASTM FBH # 225-19, 24, 26

SCAN TYPE (degree)	PROBE	SIZE (mm)	FREQUENCY (MHz)	PRIMARY RESPONSE (%)	RANGE (mm)	SCAN (dB)
0	Single	12.7	2.25	11.0 @ 80% FBH	250	+18
	↓		↓			↓
0	↓	25.4	↓	13.0 @ 80% FBH	500	↓

EXAMINATION RESULTS & COMMENTS

ULTRASONIC VOLUMETRIC EXAMINATION PERFORMED ON 100% OF THE FOLLOWING:

MAT TEMP: 20.6 °C

5) 2.5" Ø x 18.625" 17-4 MATERIAL BAR STOCK HT# 331920
3) 2.5" Ø x 14.5" 17-4 MATERIAL BAR STOCK HT# 238679
12) 5.3" Ø x 3.35" SUPER DUPLEX MAT. BAR STOCK HT# 04660H
2) 6.25" Ø x 2.675" INC. 625 MAT. BAR STOCK HT# 320846
1) 5.0" Ø x 8.20" INC. 718 MAT. BAR STOCK HT# LT 1947 EY 11/11
2) 4.75" Ø x 7.750" 17-4 MAT. BAR STOCK HT# 331874
1) 5.030" Ø x 8.650" 17-4 MAT. BAR STOCK HT# 42107

RESULTS: NO REJECTABLE REFLECTORS @ TIME OF EXAMINATION.

SIGNATURES

CLIENT REPRESENTATIVE*

TECHNICIAN (SIGN) — CGSB LEVEL 2 — CGSB REG # 12290 — SNT-TC-1A LEVEL 2

TECHNICIAN (PRINT) K. KROKER

ASSISTANT (PRINT) J. BORRA

* Clients Representative's Signature indicates acceptance and results. Nortech Advanced NDT Ltd. is liable for examination costs only.

Job #

Borza Inspections Ltd.
140 Portage Close
Sherwood Park, Alberta T8H 2W2
Business: (780) 416-0999 / Fax: (780) 416-0966
24 Hour Service

P506650

ISO 9001:2000
REGISTERED (Alberta)

Nondestructive Inspection Report

Customer: **Spirit Machining Ltd.**
2228 - 80 Avenue
Edmonton, AB
T6P 1N2

Report Notes:
Test Technique: **PT-1**
Test Method: **QAS-03-008**
Acceptance Standard: **QAS-03-008 REV. G**
API 6A PSL 3
Location: **CORRPRO NDT**

Date: **12/09/2009** Invoice No.:
P.O. Number: **186268-MF** Job Number:

Items Examined

Test Description:
VISIBLE WATER WASHABLE LIQUID PENETRANT EXAMINATION WAS PERFORMED ON THE OF THE FOLLOWING:

Item Examined	Serial Number	Rig Number	Company #	Heat Number	Part Number
12) P35 15K BALANCE SLEEVES					23290-431-02
1	186268-01-01			04684	
2	186268-01-02			04684	
3	186268-01-03			04684	
4	186268-01-04			04684	
5	186268-01-05			04684	
6	186268-01-06			04684	
7	186268-01-07			04684	
8	186268-01-08			04684	
9	186268-01-09			04684	
10	186268-01-10			04684	
11	186268-01-11			04684	
12	186268-01-12			04684	

Test Results:
NO RELEVANT INDICATIONS WERE DETECTED @ TIME OF EXAMINATION.

THE ABOVE TESTED ITEMS ARE ACCEPTED TO THE MASTERFLO QAS-03-008 REV. G COMPLIANCE STANDARD.

Comments
BI JOB# S09-1769

MATERIAL: DUPLEX

Borza Inspections Ltd.
140 Portage Close
Sherwood Park, Alberta T8H 2W2
Business: (780) 416-0999 / Fax: (780) 416-0966
24 Hour Service

P506650

ISO 9001:2000
REGISTERED (Alberta)

Nondestructive Inspection Report

SURFACE CONDITION: CLEAN BARE METAL/MACHINED
CLEANER: MAGNAFLUX SKC-S BATCH# 08H05K(POST CLEAN)
PENETRANT: MAGNAFLUX SKL-WP1 BATCH# 08J13K(DWELL TIME 20MIN)
WASH: H20
DEVELOPER: MAGNAFLUX SKD-S2 BATCH# 07C03K(DWELL TIME 10MIN)
INFRARED DIGITAL THERMOMETER: POWER FIST(SER# C0805003406)
AVERAGE SURFACE TEMPERATURE @ TIME OF INSPECTION IS(19.0)DEGREES CELSIUS

SIGNATURES
Client Representative: **DAVE**
Technician (Sign) _____
Technician (Print) **JOHN HERMANUTZ** CGSB Level SNT-TC-1A Level **II**
Assistant (Print) **MATT QUAALE**
* Client Representative's Signature indicates acceptance of report and results.

MASTER FLO™

PSL 3 HARDNESS TEST RECORD

P/N: 23290-431-02	PART DESCRIPTION: BAL SLV P35-15K	
W.O. —	DS# —	P.O. 186268

	MATERIAL / E.S.	TOLERANCE
1	UNS S 39277	MIN 93 HRB MAX 31 HRC
2		MIN MAX

EQUIPMENT USED	VERSITRON	STARRETT	KING	KING	KING
SERIAL NUMBER	7240	6791	VS-49	VS-34	UG-53

SERIAL NUMBER	HEAT #	RESULT HRC	NOTES
186268-1-1	04684	26	
2		27	
3		26	
4		27	
5		27	
6		27	
7		26	
8		28	
9		26	
10		25	
11		26	
12	04684	25 HRC	PO 186268
13			WO —
14			PN 23290-431-02
15			HT
			SN 186268-1

Q.C. APPROVED
BY NS/ulbrich DATE 14/12/09

COMPLETED BY NS/ulbrich DATE 14/12/09 PAGE 1 OF 1

Main Seal

MAIN SEAL

Test Certificate

HOWCO GROUP
HOWCO METALS MANAGEMENT
Carbrook Street
Sheffield S9 2JN
Telephone: +44 114 244 6711
Facsimile: +44 114 244 7469

Cert No. 862242

To:
HOWCO METALS MANAGEMENT
C/O JO GOODING,
9611 TELGE ROAD,
HOUSTON,
TEXAS,
U.S.A

Customer Order Number	7579 - 01	Test Number	336627
Customer Order Date	18Feb10	Part Number	81242-002 REV F.
Sales Order Number	EUR-293231-1	Cast Number	C66C-1
Report Date	22Apr10	Cert Number	EUR-212983
Quantity	20 Pcs 151 Kgs 8.43"OD X 5.75"ID X 1.8800"		
Description ALLOY 718 RINGS SOL ANN AGED & TURN		Steel Type	718

PO 189339
WO —
PN 81242-002
HT C66C-1
SN —

Results quoted only refer to the items tested.

Material Specification	ES-02-011-003REVC		
Heat Treatment Spec		Test Spec	Test Spec
Melt Practice	VIM/VAR	Production Method	INGOT

Heat Treatment	Temp(°C)	Soak	Coolant	Charge Ref	Quenchant(°C)
SOLUTION TREAT	1035	2 HRS	WATER QUENCH	SHF-138607	Initial 16 Max 30
AGE HARDEN	775	7 HRS	TABLE COOL	SHF-138607	

Temp recorded using	CONTACT THERMOCOUPLE					
Nature of T/P	Sacrificial					
Q/c size	8.875Inch OD X 5.375Inch ID					
	Req. Min/Max			Achieved		
Hardness on T/P	298	363	HBW	321	321	HBW
Hardness on Material	298	363	HBW	321	321	HBW

Tensile

Location	Direction	Rp 0.20%	Rm	A%	Z%
MID WALL	LONGITUDINAL	130 to 145	150 Min	20 Min (4d)	35 Min
Results (KSI)		130	151	24 (25.0)	44.0 (6.26)
Results					

Impacts

Location	Direction	CVN	Lat. Exp. (Inch)	% Shear
MID WALL	LONGITUDINAL	41/47 Min/Min Ave	0.015 Min	0
Results (Joules)	-60 Centigrade	90 96 99	.041 .044 .045	100 100 100
Results				

½MTR APPROVED
BY CHRIS DATE 05/11/10

Corrosion				
Pitting Resistance		Ferrite	Microstructure	
Carbon Equivalent		Grain Size	Min	Max

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Ti	NbTa	Co
0.0180	0.0100	0.0500	0.0030	0.0006	17.9500	2.9500	53.7100	0.5600	0.0300	0.9300	4.9740	0.0800

CERTS TO BS EN 10204:2004.3.2, LLOYDS APPLIES
MS-000-05-002 REV C, QAS-04-014 REV O

TOTAL RED RATIO = 91.88:1

HOWCO METALS MANAGEMENT
Mill Certificate Verified
APR 27 2010
Quality Assurance Dept.
LROA REG. No. 8622A2

Third party inspection :
WITNESSED / REVIEWED
Lloyd's Register
22/4/10

Signature

Names of Approved Signatories : S.Maxted G.Smith S.Suter
This report is not to be reproduced without written approval.

HOWCO METALS MANAGEMENT
CERTIFIED TRUE COPY
HEAT No. C66C-1 SO No. 37498
P.O. No. 189339
AUTH SIGNATORY DATE May 10 10
FOR HOWCO METALS MANGEMENT PAGE 1 OF 7

Special Testing Works Ltd
Bacon Lane, Sheffield S9 3NH
Tel: 0114 244 1061
Fax: 0114 244 0444 Works
Fax: 0114 244 5566 Acc/Admin
www.specialtesting.co.uk
0046

Test Certificate 89434A

Supercedes Test Certificate 89434

ROLLS ROYCE APPROVED LABORATORY
Approval No. 11191

CUSTOMER
SPECIAL QUALITY ALLOYS LIMITED.,
BESSEMER ROAD,
ATTERCLIFFE,
SHEFFIELD. S9 3XN
DATE RECEIVED 06 February 2008
TEST DATE 11 February 2008

CUSTOMER ORDER NO	H112938 032079/002 (1)	TEST NUMBER	89434	IDENTITY	4837A/0707	CAST	D24J-2	ALL REQUIREMENTS MIN UNLESS STATED		
SPECIFICATION	API 6A 718 1st EDITION + ERRATA					SIZE OF TEST PIECE		159mm Dia x 150mm Long		

TENSILE: ASTM A370 2007a						0.2% PROOF	UTS			ELONG ON %	R OF A %	COMMENTS
O	TEMP	SECTION	AREA SQ	UNIT	REQUIREMENTS	120000 - 145000	150000			20	35	
L	RT	12.73mm	127.28mm²	PSI	RESULTS	136000 ✓	180000 ✓			50.8mm 27.0 ✓	45.0 ✓	

IMPACT: ASTM E23 2007a	O	TEMP ✓	SECTION	NOTCH	UNIT	REQUIREMENTS	SINGLE 41 AVE 47			LAT EXPANSION MM			SHEAR %			
CHARPY	T	-60°C	10 X 10 MM	2MM V	JOULES	RESULTS	58	60	61	0.48	0.60	0.49	100	100	100	

CHARPY NOMINAL VALUE 300J

HARDNESS: ASTM E18 2005	DESIGNATION	REQUIREMENTS	RESULTS	
ROCKWELL C	HRc	32 - 40	36 ✓	36

WITNESS	David Thompson			
CONTROL NUMBER	COV0817092			
AUTHORITY	Lloyds			

WITNESSED / REVIEWED

Asset Management
Coventry
Lloyd's Register
EMEA
DN Thompson
12/2/08

Lloyd's Register

CUSTOMER ORDER N° AMENDMENT.

END OF CERTIFICATE

MTR APPROVED
1/18
BY SH DATE 02/14/08

PO 167032 L 2
WO —
PN 81248-003
MAT D24J-2
QTY

BEAN SEAL

REPRESENTING

No copy is authentic without the embossed seal and signature

For and on behalf of
SPECIAL TESTING WORKS LTD
A Member of the Special Steel Group of Companies

Jon Atkinson
Senior Technician

Test results do not in any way confer approval of the quality of manufacture of the material

718 inc 2¼ Ø HT LT3G36EY 11

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

SOUTHERN U.S.

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

ATTN: JODY BRITTAN
HOWCO METALS MANAGEMENT LP
9611 TELGE RD
HOUSTON, TX 77095

HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

CERTIFIED MATERIAL TEST REPORT No. 68418

HA ORDER NO./ITEM	DATE	PAGE	OF
300017375 1	09/22/08	1	8
QUANTITY	INSPECTED BY		
5030 LBS	HA/SMC		
CHARGE ORDER NO.	MARK ORDER NO.		
HOU-601547-01	HOU-601547-01		

DESCRIPTION OF MATERIAL SHIPPED: INCONEL ALLOY 718 HOT FIN RND ROUGH GRD OR ROUGH T SOL ANN & AGE HD
2.2500 IN 216-288 IN NOM

THIS IS TO CERTIFY THAT ALL REQUIRED SAMPLINGS INSPECTIONS AND TESTS HAVE BEEN PERFORMED IN ACCORDANCE WITH THE ORDER AND SPECIFICATION REQUIREMENTS. THE TEST REPORT REPRESENTS THE ACTUAL ATTRIBUTES OF THE MATERIAL FURNISHED AND THE VALUES SHOWN ARE CORRECT AND TRUE. AS ORDER AND INSPECTION REQUIREMENTS WE HEREBY CERTIFY THAT ARE BELOW FIGURES ARE IN COMPLIANCE WITH THE SPECIFIED CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

**********THIS REPORT RELATES ONLY TO THE ITEM(S) TESTED AND MAY NOT BE REPRODUCED EXCEPT IN FULL.**********

SPECIFICATIONS: HOWCO PURCHASE SPECIFICATION HC 718 BAR REV 5 (GRADE 125)\
SMC HA 79 REV 7 (GRADE 125)\
NACE MR0175-ISO 15156-3 1ST EDITION\
API 6A718 1ST EDITION (MAR 2004)\SMC QCP 285 REV 2\
SMC QCP 352 REV 1.\
QUALITY SYSTEM CERTIFICATION: ISO 9001:2000 (ABS-QE CERT. 30125);
EN 10 204/DIN 50049 (TYPE 3.1)

UNS:N07718

PO 185206
WO
PN 21309-001
HT LT3G36EY 11
SN 185206-L-1 to 01

CHEMICAL ANALYSIS (WT. %)

HEAT#	C / TI / PB/PPM	MN / MG / SN/PPM	FE / CO / BI/PPM	S / NO / SE/PPM	SI / NB / NB+TA	CU / TA	NI / P	CR / B	AL / CA
LT3G36EY	0.017	0.03	18.16	0.0006	0.06	0.05	53.57	18.39	0.54
	0.99	0.003	0.13	2.99	5.05	0.01	0.007	0.002	
	<0.1	12.2	<0.1	<0.1	5.06				

TO CONVERT PPM TO WT.%, MOVE DECIMAL POINT FOUR PLACES TO THE LEFT.
MELT METHOD: DUVAC (VIM ELECTRODE; VAR INGOT)

MECHANICAL PROPERTIES

HEAT/LOT	QUANTITY	HARDNESS	GRAIN SIZE	YIELD .2%PSI X 100	TENSILE PSI X 100	%ELG 2"	R/A %	DEG F	
LT3G36EY 11 ROOM TEMP-	15 PCS -AS SHIPPED			1335	1792	28.8	41.4	LONG	
HARDNESS -HRC	-AS SHIPPED	37.3							
HARDNESS -HRC	-AS SHIPPED	37.2							
HARDNESS -HRC	-AS SHIPPED	36.3							
HARDNESS -HRC	-AS SHIPPED	38.4							
HARDNESS -HRC	-AS SHIPPED	36.2							

HOWCO METALS MANAGEMENT
Mill Certificate Verified
OCT 28 2008
Quality Assurance Dept.
LROA REG. No. 8622A2

APPROVED
DATE 10/28/08

HOWCO METALS MANAGEMENT
CERTIFIED TRUE COPY
HEAT No. LT3G36EY11 SO No. 350419
P.O. No. 12830
AUTH SIGNATORY CT DATE Sept 9 09
FOR HOWCO METALS MANAGEMENT PAGE OF 14

STEM SEAL

Stem Seal

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

SOUTHERN U.S.

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

ATTN: JODY BRITTAN
HOWCO METALS MANAGEMENT LP
9611 TELGE RD
HOUSTON, TX 77095

HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

CERTIFIED MATERIAL TEST REPORT No. 68418

HA ORDER NO./ITEM	DATE	PAGE	OF
300017375 1	09/22/08	2	8
QUANTITY	INSPECTED BY		
5030 LBS	HA/SMC		
CHARGE ORDER NO.	MARK ORDER NO.		
HOU-601547-01	HOU-601547-01		

DESCRIPTION OF MATERIAL SHIPPED: INCONEL ALLOY 718 HOT FIN RND ROUGH GRD OR ROUGH T SOL ANN & AGE HD
2.2500 IN 216-288 IN NOM

THIS IS TO CERTIFY THAT ALL REQUIRED SAMPLINGS, INSPECTIONS AND TESTS HAVE BEEN PERFORMED IN ACCORDANCE WITH THE ORDER AND SPECIFICATION REQUIREMENTS. THE TEST REPORT REPRESENTS THE ACTUAL ATTRIBUTES OF THE MATERIAL FURNISHED AND THE VALUES SHOWN ARE CORRECT AND TRUE. THE MATERIAL DESCRIBED BY THIS CERTIFICATE IS IN FULL COMPLIANCE WITH ALL ORDER AND INSPECTION REQUIREMENTS. WE HEREBY CERTIFY THAT THE BELOW FIGURES ARE IN ACCORDANCE WITH THE SPECIFIED CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

HARDNESS -HRC	-AS SHIPPED	34.9
HARDNESS -HRC	-AS SHIPPED	37.3
HARDNESS -HRC	-AS SHIPPED	36.0
HARDNESS -HRC	-AS SHIPPED	35.7
HARDNESS -HRC	-AS SHIPPED	36.1
HARDNESS -HRC	-AS SHIPPED	37.0
HARDNESS -HRC	-AS SHIPPED	35.2
HARDNESS -HRC	-AS SHIPPED	36.5
HARDNESS -HRC	-AS SHIPPED	37.3
HARDNESS -HRC	-AS SHIPPED	36.2

HARDNESS-HRC-AS SHIPPED

02 O'CLOCK			06 O'CLOCK		10 O'CLOCK	
OD	MR	CEN	OD	MR	OD	MR
36.6	37.0	37.6	37.1	37.3	37.8	38.0

GRAIN SIZE-AS SHIPPED AGS ASTM NO. 3. (SEE ATTACHED) LONG SUR
NORMAL - LONG

GRAIN SIZE-AS SHIPPED AGS ASTM NO. 3. LONG MR
NORMAL - LONG

GRAIN SIZE-AS SHIPPED AGS ASTM NO. 4. LONG CEN
NORMAL - LONG

IMPACT TEST - KOON-HALL-ADRIAN METALLURGICAL - SEE ATTACHED

YIELD STRENGTH WAS DETERMINED USING A STRESS STRAIN CURVE

MACROETCH GRADED PER ASTM A604 AND RATED AS FOLLOWS:

		HEAD	TOE
CLASS 1	SEVERITY	A	A
CLASS 2	SEVERITY	A	A
CLASS 3	SEVERITY	A	A
CLASS 4	SEVERITY	A	A

HOWCO METALS MANAGEMENT
CERTIFIED TRUE COPY
PAGE 2 OF 14
HT #

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

SOUTHERN U.S. D

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

CERTIFIED MATERIAL TEST REPORT No. 68418

SHIP TO:
ATTN: JODY BRITTAN
HOWCO METALS MANAGEMENT LP
9611 TELGE RD
HOUSTON, TX 77095

SOLD TO:
HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

HA ORDER NO./ITEM: 300017375 1	DATE: 09/22/08	PAGE: 3	OF: 8
QUANTITY: 5030 LBS	INSPECTED BY: HA/SMC		
CHARGE ORDER NO.: HOU-601547-01	MARK ORDER NO.: HOU-601547-01		
DESCRIPTION OF MATERIAL SHIPPED: INCONEL ALLOY 718 2.2500 IN 216-288 IN	HOT FIN RND ROUGH GRD OR ROUGH T SQ, ANN & AGE HD NOM		

THIS IS TO CERTIFY THAT ALL INCOMING SAMPLINGS INSPECTIONS AND TESTS HAVE BEEN PERFORMED IN ACCORDANCE WITH THE ORDER AND SPECIFICATION REQUIREMENTS. THE TEST REPORT REPRESENTS THE ACTUAL ATTRIBUTES OF THE MATERIAL FURNISHED AND THE VALUES SHOWN ARE CORRECT AND TRUE. THE MATERIAL DESCRIBED BY THIS CERTIFICATE IS IN FULL COMPLIANCE WITH ALL ORDER AND INSPECTION REQUIREMENTS. WE HEREBY CERTIFY THAT THE BELOW FIGURES ARE IN ACCORDANCE WITH THE SPECIFIED CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

MICROSTRUCTURE TEST(S):SATISFACTORY (PHOTOS ATTACHED)

FORM H-2245 HUNTINGTON ALLOYS CORPORATION
ULTRASONIC TEST REPORT

FORM H2245 IS COMPOSED OF THREE SECTIONS FOR EACH HEAT/LOT REPORTED.
SECTION I IS PRINTED ONE TIME FOR EACH HEAT AND LOT
SECTION II MAY BE PRINTED MULTIPLE TIMES FOR EACH HEAT AND LOT.
SECTION III IS PRINTED ONE TIME FOR EACH HEAT AND LOT.

SECTION <<I>> HEAT/LOT:LT3G36EY11 MATERIAL TESTED 09/11/08 BY JEFF BERRY
SERIAL #: N/A
PIECE #: N/A

1. IAII IDENTIFICATION: (A) SNT-TC-1A-LEVEL: II
(B) MIL-STD-2132: INSPECTOR

2. TESTED MATERIAL 15 PIECE(S) WERE TESTED PRIOR TO CUT LGTH/WDTH AT FINAL CROSS SECTION
YIELDING 15 PIECE(S) FOR SHIPMENT AFTER CUTTING

3. PROCEDURE
APPROVED PROCEDURE NUMBER, REVISION NUMBER, APPLICABLE SPECIFICATIONS AND/OR CONTRACTUAL REQUIREMENTS WHICH WERE USED FOR THE EXAMINATION ARE FOUND IN THE SPECIFICATION BLOCK AND REMARKS SECTION OF THE MATERIAL TEST REPORT.
QCP #:332 QCP-REV:1 DATED:12/08/03

4. EXAMINATION CONDITIONS:
TEST METHOD: AUTOMATIC IMMERSION
COUPLANT: WATER
SCANNING EQUIPMENT: TUBE, BAR, OR PLATE FOLLOWER STUFFING-BOX , HARD GASKETS AND MANIPULATOR
SCANNING SPEED(INCHES PER SECOND):25

SECTION <<II>> HEAT/LOT:LT3G36EY11 PART:01 OF 02.

5. (A) TEST MODE: LONGITUDINAL
(B) WAVE PROPOGATION: NORMAL

HOWCO METALS MANAGEMENT
CERTIFIED TRUE COPY
PAGE 3 OF 14
HT #

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

SOUTHERN U.S. D

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

ATTN: JODY BRITTAN
HOWCO METALS MANAGEMENT LP
9611 TELGE RD
HOUSTON, TX 77095

HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

CERTIFIED MATERIAL TEST REPORT No. 68418

HA ORDER NO./ITEM	DATE	PAGE	OF
300017375 1	09/22/08	4	8
QUANTITY	INSPECTED BY		
5030 LBS	HA/SMC		
CHARGE ORDER NO.	MARK ORDER NO.		
HOU-601547-01	HOU-601547-01		

DESCRIPTION OF MATERIAL SHIPPED: INCONEL ALLOY 718 HOT FIN RND ROUGH GRD OR ROUGH T SOL ANN & ACE HD
2.2500 IN 216-288 IN NOM

THIS IS TO CERTIFY THAT ALL REQUIRED SAMPLINGS INSPECTIONS AND TESTS HAVE BEEN PERFORMED IN ACCORDANCE WITH THE ORDER AND SPECIFICATION REQUIREMENTS. THE TEST REPORT REPRESENTS THE ACTUAL ATTRIBUTES OF THE MATERIAL FURNISHED AND THE VALUES SHOWN ARE CORRECT AND TRUE. THE MATERIAL DESCRIBED BY THIS CERTIFICATE IS IN FULL COMPLIANCE WITH ALL ORDER AND INSPECTION REQUIREMENTS. WE HEREBY CERTIFY THAT THE BELOW FIGURES ARE IN ACCORDANCE WITH THE SPECIFIED CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

(C) INSTRUMENT MANUFACTURER: SONIC MODEL:237
(D) SERIAL NUMBER: 237-157PAB
(E) LINEARITY CALIBRATION DATE: 07/07/08
(F) SEARCH UNIT MANUFACTURER/SERIAL NUMBER: HARISONIC/E6538
(G) FREQUENCY (MHZ): 5.00
(H) SIZE (INCHES): .500
(I) TYPE: SINGLE FOCUSED CYLINDRICAL
(J) FOCAL LENGTH (IN): 2
(K) CABLE LENGTH (FT): 8
(L) ATTENUATION CORRECTION DB:000
(M) REFERENCE AMPLITUDE: %FS:80
(N) ALARM/EVAL LEVEL %CAL:50 % BR LOSS:50
(O) REJECT: OFF
(P) DISTANCE AMPLITUDE CORRECTION: YES
(Q) AREA GATED:
FRONT SURFACE TO BACK REFLECTION
BACK REFLECTION
(R) CALIBRATION STANDARD(S):
(A) K582
(S) FLAT BOTTOM HOLE(S):
(A) DIAMETER:.1240 TEST METAL DISTANCE:1.523 DEPTH:
(B) DIAMETER:.1240 TEST METAL DISTANCE:1.144 DEPTH:
(C) DIAMETER:.1240 TEST METAL DISTANCE:0.579 DEPTH
(T) NOTCH(ES):
NOT APPLICABLE

SECTION <<II>> HEAT/LOT:LT3G36EY11 PART:02 OF 02.

5. (A) TEST MODE: SHEAR
(B) WAVE PROPOGATION: CIRCUMFERENTIAL ONE-DIRECTION
(C) INSTRUMENT MANUFACTURER: SONIC MODEL:237
(D) SERIAL NUMBER: 237-192PB
(E) LINEARITY CALIBRATION DATE: 07/07/08
(F) SEARCH UNIT MANUFACTURER/SERIAL NUMBER: AEROTECH/000RPB

HOWCO METALS MANAGEMENT
CERTIFIED TRUE COPY
PAGE 4 OF 14
HT #

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

SOUTHERN U.S. D

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

ATTN: JODY BRITTAN
HOWCO METALS MANAGEMENT LP
9611 TELGE RD
HOUSTON, TX 77095

HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

CERTIFIED MATERIAL TEST REPORT No. 68418

HA ORDER NO./ITEM	DATE	PAGE	OF
300017375 1	09/22/08	5	8

QUANTITY	INSPECTED BY
5030 LBS	HA/SMC

CHARGE ORDER NO.	MARK ORDER NO.
HOU-601547-01	HOU-601547-01

DESCRIPTION OF MATERIAL SHIPPED: INCONEL ALLOY 718 HOT FIN RND ROUGH GRD OR ROUGH T SOL ANN & AGE HD 2.2500 IN 216-288 IN NOM

THIS IS TO CERTIFY THAT ALL REQUIRED SAMPLINGS INSPECTIONS AND TESTS HAVE BEEN PERFORMED IN ACCORDANCE WITH THE ORDER AND SPECIFICATION REQUIREMENTS. THE TEST REPORT REPRESENTS THE ACTUAL ATTRIBUTES OF THE MATERIAL FURNISHED AND THE VALUES SHOWN ARE CORRECT AND TRUE. THE MATERIAL DESCRIBED BY THIS CERTIFICATE IS IN FULL COMPLIANCE WITH ALL ORDER AND INSPECTION REQUIREMENTS. WE HEREBY CERTIFY THAT THE BELOW FIGURES ARE IN ACCORDANCE WITH THE SPECIFIED CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

(G) FREQUENCY (MHZ): 5.00
(H) SIZE (INCHES): .750
(I) TYPE: SINGLE FOCUSED CYLINDRICAL
(J) FOCAL LENGTH (IN): 2
(K) CABLE LENGTH (FT): 8
(L) ATTENUATION CORRECTION DB:000
(M) REFERENCE AMPLITUDE: %FS:80
(N) ALARM/EVAL LEVEL %CAL:50
(O) REJECT: OFF
(P) DISTANCE AMPLITUDE CORRECTION: NONE
(Q) AREA GATED:
FRONT SURFACE TO 1.25 NODE TMD
(R) CALIBRATION STANDARD(S):
NOT APPLICABLE
(S) FLAT BOTTOM HOLE(S):
NOT APPLICABLE
(T) NOTCH(ES):
NOT APPLICABLE

SECTION <<III>> HEAT/LOT:LT3G36EY11

6. SURFACE FINISH CALIBRATION STANDARD: NO SMOOTHER THAN MATERIAL SURFACE FINISH MATERIAL: LESS THAN 250 RHR.
7. ULTRASONIC EVALUATION OF WALL THICKNESS:N/A
8. INSPECTED MATERIAL ACCEPTED:YES
REPORTABLE INDICATIONS: NONE
9. REMARKS:
TRANSDUCER S/N-E6538, MODEL-14-0508-T, GAIN-41.6 DB.
TRANSDUCER S/N-000RPB, MODEL-ALPHA, ANGLE-45, GAIN-58.0 DB.
THE ULTRASONIC TESTING PERFORMED IN ACCORDANCE WITH QCP 332 REFERENCED ABOVE AND DETAILED IN THIS REPORT MEETS AND FULLY SATISFIES ALL ULTRASONIC TEST REQUIREMENTS OF QCP 285 REV. 2 AS WELL.
10. PITCH DATA:PITCH VALUE: 0.1875 IN

HOWCO METALS MANAGEMENT
CERTIFIED TRUE COPY
PAGE 5 OF 14
HT #

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMEVT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

SOUTHERN U.S. D

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

ATTN: JODY BRITTAN
HOWCO METALS MANAGEMENT LP
9511 TELGE RD
HOUSTON, TX 77095

HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

CERTIFIED MATERIAL TEST REPORT No. 68418

HA ORDER NO./ITEM	DATE	PAGE	OF
300017375 1	09/22/08	6	8

QUANTITY	INSPECTED BY
5030 LBS	HA/SNC

CHARGE ORDER NO.	MARK ORDER NO.
HOU-601547-01	HOU-601547-01

DESCRIPTION OF MATERIAL SHIPPED: INCONEL ALLOY 718 HOT FIN RND ROUGH GRD OR ROUGH T SOL ANN & AGE HD
2.2500 IN 216-288 IN NOM

THIS IS TO CERTIFY THAT ALL REQUIRED SAMPLING INSPECTIONS AND TESTS HAVE BEEN PERFORMED IN ACCORDANCE WITH THE ORDER AND SPECIFICATION REQUIREMENTS. THE TEST REPORT REPRESENTS THE ACTUAL ATTRIBUTES OF THE MATERIAL FURNISHED AND THE VALUES SHOWN ARE CORRECT AND TRUE. THE MATERIAL DESCRIBED BY THIS CERTIFICATE IS IN FULL COMPLIANCE WITH ALL ORDER AND INSPECTION REQUIREMENTS. WE HEREBY CERTIFY THAT THE BELOW FIGURES ARE IN ACCORDANCE WITH THE SPECIFIED CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

HEAT TREATMENT FURNANCES ARE CALIBRATED TO AMS 2750, AS REQUIRED BY MIL-H-6875.

NO WELD REPAIR HAS BEEN PERFORMED ON THIS MATERIAL.

ACTUAL HOT WORKING REDUCTION RATIO: 79:1
REMELT INGOT SIZE: 20"

QUALIFICATION TEST COUPON WAS A PROLONGATION CUT FROM PRODUCTION MATERIAL AFTER HEAT TREATMENT.
HEAT TREAT FURNANCE WAS MONITORED BY HEAT SINK THERMOCOUPLES.
HEAT SINK REQUIREMENTS OF API 6A INCLUDING EQUIVALENT ROUND WERE SATISFIED.
FOR ALL PRODUCTS 3/4" DIA & OVER, TENSILE TEST SPECIMENS WERE .500 GA. DIA. X 2" GA. LENGTH STANDARD ASTM E8 SPECIMENS.

CHEMISTRY IS REPORTED FROM REMELTED INGOT.

MATERIAL HEAT TREAT: SOL ANN 1885 DEG. F. FOR 1 HOUR AND 5 MINUTES. WATER QUENCHED.
QUENCH TEMP: IN 78 DEG. F.; END 88 DEG. F.

AGED:HEATED 7 HOURS AT 1450 DEG. F. AIR COOLED.
HEAT TREAT CHARTS ATTACHED.

MATERIAL CAPABLE OF MEETING THE LIQUID PENETRANT REQUIREMENTS OF THE ORDER AFTER ADEQUATE SURFACE PREPARATION BY THE CUSTOMER TO PERFORM A VALID TEST.

ULTRASONICALLY TESTED AND ACCEPTABLE TO API 6A CLAUSES 7.4.2.3.15 AND 7.4.2.4.11 AND SATISFACTORY PER IAII QCF 285.

MICROSTRUCTURE SPECIMENS HAVE BEEN REMOVED FROM BAR PROLONGATIONS OBTAINED FROM EVERY HEAT TREAT LOT AFTER FINAL HEAT TREATMENT. A HEAT TREAT LOT CONSIST OF BARS FROM THE SAME REMELT INGOT, OF THE SAME SIZE (EXCEPT LENGTH) AND PROCESSED IN THE SAME FURNACE LOADS FOR BOTH ANNEALING AND AGING.

REV. 6/04

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

SOUTHERN U.S. D

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

ATTN: JODY BRITTAN
HOWCO METALS MANAGEMENT LP
9611 TELGE RD
HOUSTON, TX 77095

HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

CERTIFIED MATERIAL TEST REPORT No. 68418

HA ORDER NO./ITEM	DATE	PAGE	OF
300017375 1	09/22/08	7	8

QUANTITY	INSPECTED BY
5030 LBS	HA/SMC

CHARGE ORDER NO.	MARK ORDER NO.
HOU-601547-01	HOU-601547-01

DESCRIPTION OF MATERIAL SHIPPED: INCONEL ALLOY 718 HOT FIN RND ROUGH GRD OR ROUGH T SOL ANN & AGE HD
2.2500 IN 215-288 IN NOM

THIS IS TO CERTIFY THAT ALL REQUIRED SAMPLING INSPECTIONS AND TESTS HAVE BEEN PERFORMED IN ACCORDANCE WITH THE ORDER AND SPECIFICATION REQUIREMENTS. THE TEST REPORT REPRESENTS THE ACTUAL ATTRIBUTES OF THE MATERIAL FURNISHED AND THE VALUES SHOWN ARE CORRECT AND TRUE. THE MATERIAL DESCRIBED BY THIS CERTIFICATE IS IN FULL COMPLIANCE WITH ALL ORDER AND INSPECTION REQUIREMENTS. WE HEREBY CERTIFY THAT THE BELOW FIGURES ARE IN ACCORDANCE WITH THE SPECIFIED CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

MICROSTRUCTURE SPECIMENS HAVE BEEN EXAMINED FROM LOCATIONS OF BAR PROLONGATION REPRESENTING NEAR SURFACE, MID-RADIUS AND CENTER LOCATIONS AND CONFIRMS:ABSENCE OF TOPOLOGICAL DUPLEX GRAIN SIZE (I.E.CROSS-SECTION CONDITION, NECKLACE CONDITION AND BANDING) PER ASTM E1181; MATERIAL IS FREE FROM LAVES PHASE; MATERIAL IS FREE OF CONTINUOUS GRAIN BOUNDARY NETWORKS OF SECONDARY PHASES (E.G. DELTA PHASE, CARBIDES); ASSESSMENT OF DELTA PHASE CONTENT EQUAL TO OR BETTER THAN LEVEL 2/D2; NO INDIVIDUAL GRAINS FOUND TO BE COMPLETELY SURROUNDED WITH ACICULAR DELTA; INDIVIDUAL OR ISOLATED GRAINS CONTAINING ACICULAR DELTA NOT REPRESENTATIVE OF THE BULK MICROSTRUCTURE IS NOT A CAUSE FOR REJECTION;ISOLATED AREAS NOT REPRESENTATIVE OF THE BULK MICROSTRUCTURE IS NOT A CAUSE FOR REJECTION.

TOTAL OF ALL CHEMICAL ELEMENTS NOT REPORTED IS CONSIDERED RESIDUAL, AND DOES NOT EXCEED. 0.50%.

CALCIUM AND MAGNESIUM WERE INTENTIONALLY ADDED.

COLUMBIUM (CB) EQUALS NIOBIUM (NB).

THE MAXIMUM AND MINIMUM DIAMETERS IN THE HEAT TREAT BATCH ARE WITHIN 2 INCHES.

SMC-HA WAS THE MELTING SOURCE AND TESTING FACILITY.

COUNTRY OF ORIGIN: MELTED AND MANUFACTURED IN THE USA

VISUAL AND DIMENSIONAL EXAMINATION SATISFACTORY.
MATERIAL, WHEN SHIPPED, IS FREE FROM CONTAMINATION BY MERCURY, RADIUM, ALPHA SOURCE, & LOW MELTING ELEMENTS.

"CHEMICAL ANALYSIS AS REQUIRED FOR CARBON,SULFUR,NITROGEN OR OXYGEN IS PERFORMED BY COMBUSTION TECHNIQUES. ALL OTHER REPORTED ELEMENTS ARE ANALYZED BY X-RAY AND/OR EMISSION SPECTROSCOPY."

HOWCO METALS MANAGEMENT
CERTIFIED TRUE COPY
PAGE 7 OF 14
IIT #

REV. 8/04

NOTE: THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTE.

SOUTHERN U.S. D

HUNTINGTON ALLOYS
A Special Metals Company
HUNTINGTON, WEST VIRGINIA 25720

ATTN: JODY BRITTAN
HOWCO METALS MANAGEMENT LP
9611 TELGE RD
HOUSTON, TX 77095

HOWCO METALS MANAGEMENT LP
P O BOX 841329
HOUSTON, TX 77284-1329

CERTIFIED MATERIAL TEST REPORT No. 68418

HA ORDER NO./ITEM	DATE	PAGE	OF
300017375 1	09/22/08	8	8

QUANTITY	INSPECTED BY
5030 LBS	HA/SMC

CHARGE ORDER NO.	MARK ORDER NO.
HOU-601547-01	HOU-601547-01

DESCRIPTION OF MATERIAL SHIPPED: INCONEL ALLOY 718 HOT FIN RND ROUGH GRD OR ROUGH T SOL ANN & AGE HD 2.2500 IN 216-288 IN NOM

THIS IS TO CERTIFY THAT ALL REQUIRED SAMPLINGS INSPECTIONS AND TESTS HAVE BEEN PERFORMED IN ACCORDANCE WITH THE ORDER AND SPECIFICATION REQUIREMENTS. THE TEST REPORT REPRESENTS THE ACTUAL ATTRIBUTES OF THE MATERIAL FURNISHED AND THE VALUES SHOWN ARE CORRECT AND TRUE. THE MATERIAL DESCRIBED BY THIS CERTIFICATE IS IN FULL COMPLIANCE WITH ALL ORDER AND INSPECTION REQUIREMENTS. WE HEREBY CERTIFY THAT THE BELOW FIGURES ARE IN ACCORDANCE WITH THE SPECIFIED CONTRACT REQUIREMENTS.

QUALITY CERTIFICATION REPRESENTATIVE

"QUALITY SYSTEM MEETS REQUIREMENTS OF DIRECTIVE 97/23/EC (PRESSURE EQUIPMENT DIRECTIVE), ANNEX 1, CHAPTER 4.3 PER ABS GROUP LTD CERTIFICATE 41734 (EXPIRES JULY 31, 2011)."

AUTHORIZED QUALITY CERTIFICATION REPRESENTATIVES :
W.E. BOLEN, P.D. CUSTER, M.A. MORRISON, P. WAUGH

HOWCO METALS MANAGEMENT
CERTIFIED TRUE COPY
PAGE 8 OF 14
HT #

ACTUATOR BOLTING

Test Certificate

(Conforms to EN 10204 Type 3.1)

Quality Management System
BS EN ISO 9001:2008
Registration Number FM00356

12/08/2009

Stainless Steel Fasteners Limited
Broombank Road
Chesterfield
S41 9QJ
United Kingdom
Tel: +44 (1246) 451818
Fax: +44 (1246) 455268
email: qa@ssfast.co.uk
web: ssfast.co.uk

Master Flo Valve Inc

Edmonton
Alberta
T6B 2H5 CA

Order Number: S014809 / 2
Customer Order Number: 179869

Cast Number: 061322

Chemical Analysis

C	Si	Mn	P	S	Cr	Mo	Ni	Ti	Cu	Al	Pb
0390	0.150	0.790	0.012	0.024	0.983	0.161	0.038		0.055	0.0132	

Sn	Zn	Mg	Fe	V	W	Co	Nb	Cb+Ta	N

Mechanical Properties

U.T.S (N/mm²)	0.2% Proof (N/mm²)	Elongation (%)	Reduction of Area (%)	Hardness (HB)	Proof Load	Proof Load Value
747	667	22	66	216		

Impact: Values: 75 J, 77 J, 78 J Average: 76.6 J, Temperature: -73 Deg C

Q.C. APPROVED
BY Soni DATE Aug 12, 09

PO 179869.
WO —
PN 01031-006.
HT 'CDE' heat code.
SN —

Representing
P99ZK050X01250CB110OR000
2500 Off 0.500"unc x 1.250"Ferryhead Capscrew to spec ASTM A320 L7M
To Drg 01031-006

Stamped: CDE

S.S.F.
Sign
For Stainless Steel Fasteners Ltd

S014809 / 2
47377592
QCD1 A3/060605
B05284

high nickel alloys stainless

ACTUATOR BOLTING

Test Certificate

(Conforms to EN 10204 Type 3.1)

Quality Management System
BS EN ISO 9001:2008
Registration Number FM00356

16/09/2009

Stainless Steel Fasteners Limited
Broombank Road
Chesterfield
S41 9QJ
United Kingdom

Tel: +44 (1246) 451818
Fax: +44 (1246) 455268
email: qa@ssfast.co.uk
web: ssfast.co.uk

Master Flo Valve Inc

4611-74 Avenue
Edmonton
Alberta
T6B 2H5 CA

Order Number: S016009 / 5
Customer Order Number: 183997

Cast Number: SA63852

Chemical Analysis

C	Si	Mn	P	S	Cr	Mo	Ni	Ti	Cu	Al	Pb
0.398	0.203	0.880	0.011	0.006	1.020	0.190	0.010				

Sn	Zn	Mg	Fe	V	W	Co	Nb	Cb+Ta	N

Mechanical Properties

U.T.S (N/mm²)	0.2% Proof (N/mm²)	Elongation (%)	Reduction of Area (%)	Hardness (HB)	Proof Load	Proof Load Value
741	665	18	68	222		

Impact: Values: 53 J , 50 J , 51 J Average: 51.3 J , Temperature: -73 Deg C

Q.C. APPROVED
BY CHRIS DATE 09/09/10

PO 183997
WO
PN 01031-008
HT CCI
SN

Representing
P99ZK050X01750CB110OR000
600 Off 1/2"unc x 1.3/4"Ferryhead Capscrew to spec ASTM A320 L7M
To Drg 01031 P/No 01031-008

Stamped: CCI

S.S.F.
For Stainless Steel Fasteners Ltd

S016009 / 5
24111137
QCD1 A3/080605
B05403

high nickel alloys stainless steel

NOZZLE

ISO 9001:2000

ACUREN

LIQUID PENETRANT EXAMINATION FORM

P - 070968

PAGE 1 OF 1

CLIENT: MASTER FLO VALVE
ATTENTION: C. NEUFELD
ADDRESS:
PROJECT: WO # 1025923
ITEM(S) EXAMINED: QTY 5, P35-15K NOZZLES

DATE: MAR 12/10
TIME: 12:00 PM
ACUREN JOB NO.: PO# 231-49988-04
PO/WO NO.: PO# 188724 ISSUE 2
WORK LOCATION: ACUREN
ACCEPTANCE STANDARD: API 6A PSL-3 REV./DATE: 19TH ED
PROCEDURE NO: QAS-03-008 REV I REV./DATE: 02/10
TECHNIQUE NO.: QAS-03-008 REV I REV./DATE: 02/10

JOB DESCRIPTION

PART NO.: 23290-243-01
MATERIAL: TUNGSTEN CARBIDE THICKNESS: .375" - .362"
SCOPE: PERFORM FLUORESCENT LIQUID PENETRANT ON 5, P35-15K NOZZLES, EXAMINE ALL ACCESSIBLE SURFACES

TEST DETAILS

METHOD	☒ FLUORESCENT ☐ VISIBLE	☒ WATER WASH ☐ SOLVENT REMOVABLE ☐ POST EMULSIFIED	
FAMILY BRAND	ARDROX	BLACK LIGHT S/N 425560	☒ OUTPUT > 1000 µ W/CM² ☒ AMBIENT < 2 fc
PENETRANT	970 P35E	MINIMUM DWELL TIME 15 MIN.	LIGHTING EQUIP. ☒ FLASHLIGHT ☐ TROUBLELIGHT ☒ OUTPUT>100 fc @ SURFACE
PENETRANT REMOVER	WATER	MINIMUM DRY TIME MAX-30 MIN.	OTHER N/A
DEVELOPER	9DIB	MINIMUM DWELL TIME 10 MIN.	LIGHT METER S/N 409503 CAL DUE DATE 5/4/10
DEVELOPER TYPE	☒ NON AQUEOUS ☐ AQUEOUS ☐ DRY		OTHER N/A

TEST SURFACE

SURFACE CONDITION	☐ AS GROUND	☐ AS WELDED	☒ MACHINED	☐ SHOT BLASTED	☒ CLEAN BARE METAL
SURFACE TEMPERATURE	☐ < -4°C/ 20°F	☐ -4°C/ 20°F TO 10°C/50°F		☒ 10°C/50°F TO 52°C/125°F	☐ > 52°C/125°F

RESULTS

QTY 5 P35-15K NOZZLES 5

RESULTS: QTY OF 5, P35-15K NOZZLES ARE ACCEPTED TO API 6A PSL-3, QAS-03-008 REV I.

04/16/10

Delivery
1:40
MAR 15 2010
By

DRAWING

P/N 23290-243-01 REV B
WO 1002466/1
188654-LN-1-1 THRU 188654-LN-1-5

Q.C. APPROVED
DATE 03/15/10
BY Rev

PO 188724
WO 1025923
PN 23290-243-01
HT —
SN 188724-1-1 TO 5

SIGNATURES

CLIENT REPRESENTATIVE: PRINT _____ SIGNATURE _____ DTR No. _____

TECHNICIAN (SIGN): _____ REPORT REVIEW _____ INITIAL

PRINT NAME: C. MORRIS (1ST TECHNICIAN) _____ (2ND TECHNICIAN)

CGSB LEVEL _____ SNT LEVEL 2 CGSB REG. No _____ CGSB LEVEL _____ SNT LEVEL _____ CGSB REG. No _____

WHITE - CLIENT COPY CANARY - OFFICE COPY PINK - TECHNICIAN COPY GOLD - OFFICE COPY

ACUREN

EDDY CURRENT EXAMINATION FORM — WWB E-1009

CLIENT	MASTER FLO VALVE INC.	DATE	12 MARCH 2010
ATTENTION	CORY NEUFFELD	ACUREN JOB NO.	231-49988-84
ADDRESS	4611-74 AVE	PO/WO NO.	188724 ISSUE 2
	EDMONTON AB, T6B 2H5	WORK LOCATION	ACUREN SHOP
PROJECT		ACCEPTANCE	API 6A, PSL III,
ITEM(S) EXAMINED	WO# 1025923	STANDARD	QAS-03-011 REV A — REV./DATE DEC 15, 1999
	QTY 5 P35 NOZZLES	PROCEDURE NO.	ET-0002 — REV./DATE SEPT 09, 2003
		TECHNIQUE NO.	N/A — REV./DATE N/A

TIME 1200 HRS

JOB DESCRIPTION

PART NO. 23290-243-01 — MATERIAL TUNGSTEN — THICKNESS 0.250 INCH

SCOPE PERFORM A GENERAL EDDY CURRENT SURFACE EXAMINATION ON 5 NOZZLES

TEST DETAILS

INSTRUMENT ZETEC — MODEL MIZ 21A — SERIAL NO. 375 — CALIBRATION DUE DATE 10 MARCH 2011

PROBE NO. 1	ZETEC	S/N 350998	SIZE	0.125"	TYPE	☑ SINGLE	☐ ABSOLUTE	☑ DIFFERENTIAL ☐ REFLECTION
PROBE NO. 2	N/A	S/N N/A	SIZE	N/A	TYPE	☐ SINGLE	☐ ABSOLUTE	☐ DIFFERENTIAL ☐ REFLECTION
REF. STD.	CLIENT PROVIDED		S/N	N/A				

	FREQUENCY 1	FREQUENCY 2	FREQUENCY 3	GAIN	PHASE	THICKNESS	LENGTH	MATERIAL TYPE
1	**200 KHz**	N/A	N/A	**61**	**160**	**0.250 INCH**	N/A	**TUNGSTEN**
2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TEST SURFACE

SURFACE CONDITION ☐ AS GROUND ☐ AS WELDED ☑ MACHINED ☐ SHOT BLASTED ☑ CLEAN BARE METAL

SURFACE TEMPERATURE ☐ < -4°C/ 20°F ☐ -4°C/ 20°F TO 10°C/50°F ☑ 10°C/50°F TO 52°C/125°F ☐ > 52°C/125°F

RESULTS

ITEM	SERIAL NUMBER	ACCEPT	REJECT	ITEM	SERIAL NUMBER	ACCEPT	REJECT
1	188654-LN-1-1	X		11			
2	188654-LN-1-2	X		12			
3	188654-LN-1-3	X		13			
4	188654-LN-1-4	X		14			
5	188654-LN-1-5	X		15			
6							
7							
8							
9							
10							

Q.C. APPROVED
BY Rod DATE 03/15/10

PART I.D.

QTY 5 P35 NOZZLES
P/N 23290-243-01 REV B
W/O 1002466/1
188654 -LN-1-1
188654 -LN-1-2
188654 -LN-1-3
188654 -LN-1-4
188654 -LN-1-5

188724
1025923
23290-243-01
1
188724-1-1 thru 5

THE NOZZLES AS NOTED ABOVE ARE ACCEPTABLE TO QAS 03-011 REV A FOR EDDY CURRENT EAMINATION

SIGNATURES

CLIENT REPRESENTATIVE — PRINT _____ SIGNATURE _____ — DTR NO. A 325994

TECHNICIAN (SIGN) — PRINT _____ SIGNATURE _____ — REPORT REVIEW _____ INITIAL

PRINT NAME — WAYNE BLUETT (1ST TECHNICIAN) — (2ND TECHNICIAN/ASSISTANT)

CGSB LEVEL	1	SNT LEVEL	2	CGSB LEVEL	SNT LEVEL
CGSB REG. NO	872			CGSB REG. NO	

SEAT

NORTECH ADVANCED NDT LTD.

L-030233

160 Portage Close, Sherwood Park, Alberta, T8H 2W2
Phone: 780-449-5013 Fax: 780-449-5036
www.nortechadvanced.com

Liquid Penetrant Examination Report

Client: Penn United Technologies Inc.
Box 399
Saxonburg, PA, USA 16056

Date: 21-Jun-2010
Location: Nortech Inspection Office
Project:

WO #:
Job #:
PO #: 162137
Invoice #:

TECHNIQUE DETAILS

Examination Type: Liquid Penetrant Examination, Fluorescent, Water-washable

Test Method: QAS-03-008 REV. I, 02/10 Accept Std: API 6A 19th ED. PSL 3/QAS-03-008 REV. I, 02/07 Procedure #: PTP-01 Type I Method A Rev.1, Mar. 24, 2010

Equipment Used:

Manufacturer: Spectroline Type: SB-100 Serial #: 1715755 Last Calibration: 15-Apr-2010

Materials Consumed:

Manufacturer: MAGNAFLUX	Type: ZL 60D	Batch: 08C12K	Dwell Time: 20 Minutes	
Manufacturer: MAGNAFLUX	Type: ZP 9F	Batch: 06H09H	Dwell Time: 20 Minutes	
Manufacturer: MAGNAFLUX	Type: SKC-S	Batch: 10B16K	Dwell Time:	
Manufacturer:	Type: H2O	Batch:	Dwell Time:	

Surface Condition: x Clean/Bare ___ As Ground x Machined ___ Sandblasted ___ Painted ___ Welded ___ Scale Rmvd

Source of Light: ___ Halogen 250W ___ Incandescent 100W ___ Maglight 6 Volt 20.3°C Surface Temp

Examination Results & Comments

FLUORESCENT WATER WASHABLE LIQUID PENETRANT EXAMINATION WAS PERFORMED ON TC INSERT ONLY:(AS ACCESSIBLE)

Description: 5) P35-15K SEAT ASSY. MATERIAL THICKNESS RANGE(INCHES): 0.488,0.894,1.006

Part Description	WO ID	Serial #	Work Order	Heat #	Part #	Material Type
P35-15K SEAT		191147 LN1-1	W1013301/1	773562 / 518440	23290-341-03 REV. E	AISI 17-4 (CARRIER) / PUC-10N(INSERT)
P35-15K SEAT		191147 LN1-2	W1013301/1	773562 / 518440	23290-341-03 REV. E	AISI 17-4 (CARRIER) / PUC-10N(INSERT)
P35-15K SEAT		191147 LN1-3	W1013301/1	773562 / 518440	23290-341-03 REV. E	AISI 17-4 (CARRIER) / PUC-10N(INSERT)
P35-15K SEAT		191147 LN1-4	W1013301/1	773562 / 518440	23290-341-03 REV. E	AISI 17-4 (CARRIER) / PUC-10N(INSERT)
P35-15K SEAT		191147 LN1-5	W1013301/1	773562 / 518440	23290-341-03 REV. E	AISI 17-4 (CARRIER) / PUC-10N(INSERT)

NO RELEVANT INDICATIONS WERE DETECTED @ TIME OF EXAMINATION ON REMAINING ITEM IN ACCEPTANCE WITH QAS-03-008 REV.I 02/10 / API 6A PSL 3

POST EXAMINATION CLEANING APPLICABLE

NORTECH ADVANCED NDT LTD.

Signatures

Technician (Sign): _____

Technician:	Carreiro, Mike	CGSB Lvl:	CGSB Reg:	SNT-TC-1A Lvl:	II
Assistant:		CGSB Lvl:	CGSB Reg:	SNT-TC-1A Lvl:	

Client Signature

Client Representative: Michael Hite _____

*Client Representative's Signature indicates acceptance of reports and results. Nortech Advanced NDT Ltd. is liable for examination costs only.

CLAMP SEGMENT

*** CERTIFICATE OF CONFORMANCE ***

IMT - FORGE DIVISION (P.C. DROP FORGE)
837 REUTER ROAD
PORT COLBORNE, ONTARIO, CANADA
P.O. BOX 100 L3K 5V7
Telephone: (905) 834-7211
Fax: QA (905) 834-6018

TO:
MASTER FLO VALVE

DATE OF ISSUE:	04-Dec-08
PART NUMBER:	81226
DESCRIPTION:	CLAMP SEGMENT
DIE NO.:	**P1691**
ORDER NO.:	172287
QUANTITY:	50 Pcs.
HEAT CODE:	D
HEAT NO.:	207K028
MATERIAL SPEC.:	4130 PER ES 02-003-016 REV A

CHEMICAL ANALYSIS

Carbon	Manganese	Phosphorus	Sulphur	Silicon	Chromium	Molybdenum	Nickel	Copper	Vanadium	Niobium
0.31	0.57	0.006	0.01	0.28	1.02	0.23	0.17	0.16	0.026	

PHYSICAL TESTS

Charpy Results	Testing Temperature	Yield Strength (PSI)	Tensile Strength (PSI)	Elongation (%)	Reduction of Area (%)	Hardness (BHN)
127-123-141	0°F	77,100	98,500	26.0%	72.0%	211
131-114-138	-20°F					
115-133-99	-50°F					

HEAT TREATMENT: QUENCH & TEMPER PER ES 02-003-016 REV. A
MILL CERT ATTACHED
HEAT TREAT CERT & CHARTS ATTACHED
SHOTBLAST
PHYSICAL TEST REPORT ATTACHED
ALL CERTS REFERENCE CUSTOMER PO # 172287
HARDNESS RESULTS ATTACHED

PO 172287 L 1
WO 1019066
PN 81226
HT D
SN —

CERTIFICATION: I hereby certify that the material covered by this Certificate of Conformance has been inspected and tested and conform to all specifications relevant thereto in accordance with the conditions of the contract or purchase order and that documentary evidence of the tests or release certificates from the place of origin, are on file in the records of this office.

Authorized Signature
Ken McClemont, QA Technician

MTR APPROVED
BY SM DATE 12/17/08

3rd. Party Witness done on Purchase P.O. # 172294
for UT - P&DR24 P.O. # 172313

CLAMP SEGMENT

*** CERTIFICATE OF CONFORMANCE ***

IMT - FORGE DIVISION (P.C. DROP FORGE)
837 REUTER ROAD
PORT COLBORNE, ONTARIO, CANADA
P.O. BOX 100 L3K 5V7
Telephone: (905) 834-7211
Fax: QA (905) 834-6018

TO:
MASTER FLO VALVE

DATE OF ISSUE: 18-May-06

PART NUMBER: 81226

DESCRIPTION: CLAMP SEGMENT

DIE NO.: **P1691**

ORDER NO.: 143716

QUANTITY: 212 Pcs

HEAT CODE: B

HEAT NO.: A060229

MATERIAL SPEC.: 4130 PER ES 02-003-016 REV A

CHEMICAL ANALYSIS

Carbon	Manganese	Phosphorus	Sulphur	Silicon	Chromium	Molybdenum	Nickel	Copper	Vanadium
0.3	0.5	0.006	0.017	0.25	0.87	0.16	0.12	0.31	0.006

Niobium
0.004

PHYSICAL TESTS

Charpy Results	Testing Temperature	Yield Strength (PSI)	Tensile Strength (PSI)	Elongation (%)	Reduction of Area (%)	Hardness (BHN)
57-73-64	0°F	68,600	91,800	25.5%	66.3%	186
56-61-81	-20°F					
43-46-71	-50°F					

HEAT TREATMENT: QUENCH & TEMPER PER ES 02-003-016 REV. A
MILL CERT ATTACHED
HEAT TREAT CERT & CHARTS ATTACHED
SHOTBLAST
PHYSICAL TEST REPORT ATTACHED
ALL CERTS REFERENCE CUSTOMER PO # 143716
HARDNESS RESULTS ATTACHED

PO 143716 L3
WO 1009493
PN 81226
HT A 060229
~~SN~~ HEAT CODE B

CERTIFICATION: I hereby certify that the material covered by this Certificate of Conformance has been inspected and tested and conform to all specifications relevant thereto in accordance with the conditions of the contract or purchase order and that documentary evidence of the tests or release certificates from the place of origin, are on file in the records of this office.

Authorized Signature
Ken McClemont, QA Technician

MTR APPROVED
1/13
BY SH DATE 05/26/06

NOTE : FOR UT SEE BORZA P.O.# 143756.
SH

CLAMP SEGMENT

*** CERTIFICATE OF CONFORMANCE ***

IMT - FORGE DIVISION (P.C. DROP FORGE)
837 REUTER ROAD
PORT COLBORNE, ONTARIO, CANADA
P.O. BOX 100 L3K 5V7
Telephone: (905) 834-7211
Fax: QA (905) 834-6018

TO:
MASTER FLO VALVE

DATE OF ISSUE:	04-Nov-08
PART NUMBER:	81227
	CLAMP SEGMENT
DIE NO.:	**P1692**
ORDER NO.:	172289
QUANTITY:	25 Pcs.
HEAT CODE:	E
HEAT NO.:	A084116
MATERIAL SPEC.:	4130 PER ES 02-003-016 REV A

CHEMICAL ANALYSIS

Carbon	Manganese	Phosphorus	Sulphur	Silicon	Chromium	Molybdenum	Nickel	Copper	Vanadium
0.3	0.52	0.011	0.022	0.26	1.02	0.18	0.12	0.25	0.003

Niobium
0.001

PHYSICAL TESTS

Charpy Results	Testing Temperature	Yield Strength (PSI)	Tensile Strength (PSI)	Elongation (%)	Reduction of Area (%)	Hardness (BHN)
54-76-73	0°F	77,700	100,500	24.0%	61.0%	222
56-77-58	-20°F					
42-54-46	-50°F					

HEAT TREATMENT: QUENCH & TEMPER PER ES 02-003-016 REV. A
MILL CERT ATTACHED
HEAT TREAT CERT & CHARTS ATTACHED
SHOTBLAST
PHYSICAL TEST REPORT ATTACHED
HARDNESS RESULTS ATTACHED
ALL CERTS REFERENCE CUSTOMER PO # 172289

PO 172289 L1
WO 619068
PN 81227
HT E
SN —

CERTIFICATION: I hereby certify that the material covered by this Certificate of Conformance has been inspected and tested and conform to all specifications relevant thereto in accordance with the conditions of the contract or purchase order and that documentary evidence of the tests or release certificates from the place of origin are on file in the records of this office.

MTR APPROVED
BY KN DATE 11/21/08

Authorized Signature
Ken McClemont, QA Technician

For 3rd. Party Witness See Russell P.O. # 172297
For UT See Borsa P.O. # 172315

VANGUARD STEEL LTD
7606 MCINTYRE ROAD
EDMONTON, ALBERTA
T6E 6Z1
PHONE: (780)466-1115 FAX: (780) 469-4545

MTR APPROVED
BY Miyano V/C DATE 10/07/08

PO 171079
WO
PN 23290-100-03
HT X30037
SN 171079-2-1 thru

SIZE: 2 1/2
HEAT#: X30037

PRODUCT CODE: 02000232
COLOR CODE RED/WHITE

4140 Q & T

171079-2-10

IN #: 34099 HEAT#:X30037 SIZE: 2 1/2 GRADE: SAE-4140 CERTIFICATE 132673

CHEMICAL COMPOSITION %

C:	Mn:	Si:	S:	P:	Ni:	Cr:	Mo:	Cu:	Al:	V:	Sn:	Ti:
0.405	0.860	0.260	0.007	0.005	0.200	1.040	0.220	0.140	0.029	0.006		

MECHANICAL AND PHYSICAL PROPERTIES OF MATERIAL

SPECIMEN Pos.	SPECIMEN Size	SPECIMEN Dir:	*TC PR:	HEAT TREATMENT:	L T:	Y S PSI 2%:	UTS PSI:	ELONG % IN 2":	R A %:	L T:	IMPACT TESTS TYPE:	IMPACT TESTS SIZE:	IMPACT TESTS TEMP F:	IMPACT TESTS FT LBS:	HARDNES RC
				QUENCH & TEMPER		87000	114000	26.70	63.10				-75 F	38, 39	20, 21
														39	HBN

*CHECKED ON => TC=TEST COUPON PR=PRODUCT AS DELIVERED. L=LONGITUD. T=TRASVER

OTHER RESULTS

GRAIN SIZE: 7-8
HEAT TREATMENT: H. 1616 F 65 MIN
OIL TEMP 1328 F 130 MIN

REDUCTION RATIO:
FINISH CONDITION:
MELTING EAF MELTED

ULTRA SONIC TESTING: OK 100% AS PER ASTM A388
CONFORMS TO: API 6A TYPE 80K, PSL 1-3 NACE MR01-75(L.EDITION)
VACUUM DEGASSED, MERCURY FREE

STEEL FREE FROM ABNORMAL RADIOACTIVITY

WE HEREBY CERTIFY THAT THE ABOVE DATA IS A TRUE COPY OF THE DATA FURNISHED US BY THE PRODUCTING MILL OR SUPPLIER OR THE DATA RESULTING FROM TESTS PERFORMED IN APPROVED LABORATORIES.
WE CERTIFY THAT ABOVE MATERIALS CONFORMS TO THE REQUIREMENTS OF THE ABOVE SPECIFICATION(S)
E. & O.E.

CLAMP PINS

Earle M. Jorgensen Co. Original test report for the order shown below.
EMJ SID#:T141507 CUSTOMER:STAMCO SPECIALTY TOOL & MP.O:15771
QTY:[illegible] DATE:09-10-09 SIGNATURE:SUSIE WICKLAND

CUST. PART#:

Steel Dynamics, Inc.
Engineered Bar Products Division
3550 N. County Road 225 East
Pittsboro, IN 46167
Phone: (317) 892-7000
Fax: (317) 892-7285

4/23/09

Certified Material Test Report

Cert # : 70588
Work Order : 73769
Load # : 91323
Size : 4-1/2"
Grain Practice : Al Fine Grain (5-8) per ASTM A29

Mill Order : 0902318
Sales Order : 53726-1
Reference # : 506515
Shape : Round

Heat # : A090577
Customer : EMJ
Reference Desc : 506515
Grade : 4140/42
Reduction Ratio : 8.7 to 1

Issued : 4/21/2009 14:51:36
PO # : P212159-453-1
End Use :
Length : 20'00"
Disposition : 1

506515

Ladle Chemistry Analysis (ASTM A29)

C	Mn	P	S	Si	Al	Cu	Ni	Cr	Mo	Sn	N	V	Cb	B	Ca	W	Ti	DI
0.42	0.86	0.010	0.015	0.26	0.026	0.24	0.11	0.99	0.22	0.013	0.0103	0.003	0.001	0.0002	0.0007	0.000	0.001	5.88

Pb	Co	As	Sb	H	Ceq
0.000	0.009	0.007	0.008	1.5	0.83

Product Check Analysis (ASTM A29)

	C	Mn	P	S	Si	Al	Cu	Ni	Cr	Mo	Sn	N	V	Cb	Ti	B	Ca
Front																	
Back																	

Jominy (ASTM A255)

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J12	J14	J16	J18	J20	J24	J28	J32
Calc'd	57	57	57	57	57	57	57	57	57	55	51	51	49	48	48	46	44	41
Front																		
Back																		

A090577

Microcleanliness (ASTM E45)

Method A								Method C		Method E	
AT	AH	BT	BH	CT	CH	DT	DH	S	D	SAM "B"	SAM "D"

Microcleanliness (DIN 50602)

K			M
S	O	Tot	Tot

Decarb

Depth	% of Diameter

Grainsize

Austenitic	Ferritic

Macrostructure (ASTM E381)

S	R	C

Magnetic Particle Inspection

Frequency	Severity

Mechanical Properties (ASTM A370)

Tensile Properties				Hardness	
Tensile Strength	0.2% Yield Strength	% Elong (2")	% ROA	(MR)	(Surf)

R780333

Steel Dynamics - Engineered Bar Products has a quality system in place which has been certified ISO 9001:2000 compliant, including PED certification.

Comments/Specs

ASTM A322 (latest rev.) ---- ASTM A304 (latest rev.) ---- Quench & Temper, Straighten, Stress Relieve ---- NACE MR-01-75 / ISO 15156

MTR APPROVED
BY JB DATE 07/12/10

PO 185218
WO
PN 23290-074-01
HT A090577
SN

Condition : Quench and Temper, Straighten, Inspect Contact UT, and Stress Relieve

UT: Passed Ultrasonic Inspection

I hereby certify that the content of this report is correct and accurate, and that all tests and operations performed on this material were in compliance with applicable material specifications and purchaser designated requirements.

Garrett Bouyett - Rolling Mill Metallurgist

Any alteration to this report voids Steel Dynamic's warranting of results. No weld repair has been performed on this material. This material is not radioactive and has not been exposed to radioactivity while under the control of Steel Dynamics. This material has not been exposed to mercury while under the control of Steel Dynamics. Unless otherwise noted, this material was melted, continually cast, and rolled in the USA; w/ all testing performed by Steel Dynamics.

Steel Dynamics Rev Level 1 [106] - 241

retrieve_on

Earle M. Jorgensen Co. Original test report for the order shown below.
EMJ SID#:T141507 CUSTOMER:STAMCO SPECIALTY TOOL & MP.O:15771
QTY:5306000 DATE:09-10-09 SIGNATURE:SUSIE WICKLAND

CUST. PART#:

Steel Dynamics, Inc.
Engineered Bar Products Division
3000 N. County Road 225 East
Pittsboro, IN 46167
Phone: (317) 892-7000
Fax: (317) 892-7285

Certified Material Test Report

Heat Treatment Addendum

Cert # : 70588
Work Order : 73769
Load # : 91323
Size : 4-1/2"

Mill Order : 0902318
Sales Order : 53726-1
Reference # : 506515
Shape : Round

Heat # : A090577
Customer : EMJ
Reference Desc : 506515
Grade : 4140/42

Issued : 4/21/2009 14:51:37
PO # : P212159-453-1
End Use :
Length : 20'00"

Normalize		Austenitize		Quench Media			Temper		Stress Relieve	
Time	Temp	Time	Temp	Type	Time	Temp	Time	Temp	Time	Temp
hrs	F	2.8 hrs	1650°F	Water	15 min	95-100°F	5.0 hrs	1275°F	4.0 hrs	1100 F

* Furnaces are calibrated to AMS 2750 by an outside source bi-annually, and use atmospheric thermocouples.
** QTC is 12" prolongation from longitudinal orientation .machined to a 0.505" buttonhead for tensile.

Surface Hardness (ASTM A370)

Sample ID	Location		HB	
08504	Surface	Q1	229	
09104	Surface	Q1	228	
08514	Surface	Q2		22
09114	Surface	Q2		21

Tensile (ASTM A370)

Sample ID	Orientation	Location		Tensile	0.2% Yield	%E	%ROA
08500	Longitudinal	Mid-Radius	Q1	110,700	83,000	21	60
09100	Longitudinal	Mid-Radius	Q1	110,900	85,300	22	64

I hereby certify that the content of this report is correct and accurate, and that all tests and operations performed on this material were in compliance with applicable material specifications and purchaser designated requirements.

Colin Meidell - Bar Finishing Metallurgist

Any alteration to this report voids Steel Dynamic's warranting of results.

retrieve_on

Steel Dynamics Rev Level 1 [108] - 350

CLAMP PINS

2444-2
-3
506515 -4
R165079-6

Earle M. Jorgensen Co. Original test report for the order shown below.

EMJ SIDE:L 61881 CUSTOMER:SATURN MACHINE WORKS LTD P.O:3038 CUST. PART#: QTY: 5,891.141 DATE:07-08-14 SIGNATURE:SUSIE WICKLAND

SIDENOR

MILL TEST CERTIFICATE

Reinosa Plant ISO 9001/2000 ER-0033/1994 ESO-PS 36965 (2002) MAD-0071/2001-02

CUSTOMER:ENERGY ALLOYS		WORKS REFERENCE:1940745
REFERENCE:204222 / 537057	SALES ORDER:164530-3	HEAT NUMBER:5650
PRODUCT NR:0131-3000	VERSION:78203	ROLLED:30.11.2006

5650

REQUIRED PRODUCT

AISI4140 ROUND BARS AS ROLLED Q+T+STRESS RELIE 4.5" ASTM A-29 (2) 20'/23' RANDOM

EXPEDITION DELIVERY:80167613 WEIGHT (KG):10.750 PIECES:8 UNITS:20

MADE ACCORDING TO

ASTM A370 - 2001 ; ASTM E8 01E1 2002 ; ASTM A304-02 - 2002

NACE MR0175 2002 01.01.2002 ; ASTM A29-A29M 99E1 . .1999

MAGELLAN MIC1018 - 26.10.2005 ; ASTM A322-91(R01) - 1991(R01)

MAGELLAN MIC1016 - 19.07.1996 ; API SPEC 6A 17ED+ERRATA 12/96 01.02.1996

MAGELLAN MIC1016 AD.3C 25/5/01 - 25.05.2001 ; EN 10204:2004 3.1

CHEMICAL ANALYSIS OF HEAT U:% HEAT NUMBER:5650

	C	Mn	Si	P	S	Cr	Ni	Mo	V	Cu	Al
Min.	0,400	0,750	0,150			0,800		0,150			0,020
Max.	0,430	1,000	0,350	0,025	0,025	1,100	0,250	0,250	0,050	0,350	0,050
Cast.	0,417	0,870	0,240	0,014	0,008	1,060	0,161	0,230	0,003	0,262	0,028

	Ca	H
Min.		
Max.		0,00030
Cast.	0,0015	0,00009

P+S<=0,045:0,022 U.I.ASTMA255(*):6,421

JOMINY HARDENABILITY HARDNESS U.:HRC QUENCHING TEMP.:1,550 °F

	1/16"	2/16"	3/16"	4/16"	5/16"	6/16"	8/16"	10/16"	12/16"	14/16"	16/16"
Min.	53,0	52,0	52,0	51,0	51,0	50,0	47,0	42,0	39,0	37,0	35,0
Max.	60,0	60,0	60,0	59,0	59,0	58,0	57,0	56,0	55,0	54,0	53,0
Cast.	57,0	56,7	56,6	56,3	56,2	55,7	55,0	54,0	51,8	49,0	48,4

	20/16"	24/16"	28/16"	32/16"
Min.	33,0	32,0	31,0	30,0
Max.	51,0	48,0	46,0	44,0
Cast.	42,1	37,8	37,5	35,0

JOMINY Standard (ASTM A255-2002)

INCLUSIONS (MICROINCLUSIONS)

Standard (ASTM E45-97(R2002)) ; Type/method (A) ; A(t):1 ; A(h):0,5 ; B(t):1,5 ; B(h):1 ; C(t):0 ; C(h):0 D(t):1 ; D(h):0,5

MECHANICAL PROPERTIES AS SUPPLIED (CONDITIONS)

Sample:QTC ; Specimen Test location:At 1/2 radius ; Temperature of: (1):Austenitizing 1.562 °F

Time: (1):210 Minutes ; Cooling: (1):Water 53/95 °F ; Temperature of: (2):Tempering 1.292 °F

Time: (2):360 Minutes ; Cooling: (2):Air ; Temperature of: (3):STRESS RELIEVED 1.192 °F

Time: (3):8 hours

MECHANICAL PROPERTIES AS SUPPLIED (TEST)

Tensile test specimen direction (Longitudinal):Longitudinal

Tensile Strenght (>= 100.000 PSI):158.941 PSI

Yield Strenght(1) (Rp(0,2%) 80.000/95.000 PSI):Rp(0,2%) 92,189 PSI

Yield Strenght(2) ((0,5%) 80.000/95.000 PSI):(0,5%) 96.506 PSI

Yield Strengh(3) (10,02%) PSI):(0,02%) 79.870 PSI ; Elongation (2 " >= 20 %):2 " 27,2 %

Reduction of Area (>= 40 %):62,1 % ; Standard (API 6A\17 01/02/96+ER 12/96-01.02.1996)

Notch Impact sample type (CHARPY-V):CHARPY-V ; Notch Impact test Temperature (-75 °F):-75 °F

K(1):33 Ft.Lb ; K(2):33 Ft.Lb ; K(3):30 Ft.Lb ; K (average) (>= 20 Ft.Lb):32,67 Ft.Lb

TECHNOLOGY & QUALITY CERTIFIES THAT THE PRODUCT FULL FILLS THE ORDER'S SPECIFICATION

APPROVED BY:NATALIA MANTILLA DIAZ SIGN:

DATE:24.04.2007

Metallurgical Technical Engineer level II

PO 101317
WO 13290-074-02
PN 5650
HT
SN

MTR APPROVED
BY
DATE 4/10/07

4140 4½"

Earle M. Jorgensen Co. Original test report for the order shown below.

EMJ SIDE:E 151691 CUSTOMER:SATURN MACHINE WORKS LTD P.O:3039 CUST. PART#: QTY: 5,891.141 DATE:07-08-14 SIGNATURE:SUSIE WICKLAND

SIDENOR

MILL TEST CERTIFICATE

Reinosa Plant ISO 9001/2000 MR-0039/1994 ISO-TS 16949 (2002) MA02-0071/2001-02

CUSTOMER: ENERGY ALLOYS		WORKS REFERENCE:1240745
REFERENCE: 204223 / 537057	SALES ORDER:164530-3	HEAT NUMBER:5650
PRODUCT NR:0111-3000	VERSION:78203	ROLLED:30.12.2006

K (single) (= Lb Ft.Lb):30 Ft.Lb ; Lateral expansion:0,63- 0,86- 0,92 mm
Brittle fracture:63- 67-75 % ; Standard (ASTM A370-00A- . .2000)
Surface hardness (207/237 HB):228 HB ; Hardness at 1/2 radius (HB):215 HB

ADDITIONAL TESTS

Standard (ASTM E112-96- . .1996) ; Grain size:Austenitic 6 ; Standard (ASTM E381G13001)
macroetching(1):S 1 ; macroetching(2):S 1 ; macroetching(3):C 1

NON DESTRUCTIVE TESTS

Internal defects standard (STAHL EISEN SEP1921-01.12.1984)
Internal defects type/method (level <- D/d)
ULTRASONIC CONTROL 100%: OK. SEP1921 Group .2 Class D/d - T.1-2.
CRACKS CONTROL 100%:OK - ASTM E709-1995

ADDITIONAL INFORMATION

Deflation at... (Solicita 1/8") ; Reduction ratio:30,7 ; CALCIUM TREATED ; FREE FROM Bi
MADE IN ELECTRIC FURNACE AND VACUUM DEGASSED. INGOT CAST.

COUNTRY OF ORIGIN – SPAIN

TECHNOLOGY & QUALITY CERTIFIES THAT THE PRODUCT FULL FILLS THE ORDER'S REQUIREMENTS

APPROVED BY:NATALIA MANTILLA DIAZ SIGN:

DATE:24.01.2007

REF.:

Metallurgical Technical Assistant Level II

ACTUATOR HOUSING

MST1201 Highland Foundry Ltd. Page 1
7/16/09 CHEMICAL AND PHYSICAL ANALYSIS 7:09:56

Product#. . . : 81270 Order/Item# . : 32658 / 1
Customer Part#: 81270 Customer P.O.#: 18C777
Customer. . . : MASTER FLO VALVE INC.
4611 74TH AVENUE
EDMONTON AB T6B 2H5

Approved By: Shauna Puchniak
Quality Assurance Technician

Castings have been visually inspected and accepted to MSS-SP-55

Melt#	Quantity	Date	Heat Treat	BATCH # :	Specification
3-4697	16	6/09/09		UD1 - -	ASTM A352 LCC

CHEMICALS

C :.1400	-MN:1.0800	SI:.5000	P :.0170
S :.0190	NI:.0600	CR:.3000	MO:.0800
CU:.0900	V :.0150		

PHYSICALS

YIELD KSI	66.4	TENSILE KSI	85.6
ELONGATION %	29	RED OF AR. %	59
IMPACT FT LB	20	IMPACT FT LB	22
IMPACT FT LB	20	TEST TEMP.	-50F

MTR APPROVED
BY 15 DATE 07/21/09

PO 18077L2
WO —
PN 81270
HT UD1
SN —

HIGHLAND FOUNDRY LTD

MATERIAL TEST REPORT
9670-187th Street, Surrey, BC Canada V4N 3N6
Phone 604•888•8444 Fax 604•888•3634
www.highlandfoundry.com

ISO 9001:2008

BEARING HOUSING

BRUSHWELLMAN
ENGINEERED MATERIALS

27555 College Park Drive, Warren, MI US 48088-4875
Phone: 586-772-2700 ; Fax: 586-772-2472

Material Certificate

Date
05/24/2010
Purchase order item/date
5400062163 10 / 05/20/2010
Delivery item/date shipped
80457673 000010 / 05/24/2010
Order item/date
280662 000010 / 05/20/2010
Customer nbr Customer part nbr
13155 CU_RD
Customer spec
ASTM-B-196-07

Rev	Type	Comp	Class	Grade

MTR APPROVED BY Rav DATE 07/20/10

Copper & Brass Sales, Inc.
4143 101st Street
EDMONTON-CA AB T6E 0A4
CANADA
CA

Our Material: K430190100 ROD CD 25 H 2.25000 X
During manufacturing process, tests and inspections, the product offered did not come in direct contact with Mercury or any of its compounds nor with any Mercury containing device employing a single boundary of containment.

Brush Wellman testing for chemistry composition, mechanical and physical properties were tested at our laboratory in Elmore OH. or as necessary, outside laboratories under control of the Elmore Quality Department.
This material was inspected and tested and is conforming as required in accordance with the noted part, specification, drawing and revision. The test methods for these tests are available for review by the buyer.

Batch 0000854859 / Quantity 576 LBS

Characteristic	Unit	Value	Specification Limits Lower	Upper
CDA (UNS) Alloy	-	C17200		
ASTM Temper	-	TD04		
Dimensional Attributes				
Diameter	"	2.25000		
Diameter Plus	"	0.01000		
Length	"	156.00000		
Mechanical/Physical Properties				
Tensile	ksi	100.6	85.0	115.0
Yield @ 0.2% Offset	ksi	92.9	75.0	
Elongation (4D or 2")	%	21	8	
Hardness Scale	-	HRBW		
Hardness Value		99	88	101

RECD: 06/04/10
COPPER & BRASS PO. 26068
MASTERFLO PO 191718
P/N 27270-J

PO 191718 | WO | PN 27270 | HT 19513 | SN

The material supplied with this certification has not been heat treated. The following properties were achieved in Brush Wellman's laboratory. They represent what you may expect after heat treating the material, using the time and temperatures shown.

R1 Temper	-	HT		
R1 Heat Treat Time	hrs	3.00	3.00	3.00
R1 Heat Treat Temp	°F	635	600	675
R1 Tensile	ksi	190.7	175.0	205.0
R1 Yield	ksi	168.7	145.0	
R1 Elongation	%	7	4	
R1 Hardness Scale	-	HRC		

BRUSHWELLMAN
ENGINEERED MATERIALS

Copper & Brass Sales, Inc.
4143 101st Street
EDMONTON-CA AB T6E 0A4
CANADA

Delivery item/date
80457673 000010 /
05/24/2010

R1 Hardness Value			42	37	44
Chemistry Composition					
Beryllium	%		1.87	1.80	2.00
Ni+Co	%		0.26	0.20	0.35
Ni+Co+Fe	%		0.30		0.60
Silicon	%		0.04		0.15
Aluminum	%		0.03		0.10
Lead		-	0.004 %		
Alloy Balance		-	COPPER		
Lot Identification					
Heat Number		-	19513		
Prod Order/Pc/Lot Nbr.		-	100448688		

Brian M. Kanikowski

Quality Representative - Brian M. Kanikowski

PISTON

MTR APPROVED BY Soni DATE Feb 5, 10.

Seite / Page 1 / 1

E10003 1 of 3

BGH

BGH Edelstahl Freital GmbH

BGH Edelstahl Freital GmbH Am Stahlwerk 1 01705 Freital

ASA Alloys Inc.

20 Challenger Crescent

T8H 2R1 Sherwood Park, Alberta
Kanada

PO 185029. | WO — | PN 27362-003. | HT 334065. | SN —

Zeugnis-Nr. / Certificate no. / No. de certificat: **293899**

Bescheinigung über Werkstoffprüfung nach DIN EN 10204 / Certificate of material tests according to DIN EN 10204 **3.1** / Certificat des essais des matériaux selon DIN EN 10204

Die Lieferung entspricht den vereinbarten Lieferbedingungen. / Delivery in accordance with the agreed terms of delivery. / La livraison correspond aux conditions de livraison convenues.

Zeichen des Lieferwerkes / Trade mark / Signe du fournisseur

Stempel des Werkssachverständigen / Inspector's stamp / Poinçon de l'inspecteur

BGH Q406

Kunden-Bestell-Nr. / Customer order no. / Cde. no. du client: **P016673**

BGH-Auftrags-Nr. / BGH works no. / BGH référence: **44247101/108416**

Erzeugnisform / Product	Blanker Stab, rund, geschält / Round bright bars,peeled
Werkstoff / Quality	17-4PH (H1150D)
Anforderungen / Requirements	ASA MS 17-4PH Rev E 10/07 17-4PH /UNS S17400 NACE MR 01 75 ISO15156-1 2004 17-4PH (H1150D) ASTM A 564 /A 564M -04 API 6A PSL 3

Besichtigung und Maßnachprüfung / Inspection and dimensional control / Inspection et contrôle de dimension	Erschmelzung/Nachbehandlung / Melting process/secondary refining / Mode d'élaboration/traitement ultérieur	Verwechslungsprüfung (spektroanalytisch) / Identification test (spectral-analysis) / examination d' identification(analyse spectrale)
ohne Beanstandung / without objection	E - VOD	ohne Beanstandung / without objection

Pos. / Item	Anzahl / Quantity	Abmessung / Dimension	Gewicht / Weight kg	Schmelz-Nr. / Heat-No.
1	52	1.625"dia	3252	334065

Schmelze / Heat %	C	Si	Mn	P	S	Cr	Ni	Cu	Nb	Ta	Nb+Ta
334065	0,037	0,56	0,58	0,024	0,0020	15,70	4,14	3,30	0,264	0,004	0,268

Wärmebehandlungszustand / Condition of heat treat: lösungsgeglüht + 2x ausgehärtet / solution annealed + 2x precipitation hardening

Probe-Nr. / Test-No.	Lage	Temp. °F	Rp0,2 ksi		Rm ksi	A4 %	Z %	Kerbschlagarbeit / Impact value ftlbs		Probenform / Shape of test piece		Härte / Hardness HRC
Soll/Req.	L	RT	>=105		>=135	>=16	>=50	>=21			-50	>=24 <=33
155DD1	L	RT	125		140	23	66	64	65	65	-50	31

Ursprungsland: GERMANY
Proben wurden von der Stabverlängerung entnommem x 6" Länge, gemäß ASTM A 370.

Country of origin and melt: GERMANY
Test pieces taken from actual bar prolongation x 6" length according to ASTM A 370.

APPROVED BY:

DATE: 10/04/09

Anlagen / Encl. / Annex	Freital,den / Place and date / Lieu et date	Abnahmebeauftragter / Inspector representative / Inspecteur de réception
US-certificate / Protokoll Glühbesch./Heat treatment cer.	06.05.2009	MUELLER

Das Zeugnis wurde maschinell erstellt und ist auch ohne Unterschrift gültig. / This certificate was generated by data system it must not be signed for validity as well. / Ce certificat a été établi sur système informatique et est valable sans signature aussi.

CYLINDER

Mill Test Report

E 20267

MILL TEST REPORT This MTR contains 1 page (Page: 1)

MTR#: VJRB190524 Customer#: ASAALB PO#: P020306 SO#: LFJ617
Item#: RB6L0416 Bundle#: VJ257076 Heat#: 14312

VIRAJ IMPOEXPO

(A DIVISION OF VIRAJ PROFILES LTD.)
10 IMPERIAL CHAMBERS, FIRST FLOOR,
WILSON ROAD BALLARD ESTATE,
MUMBAI - 400 038 INDIA

TEST CERTIFICATE

ORDER NO.	PACKING LIST NO.	INSPECTION NO	DATE
L22056	IMP/19052	IMP/19052/4	03/01/2008

BUNDLE NO.
257076,257246

GRADE
T-316/316L

DESCRIPTION:
STAINLESS STEEL BRIGHT BARS

ROUGH TURNED

SIZE (INC)	SHAPE	TOLERANCE	LENGTH (FT)	PIECES	WEIGHT (LBS)
4 1/4	ROUND	RT	12FT - 18FT	3	2769

CHEMICAL ANALYSIS

HEAT NO. 14312

C	Mn	Si	S	P	Ni	Cr	Mo	Cu	N	Co
0.019	1.73	0.42	0.021	0.040	10.09	16.60	2.03	0.41	0.059	0.16

TEST RESULT

.2% YIELD STRENGTH KSI	TENSILE STRENGTH KSI	ELONGATION %	REDUCTION OF AREA %	HARDNESS BHN	GRAIN SIZE
37	82	57	72	166	5

Specification :
MATERIAL CONFIRMS TO ASTM A276-06 COND. A,A479/A479M-06a CON A , A193/A193M-06a B8M CL1, A320/A320M-05a B8M CL1 ASME SA 182-06(CHEMISTRY ONL' ASME SA479-06 COND A, SA193-06 B8M CL1 SA 320-06 B8M CL1, AMS QQ-S-763B-08 COND A (EXCEPT MARKING), AMS 5648J, AMS 5653F(EXCEPT MARKING), UNS-31600/S-31003 ASTM A182/A182M-05 (CHEMISTRY ONLY), NACE-MR-0175, GRAIN SIZE AS PER ASTM E112-96e1. IMPROVED MACHINABILITY QUALITY.INTERGRANULAR CORROSION TEST PASSED IN ACCORDANCE WITH ASTM A262-02a PRACRICE E. CERTIFICATE AS PER EN 10204-3.1b.

Remarks :
MATERIAL IS FREE FROM MERCURY CONTAMINATION. FREE FROM WELD OR WELD REPAIRS. MICRO:FREE FROM CONTINOUS CARBIDE NETWORK ON GRAIN BOUNDARIES. MACRO:GOOD. MINIMUM SOLUTION ANNEALING TEMPERATURE 1050C, SOAKING TIME thr/inch., WATER QUENCHED. MELT SOURCE:AOD.

We hereby certified that the material described above has been tested and complies with the terms of order/contract.

APPROVED BY:
DATE: 4/1/10

Suvarna
WORKS INSPECTOR
S. SUVARNA

189016

PO
WO —
PN 27390 - 101
HT 14312
—

MTR APPROVED
BY Ron DATE 04/08/10

END CAP

VIRAJ PROFILES LIMITED

10 IMPERIAL CHAMBERS, FIRST FLOOR,
WILSON ROAD, BALLARD ESTATE,
MUMBAI 400038 INDIA

E 18011

INSPECTION CERTIFICATE

CUSTOMER :	ORDER NO .	PACKING LIST NO.	INSPECTION NO	DATE
ASA ALLOYS EDMONTON 20 CHALANGER CRES, SHERWOOD PARK, EDMONTON ALBERTA, CANADA, T8H 2R1	P016666 BUNDLE NO . 2037063,2037070	IMP/101389	IMP/101389/8	05/12/2008 GRADE 316/316L

PO 186716
NO
PN 27391
HT 16814
SN

DESCRIPTION :
STAINLESS STEEL ROUND BARS L/C NO.: 1700373 DT.: 29/01/09

ROUGH TURNED

SIZE (INC)	SHAPE	TOLERANCE	LENGTH (FT)	PIECES	WEIGHT (LBS)
4 1/4	ROUND	RT	13' R/L	4	3920

CHEMICAL ANALYSIS

HEAT NO. 16814

C	Mn	Si	S	P	Ni	Cr	Mo	Cu	N	Co
0.018	1.44	0.40	0.020	0.035	10.00	16.36	2.03	0.45	0.062	0.17

TEST RESULT

.2% YIELD STRENGTH KSI	TENSILE STRENGTH KSI	ELONGATION %	REDUCTION OF AREA %	HARDNESS BHN	GRAIN SIZE
38	82	59	70	163	6

Specification :
MATERIAL CONFIRMS TO ASTM A276-06, A193/A193M-05 B8MCL1, A182/A182M-2006, A479/A479M-06a, ASME SA182-97, SA193-98 B8MCL1, SA479-97, CQS-763F, AMS 5648J/5853E, NACE MR01-75 - 03. TEST SPECIMENS AS PER ASTM A370-05. I.G.C. SATISFACTORY AS PER ASTM A262 PRACTICE E CERTIFIED AS PER 10204-3.1

MTR APPROVED
BY ____ DATE Feb. 22/10

Remarks :
MATERIAL IS FREE FROM MERCURY CONTAMINATION FREE FROM WELD OR WELD REPAIR. MICRO STRUCTURE : FREE FROM CONTINOUS CARBIDE NETWORK. MACRO STRUCTURE : GOOD, MIMIMUM SOLUTION ANNEALING TEMPERATURE 1050C, SOAKING TIME 1Hr/inch, WATER QUENCHED, COUNTRY OF ORIGIN INDIA

We hereby certified that the material described above has been tested and complies with the terms of order/contract.

RECD: 11/09/09 ASA PO 2540
MASTERFLO PO 186716
P/N 27391

WORKS INSPECTOR

LVOT

Soil Mechanics

R.D.P ELECTRONICS LTD
Grove Street
Heath Town
Wolverhampton
WV10 OPY
Attn: Mr K Short

Soil Mechanics
4-6 Wharfside
Off Rounds Green Road
Oldbury, West Midlands
B69 2BU
Tel: 0121 552 1565
Fax: 0121 544 8581

Certificate No: RDP051/09-03

Description:	1 off E526 Module Serial No. 128023B		
Client Ref:	R63457	**Certificate Date:**	04th September 2009
Specification:	TP 1175 Issue E	**Date received:**	21st August 2009

INTRODUCTION

The above module was received for leak testing in accordance with client procedure: TP1175 Issue E

METHOD

The tests were carried out as follows:-

1. Place the unit in a chamber and pressurise with helium to 1000psi for 15 minutes.
2. Remove from the chamber
3. Place in a second chamber and evacuate to less than 10^{-5} mbar.
4. Measure leak rate

RESULTS

Leak Rate Recorded mbar litre/second	Leak Rate Requirement mbar litre/second
$<1 \times 10^{-7}$	$<1 \times 10^{-3}$

COMMENTS

This sample satisfies the specification requirements.

Test Procedures: E10TP 07.004. **Test Equipment:** Edwards LT101 Helium Leak Detector, Serial No. 55140-4 Calibrated Gauge (PRD 11A) Helium Gas	**Test Date:** 28th August 2009 **Authorised By:** ..... **C. Merrix – Team Leader**

RESULTS OF TEMPERATURE TESTS ON E526 UNITS

1. Date 2.9.09 Time 13.15 Temperature 20°

Serial No	Datum Output in mA			
	Low	Centre	High	
128021	4.128	12.100	20.076	
128022	4.166	12.130	20.100	
128023	4.214	12.134	20.061	

2. Date 2.9.09 Time 16.00 Temperature 50°

Serial No	Datum Output in mA			
	Low	Centre	High	
128021	4.098	12.069	20.042	
128022	4.137	12.096	20.057	
128023	4.204	12.121	20.041	

3. Date 3.9.09 Time 8.30 Temperature 50°

Serial No	Datum Output in mA			
	Low	Centre	High	
128021	4.083	12.069	20.059	
128022	4.123	12.092	20.070	
128023	4.189	12.117	20.049	

4. Date 3.9.09 Time 13.30 Temperature 50°

Serial No	Datum Output in mA			
	Low	Centre	High	
128021	4.085	12.070	20.055	
128022	4.123	12.094	20.062	
128023	4.193	12.115	20.043	

5. Date 3.9.09 Time 14.45 Temperature 0°

Serial No	Datum Output in mA			
	Low	Centre	High	
128021	4.101	12.132	20.145	
128022	4.131	12.186	20.186	
128023	4.138	12.157	20.146	

Test Engineer ..... Witnessed by .....

FINAL TEST RESULTS FOR E526 OR E477/321 WITH D5/2000A/427

Module Type ..... E526 ..... **Serial Number** 128023B

D5/ 2000A/427 **Serial Number** 128023A

1.0 E526 or E477 with D5/ 2000A/427
Transducer where cable length on 4-20mA output is varied

1.1 With 18v Supply

Cable Length m	3	11.5	50
+F.S. Output mA	4.066	4.066	4.066
Zero Output mA	12.025	12.025	12.025
-F.S. Output mA	20.027	20.026	20.024

1.2 With 32v Supply

Cable Length m	3	11.5	50
+F.S. Output mA	4.069	4.069	4.069
Zero Output mA	12.027	12.027	12.027
-F.S. Output mA	20.027	20.027	20.025

2.0 Linearity Test (with 11.5m cable at 24v)

Non-linearity ..... 0.26 .....% of F.S. (least squares)

3.0 Armature full-out dimension (x) ..... 5.652" .....

4.0 Insulation resistance (at 50 volts) ..... 2G ..... (E526) ... 20G .... (transducer)

Test Engineer ..... AJ ..... Approved by ..... IC .....

Date of Test ..... 8.9.09 ..... Temperature ..... 21°C .....

MASTER FLO VALVE INC.
Head Office
4611 - 74 Avenue
Edmonton, Alberta
Canada, T6B 2H5

FABRICATION TEST REPORT

FAT For P35-15K HRV Insert c/w Series II SL Actuator

NEWFIELD EXPLORATION

Rev		Rev		Document Title
0	24 Aug 2010			FAT For P35-15K HRV Insert c/w Series II SL Actuator NEWFIELD EXPLORATION

Design File			
Created By	J. KROL	Date	24 August 2010
Approved By	P Brzezicki	Date	25 August 2010
Document Number		FAT 10-052	
Rev	0	Date	25 Aug 2010

1.0 SCOPE:

1.1 This procedure provides details of the testing required to be carried out on **P35-15K HRV Choke Inserts** with **5,000 psig** Series II SL Actuators for use on the **Newfield Exploration GOM** project.

2.0 GENERAL REQUIREMENTS:

2.1 The FAT is not completed until a final QA and Engineering review has been carried out.

2.2 At each point where "**(SR)**" appears in the text a sign off confirming successful completion of the that section and, where applicable, relevant data collected must be recoded in the corresponding location in Appendix I.

2.3 Testing activities in the FAT must be carried out by properly trained personnel using appropriate equipment and procedures in accordance with Master Flo HSE standard HSE-02-SWP-213. All Safe Work Procedures (SWP) associated with the type of testing being performed and the equipment being used must be followed.

2.4 All proof testing (shell) of valve body must be carried out within a designated test bay.

2.5 Ensure that drawing **52211-B03-01-0** is available.

3.0 EQUIPMENT REQUIREMENTS:

3.1 The test requirements as specified under Section 4.0 of PS-01-A-005 shall apply.

3.2 Where specified in the test procedure, nitrogen gas will be substituted.

3.3 Hydraulic fluid to be used is **MARSTON BENTLEY HW 443. (SR)**

3.4 All components exposed to hydraulic actuation fluid are to be ultrasonically cleaned.

3.5 Upon completion and acceptance of F.A.T., actuator cylinders are to be flushed per PS 01-A-009. Flushing fluid shall be **MARSTON BENTLEY HW 443**. Cleanliness level shall be to **SAE AS4059 Class 6B-F**.

3.6 Complete Table 1a of Appendix I and record actuator serial number and choke insert serial number. **(SR)**

3.7 The running tool is to be used with lower clamp guide cage P/N **41022-003**, clamp override adapter **80331-001** and actuator override adapter P/N **80331**. Record the cage serial no. **(SR)**

3.8 The following is required throughout all areas of testing to most accurately simulate worst-case sub-sea conditions.

3.8.1 Hydraulic supply to choke shall be through maximum 12 feet 3/8" OD (0.065" wall) rigid tubing.

3.8.2 All fittings utilized between hydraulic supply cart and choke shall be full-bore.

3.8.3 Quick-connect couplers shall not be utilized.

3.8.4 The hydraulic supply shall be plumbed into the body (through the subsea-sea mateable connectors).

3.8.5 Hydraulic supply cart shall be plumbed to accommodate both supply flows of standard Cv=0.15 and Cv=0.54. Flow of Cv=0.54 shall be used for test in section 8.0 only, all other sections shall use standard Cv=0.15.

4.0 ACTUATOR TEST DURING ASSEMBLY

4.1 Verify the performance of the actuator check valves prior to actuator assembly. The check valves are to release between 21 psig and 29 psig, and to reset above 17 psig. **(SR)**

4.2 Pressure test housing per PS 01-R-006. **(SR)**

4.3 SL Actuator Pawl Spring Force Measurement and Pawl Setting Procedure Steps: **(SR)**

4.3.1 Assemble drive rings complete with pawls and springs.

4.3.2 Mark drive rings clearly to ensure that it is clear in which side of the actuator the drive ring will be installed.

4.3.3 Measure the pawl spring force in accordance with FAT 08-003 and record the results in Appendix II. **(SR)**

4.3.4 Ensure that the springs sit correctly in the drive rings and that the ends sit evenly in the slot in the drive ring. Both ends of the springs should protrude past the spring pin by at least .125". **(SR)**

4.3.5 Ensure that the drive rings are assembled in the correct position as specified above. **(SR)**

4.3.6 Set the pawl stops using the "wire method" per Section 4.0 of PS 01-R-005.

4.3.7 Assemble flow collar to stem, verifying that in the fully open position the flow collar bottoms out on the balance sleeve or bonnet before the stem bottoms out on the stem nut. **(SR)**

4.4 Piston Spring Return Test;

4.4.1 Prior to each test run, cycle the actuator two steps in both directions to verify the correct operation of the ratchet mechanism.

4.4.2 Use the hand pump to fully extend the open piston.

4.4.3 Ensure the piston is fully retracted with a **175 psig** minimum back pressure. Record the back pressure. **(SR)**

4.4.4 Repeat steps 4.4.1 – 4.4.3 for the close piston. **(SR)**

4.5 Complete assembly of the actuator and verify orientation of actuator and all accessories as per interface drawing **52211-B03-01-0**. **(SR)**

4.6 After the check valves are assembled into the actuator housing, confirm the release pressure of the housing assembly is between 50 psig and 100 psig. **(SR)**

4.7 Assemble actuator override and position indicator assembly. Ensure drive stem cover is centered and seals are lubricated. Verify override location per interface drawing **52211-B03-01-0**. **(SR)**

4.8 Verify that local position indicator moves within two steps of direction change of actuator. **(SR)**

4.9 Using a multi-meter, perform a resistance check on the LVDT by testing each pin of the electrical connector to the actuator housing. Ensure that no short circuit exists. **(SR)**

4.10 Close valve utilizing **5,000** psig effective pressure through the actuator. Calibrate position transmitter with **24** volt D.C. supply, connected per position transmitter connection detail in interface drawing **52211-B03-01-0**, at full closed position and check at full open. Transmitter reading at full closed position shall be 4.00 mA ± (output range over nominal choke travel (**16.00** mA)/number of steps for nominal choke travel (**160**)), which is equivalent to **4.00** mA ± **0.10** mA. **(SR)**

4.11 Pour fill the actuator housing with **Mobilgear 600 XP 68**. Final vacuum oil fill the actuator housing per PS-01-R-003 prior to the oil fill verification test in Section 11.0. **(SR)**

4.12 Perform electrical continuity test between the following and record the results below. Record the maximum resistance. This should be ≤ 0.1Ω. **(SR)**

- ROV Override Bucket and Bonnet
- ROV Override Drive Shaft and Bonnet
- Local Indicator Shaft and Bonnet
- Electrical Connector Housing and Bonnet

4.13 Prepare test body.

4.14 Mount running tool guide funnel onto test body.

4.15 Pick up choke insert from transportation body with Master Flo Valve Master running tool or a running tool which has passed FAT PS-02-O-005. Align CIRT orientation indicator line with an extreme corner of the CIRT orientation marked capture range on the funnel and lower insert into choke body. Verify that the initial and final landing marks on the funnel correspond with the markings on the running tool. Verify that running tool does not bind as it enters and exits the funnel. Repeat on the opposite extreme corner. **(SR)**

4.16 With running tool still engaged to insert, make up insert clamp connector with a torque of **2,500** ft-lb (**3400** Nm) (Torque wrench set at **135** ft-lb (**183** Nm) and a multiplier efficiency of 18.5:1). Record make-up torque, range is **2,500 – 3,000** ft-lb (**3400 - 4080** Nm), and number of turns required. Verify that the alignment marks for the clamp align at both the open and closed positions. **(SR)**

4.17 Ensuring that the clamp is not backed off more than 1/2 a turn, measure and record the clamp break-out torque. The torque should be less than recorded in Section 4.16. Make-up the clamp again to the torque recorded in Section 4.16. Note: At no time during this section is the clamp to be released/reversed more than 1/2 a turn. **(SR)**

4.18 Raise running tool from insert. Align CIRT orientation indicator line with an extreme corner of the CIRT orientation marked capture range on the funnel and lower running tool into choke funnel. Verify that the initial and final landing marks on the funnel correspond with the markings on the running tool. Verify that the running tool engages properly and does not bind when entering the funnel. Repeat on the opposite extreme corner of the CIRT orientation marked capture range. **(SR)**

4.19 With the insert in the body and clamped and with the funnel attached, perform electrical continuity test between the following and record the results below: This should be ≤ 0.1Ω. **(SR)**

ROV Override Shaft and Body Inlet Bore
Drive Shaft and Clamp ROV Override Bucket
ROV Override Shaft and Clamp Drive Shaft
Clamp Drive Shaft and All 4 Clamp Pins

5.0 BODY SHELL AND SEAT TESTS:

5.1 Mount the valve on hydrotest rack.

5.2 Ensure that the choke inlet is not facing the front wall of the test bay.

5.3 With the valve in the partially open position, shell test the choke body at **22,500** psig. Test procedure and acceptance criteria shall be as per PS-01-A-005 Section 6.0. **(SR)**

5.4 Fully close the valve using **4,500 psig** hydraulic control pressure. Ensure that the LVDT reading is the same as that obtained in Section 4.10. **(SR)**

5.5 Pressurize the valve to **16,500** psig hydrostatic from upstream side and monitor the through-valve leakage for 3 minutes minimum. The seat test criterion is per F.C.I. 70-2 2003 Class V Type B which allows a rate of **89.7** mL over 3 minutes. (The maximum allowable leakage of each seat closure shall be 5 x 10-4 ml/min of liquid per inch of seat diameter per psi differential test pressure). Vent all pressure. **(SR)**

6.0 CHOKE VALVE AND ACTUATOR OPERATION TEST:

6.1 Tests at Zero Bore Pressure.

6.1.1 With zero pressure in the valve, operate 3 complete cycles using the manual override drive. Running torque is not to exceed **50** ft-lbs (**68** Nm). Check local calibration indicator and ensure correct readings. Operation shall be smooth throughout. Record torques required and the number of turns during each cycle. **(SR).**

6.1.2 Repeat 6.1.1 using hydraulic supply of **4,500** psig to step the actuator. Count and record the number of steps required from full close to full open. Steps are to be counted for all full steps plus the partial steps at the ends of the choke travel. Once the partial step occurs, no further counting will occur. Once the partial step occurs, step the actuator an additional **5** times with **5,000** psig hydraulic pressure (do not count these steps). Verify that the valve reverses from the end of travel with **4,500** psig maximum hydraulic pressure (ensure to count this step). Acceptance criteria = **160** steps ± **5** steps. Record minimum hydraulic pressure required to operate actuator in each direction. **(SR)**

6.1.3 Verify that the hydraulic port labels are installed and are correct. **(SR)**

6.2 Tests at **15,000** psig Bore Pressure.

6.2.1 At **15,000** psig valve pressure, use the actuator mechanical override to cycle the valve through 5 complete cycles. Check local calibration indicator and ensure correct readings. Operation shall be smooth throughout. Running torque is not to exceed **500** ft-lbs (**677** Nm). Ensure actuator retains choke position in "fail in last position". i.e. no backdriving. **(SR)**

6.2.2 Repeat 6.2.1 using hydraulic supply to step the actuator. Record minimum hydraulic pressures required to step actuator in each cycle. Pressure is not to exceed **4,500** psig. **(SR)**

6.2.3 Vent all pressure.

Note: Ensure valve is in partially open position prior to depressurization.

7.0 POSITION TRANSMITTER READING

Valve pressure is to be maintained at no less than **5,000** psig, but not greater than working pressure of valve, while transmitter readings are measured.

Variable definition

a	=	output at choke closed position (zero steps)
b	=	output at choke nominal travel ('n' steps)
x	=	number of actuator steps from closed position that reading is taken at
g	=	output at x = 5 steps
f	=	output at x = n/2 steps
h	=	output at x = (n - 5) steps
r	=	output range over nominal choke travel **(16.00 mA)**
n	=	number of actuator steps for nominal choke travel **(160)**

7.1 Transmitter calibration check:

The "transmitter calibration check" is required to ensure correct calibration of transmitter feedback.

7.1.1 Close choke utilizing **5,000** psig effective actuator pressure and record transmitter reading as reading 'a'. Ensure reading is: **4.00** mA ± **0.10** mA. Set local indicator at the close position "S". **(SR)**

7.1.2 Open choke 5 steps from closed position utilizing actuator. Record transmitter reading as reading 'g'. **(SR)**

7.1.3 Open choke to 50% nominal travel (n/2). Record transmitter reading as 'f'. Record local indicator reading. **(SR)**

7.1.4 Open choke 'n - 5' steps from closed position utilizing actuator. Record transmitter reading as reading 'h'. **(SR)**

7.1.5 Open choke 'n' steps from closed position utilizing actuator. Record transmitter reading as reading 'b'. Record local indicator reading. **(SR)**

7.1.6 Ensure reading is: **20.00** mA ± **0.26** mA. **(SR)**

7.1.7 Open choke to open travel stop utilizing actuator. Record transmitter reading and local indicator reading. **(SR)**

7.2 Transmitter output check (if applicable)

The transmitter output at any choke position can be checked if required by the work order or as a check on the transmitter output throughout the choke travel by utilizing the following formula. This formula can be utilized for any choke position excluding the full closed (x = 0) and full open position assuming that the transmitter calibration check has been performed and the transmitter is calibrated correctly.

Transmitter Output at X Steps from Closed =

$[g + (x - 5) * ((h - g)/(n - 10))] \pm [(n* ((h - g) / (n - 10)) / 100]$

7.3 Vent all pressure.

Note: Ensure valve is in partially open position prior to depressurization.

8.0 Stepping Test

8.1 Ensure hydraulic supply flow is controlled to Cv= **0.54**. With zero pressure in the choke, operate one complete cycle using hydraulic supply of **5,000** psig to the actuator. Monitor stepping to ensure no skipping is observed in either direction. Partial steps at the ends of choke travel are acceptable. **(SR)**

9.0 Cylinder Test

9.1 With the crossover connections installed on the double acting cylinders, pressurize open side hydraulic cylinder to **1,000** psig and hold pressure for 3 min. Record initial and final pressures. Increase pressure to **5,000** psig and repeat procedure. **(SR)**

9.2 Pressurize close side hydraulic cylinder to **1,000** psig and hold pressure for 3 minutes. Record initial and final pressures. Increase pressure to **5,000** psig and repeat procedure. **(SR)**

9.3 Ensure that the containment shroud is in place.

9.4 Hydrotest entire hydraulic circuit (open and closed cylinders simultaneously) at **8,250** psig for 15 minutes. Depressurize and record initial and final pressures. Re-pressurize to **8,250** psig and repeat procedure. Acceptance criteria shall be per PS-01-S-A-005 Section 6.4. **(SR)**

10.0 GAS TEST – API 6A PSL 3G:

10.1 Remove valve from hydrotest rack. With the valve set up for gas test, immerse in test tank. Ensure valve is partially open. Valve pressure is to be brought up gradually with all personnel well clear of tank.

10.2 Gas test the choke at **15,000** psig. Test procedure and acceptance criteria shall be per PS-01-A-005 Section 7.0. **(SR)**

11.0 OIL FILL VERIFICATION TEST:

11.1 Prior to performing the oil fill verification test in Section 11.2 below, an oil fill per **PS-01-R-003** must be completed. The oil fill per **PS-01-R-003** may be completed at any time after step 4.11 but prior to step 11.2. **(SR)**

11.2 Complete the oil fill verification test per **PS-01-R-009**. The acceptance criteria shall be per the latest version of the calculator referenced in **PS-01-R-009**. During the test, verify the oil does not eject from the check valve assembly. **(SR)**

12.0 FINAL POSITION VERFICATION

12.1 Ensure that the valve is moved to fully closed prior to shipping. **(SR)**

13.0 HYDRAULIC SYSTEM FLUSHING

13.1 Flush the actuator hydraulic lines and cylinders in accordance with PS 01-A-009. Flushing fluid shall be **MARSTON BENTLEY HW 443**. Cleanliness level shall be to SAE AS4059 Class 6B-F. **(SR)**

APPENDICES

APPENDIX I Test Review and Data Recorded

Table Ia Serial Numbers

			Work Order No	53749
3.6	**HRV Serial No**	HRV-865	**ROT Serial No**	ROT-3873
3.6	**Part Number**	42005-011-01		
3.6	**Description**	7 35 15k Choke Valve.		
3.6	**Actuator Working Pressure**	5000psi	**Choke Working Pressure**	15000 psi
3.7	**Running Tool Guide Cage Part No.**		**Running Tool Guide Cage Serial No.**	

Table Ib Completed Test Sign Off and Data Collection

Sect	Test					Completed by Date	QA Review Date	Customer Witness Date
3.3	Hydraulic Fluid Confirmed **MARSTON BENTLEY HW 443**					31 AUG/10 JOHN F	SSM Sep 9/10	
4.1	Inner Check Valve Release, Reset, and Reverse					31 AUG/10 JOHN F	SSM Sep 9/10	
	Release (21-29 psig)	Reset (≥ 17psig)						
	27	24						
4.1	Outer Check Valve Release and Reset					31 AUG/10 JOHN F		
	Release (21-29 psig)	Reset (≥ 17psig)						
	28	26						
4.2	Housing Pressure Test					31 AUG/10 JOHN F		
4.3.3	Pawl Spring Force Measurement (3.75 lb-f min)					AUG 25/10 JW		
	Close lb-f	4.8	Open lb-f	5.0				
4.3.4	Pawl springs sit correctly, end protrude by .125"					AUG 25/10 JW		
4.3.5	Drive Rings assembled in correct location					AUG 25/10 JW		
4.3.7	Flow collar bottoms out on balance sleeve or bonnet.					31 AUG/10 JOHN F		
4.4.3	Open Piston Fully Retracted at **175** psig (min) back pressure		Pressure	195		31 AUG/10 JOHN F		
4.4.4	Closed Piston Fully Retracted at **175** psig (min) back pressure		Pressure	190		31 AUG/10 JOHN F		
4.5	Verification of correct orientation					31 AUG/10 JOHN F		
4.6	Check valve release pressure 50 - 100 psig					31 AUG/10 JOHN F		
4.7	Override Location Verified					31 AUG/10 JOHN F		
4.8	Local position indicator moves within two steps of direction change					31 AUG/10 JOHN F		
4.9	LVDT Short Circuit Test					31 AUG/10 JOHN F	SSM Sep 9/10	
4.10	Fully Closed LVDT Reading 4.00 +/-.**10** mA				4.04 mA	31 AUG/10 JOHN F	SSM Sep 9/10	

Sect	Test	Completed by Date	QA Review Date	Customer Witness Date
4.11	Actuator Oil Fill with Mobilgear 600 XP68	31 AUG/10 JOINT E		
4.12	Electrical Continuity Test (Resistance ≤ 0.1Ω)	9-03-10 T.C		
	ROV Override Bucket and Bonnet:	9-03-10 T.C		
	ROV Override Drive Shaft and Bonnet	9-03-10 T.C		
	Local Indicator Shaft and Bonnet	9-03-10 T.C		
	Electrical Connector Housing and Bonnet	9-03-10 T.C		
4.15	Running Tool Interface Verification			
	Proper Insertion of Insert into Test Body:	9-07-10 T.C		
	Verification of Orientation marking range:	9-07-10 T.C		
	Verification of Initial and Final Landing Markings:	9-07-10 T.C		
4.16	HRV Clamp Make Up	9-07-10 T.C		
	Torque (**2500 - 3000** lb-f ft / **3400 - 4080** Nm) 2516	9-07-10 T.C	SSM Sep 9/10	
	Turns 35 1/2 Alignment Marks Verified ✓	9-07-10 T.C	SSM Sep 9/10	
4.17	Clamp Break Out Torque 1147 lb-f ft	9-07-10 T.C		
4.18	CIRT Verification			
	Verification of Initial and Final Landing Markings	9-09-10 T.C		
	Proper Engagement of Running Tool	9-09-10 T.C		
4.19	Electrical Continuity Test (Resistance ≤ 0.1Ω)	9-07-10 T.C		
	ROV Override Shaft and Body Inlet Bore	9-07-10 T.C		
	Drive Shaft and the Clamp ROV Bucket	9-07-10 T.C		
	ROV Override Shaft and Clamp Drive Shaft	9-07-10 T.C		
	Clamp Drive Shaft and All 4 Clamp Pins:	9-07-10 T.C		
5.3	Body hydrostatic shell test	9-08-10 T.C	SSM Sep 9/10	
5.4	Verification of LVDT reading at closed 4.01 mA	9-08-10 T.C	SSM Sep 9/10	
5.5	Seat Test (**16,500** psig x **89.7** ml in **3** minutes)	9-08-10 T.C	SSM Sep 9/10	
	Leakage 2 ml Time 3 min	9-08-10 T.C	SSM Sep 9/10	

6.1.1	Manual Override Test at Zero Bore Pressure	Completed by Date	QA Review Date	Customer Witness Date
		9-08-10 T.C	SSM Sep 9/10	

Cycle No	Choke Pressure	Torque Required to Initiate Movement (Max **600** ft-lb **816** Nm)		Running Torque Required (Max **50** ft-lb **68** Nm)		Verification Choke Moved Smoothly and Without Backdriving Within Specified Torque Limit		
		Close Choke	Open Choke	Close Choke	Open Choke	During Opening	During Closing	No Turns
1	Atmospheric	32	20	28	15	✓	✓	16
2	Atmospheric	30	28	25	23	✓	✓	16
3	Atmospheric	22	20	17	15	✓	✓	16

6.1.2	Hydraulic Stepping Test At Zero Bore Pressure	Completed by Date	QA Review Date	Customer Witness Date
		9-08-10 T.C	SSM Sep 9/10	

Cycle No	Choke Pressure	Minimum Hydraulic Pressure Required (Max **4,500** psig)		Verification Choke Moved Smoothly and Without Backdriving		Choke Reversed Properly	
		Close Choke	Open Choke	During Opening	During Closing	After Opening	After Closing
1	Atmospheric	480	360	✓	✓	✓	✓
2	Atmospheric	480	380	✓	✓	✓	✓
3	Atmospheric	480	380	✓	✓	✓	✓
	Number of Steps Open to Close (**160 +/- 5** steps)		160				
6.1.3	Hydraulic Ports Verified		N/A				

6.2.1	Manual Override Test at Working Pressure	Completed by Date	QA Review Date	Customer Witness Date
		9-08-10 T.C	SSM Sep 9/10	

Cycle No	Choke Pressure	Torque Required to Initiate Movement (Max **600** ft-lb **816** Nm)		Running Torque Required (Max **500** ft-lb **677** Nm)		Verification Choke Moved Smoothly and Without Backdriving Within Specified Torque Limit		
		Close Choke	Open Choke	Close Choke	Open Choke	During Opening	During Closing	No Backdriving
20% 1	Working Pressure	310	190	~~400~~ 300	180	✓	✓	✓
40% 2	Working Pressure	360	220	350	210	✓	✓	✓
50% 3	Working Pressure	380	170	370	160	✓	✓	✓
60% 4	Working Pressure	280	120	270	110	✓	✓	✓
5	Working Pressure	320	155	310	145	✓	✓	✓

6.2.2	Hydraulic Stepping Test At Working Pressure	Completed by Date	QA Review Date	Customer Witness Date
		9-08-10 T.C	Sep 9/10 SSM	

Cycle No	Choke Pressure	Minimum Hydraulic Pressure Required (Max **4,500** psig)		Verification Choke Moved Smoothly and Without Backdriving		Choke Reversed Properly	
		Close Choke	Open Choke	During Opening	During Closing	After Opening	After Closing
1	Working Pressure	2650	1400	✓	✓	✓	✓
2	Working Pressure	2600	1250	✓	✓	✓	✓
3	Working Pressure	3050	1750	✓	✓	✓	✓
4	Working Pressure	2850	1300	✓	✓	✓	✓
5	Working Pressure	3000	1600	✓	✓	✓	✓

7.1	Transmitter Calibration Check	Completed by Date	QA Review Date	Customer Witness Date
		9-08-10 T.C	SSM Sep 9/10	

Test Supply Voltage		24 VDC	Local Indicator
Transmitter Signal at Fully Closed (4.00 +/- **0.10** mA)	**a =**	4.03 mA	0%
Transmitter Signal at 'x' = 5 Steps from Closed	**g =**	4.45 mA	
Transmitter Signal at 'x' – n/2 Steps from Closed	**f =**	18.65 mA	90%
Transmitter Signal at 'x' = n-5 Steps from Closed	**h =**	19.15 mA	
Transmitter Signal at 'x' = n Steps from Closed (20.00 +/- **0.26** mA)	**b =**	19.92 mA	100%
Transmitter Signal at Fully Open -		19.92 mA	

7.2	Transmitter Output Check	Completed by Date	QA Review Date	Customer Witness Date
		9-08-10 T.C	SSM Sep 9/10	

Transmitter Output at X steps from closed = g +[(x - 5) * ((h - g)/(n - 10))] ± [(n* ((h - g) / (n - 10)) / 100]				**X =**	5	steps	
Calculated Output at X	4.45	mA	Measured Output at X		4.45	mA	

8.1	Stepping Test – 5000 psig Supply	Completed by Date	QA Review Date	Customer Witness Date
		9-08-10 TC	SSM Sep 9/10	

9.0	Hydraulic Cylinder Test	Completed by Date	QA Review Date	Customer Witness Date
		OB 09/07/10	SSM Sep9/10	

Test Pressure	Open Cylinder		Closed Cylinder		Hydraulic Circuit Test	
	Start Pressure	End Pressure	Start Pressure	End Pressure	Start Pressure	End Pressure
1,000 psig	1,040	1,040	1,040	1,040		
5,000 psig	5,160	5,160	5,260	5,260	① 8,420	8,420
8,250 psig					② 8,440	8,490

10.2	Gas Test	Completed by Date	QA Review Date	Customer Witness Date
		9-08-10 T.C	SSM Sep9/10	

		Completed by Date	QA Review Date	Customer Witness Date
11.1	Oil Fill per PS-01-R-003	9-08-10 OB	SSM Sep9/10	
11.2	Oil Fill Verification Test 1.2	9-08-10 OB	SSM Sep9/10	

Choke Size	P35	Oil Type	Mobil Gear XP 68	Stem Sealing Dia	1.375	Threads Per Inch	6
Initial Volume V_i	390	Final Volume V_f	365	Number of turns N		9	
Oil Ejection	NO	Pressure Reading Pg	30	Depth Rating from Calculator (Must Exceed 10,000 feet)		11318	

12.1	Final Position Verified (Fully Closed)	Completed by Date	QA Review Date	Customer Witness Date
		9-08-10 T.C	SSM Sep9/10	

13.1	Actuator Hydraulic Circuit Flushed to SAE AS4059 Class 6B-F	Completed by Date	QA Review Date	Customer Witness Date
		9-08-10 OB	SSM Sep9/10	

Comments

QA Review	Sandra Mahmud
Engineering Review	Jim Kirk Sep 10/2010
Customer Witness	

TITLE: REVISION RECORD

REVISION	DATE	DESCRIPTION	PREPARED	APPROVED
0	08/10	Initial Approval	JK	Peter Brzezicki

MASTER FLO™ FACTORY ACCEPTANCE TEST PROCEDURE	FAT 08-003
	PAGE: 3 OF 5
	DATE: JAN 18, 2008
	REVISION: B (09/08)
TITLE: FAT TO MEASURE PAWL SPRING FORCES AS INSTALLED IN DRIVE RING FOR SL SERIES SUBSEA ACTUATORS .	

Appendix 1: Test Summary and Data

Actuator Data

Work Order No.	53749	Pawl Spring Part Number	27031-001
Actuator Serial No.	ROT-3873	Choke Serial No.	
Part Number	27389	HRV Number	HRV-865

Test Check List

Sect	Test	Conducted By and Date	3rd Party Sign and Date
3.2	Drive Ring Assemblies Clearly Labelled	Aug 25/10 G.W	
3.3	Spring Leg Protrusion Verified (.125" minimum)	Aug 25/10 G.W	
3.7	Spring Force Measured (3.75 lbf minimum)	Aug 25/10 G.W	
3.10	Data Record Complete	Aug 25/10 G.W	

Data Collection Table

Sect	Description	Side	Force (lbf)		
3.7	Spring Force Measured	OPEN	5.0	5.0	5.0
3.9	Spring Force Measured	CLOSE	4.8	4.8	4.8

Comments:

NOTE: Attach this completed form to the work order

1 HOUR

45 MIN.

15 MIN.

30 MIN.

FAT 9.0

MASTER FLO VALVE INC.

Close Cylinder

WO # 53749

DATE SEPT. 07/10

TESTED BY O.B.

TEST EQUIP # 2769

WITNESSED BY

SERIAL # HRV-865

ROT-3873

CUSTOMER PO #

CUSTOMER Newfield

HYDRO STATIC TEST CHARTS

P2000-1HR-MF

MADE IN CANADA

MINUTES

60 5 10 15 20 25 30 35 40 45 50 55

PRESSURE (p.s.i.)

1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 11000 12000 13000 14000

START

3 min. END

FAT 9.0

MASTER FLO VALVE INC.

Close Cylinder

W.O. # 53749

DATE SEPT. 07/10

TESTED BY C.B.

TEST EQUIP. # 2096

WITNESSED BY

SERIAL # HRV-865 R07-3873

CUSTOMER P.O. #

CUSTOMER NewField

HYDROSTATIC TEST CHARTS

P15000--1HR-MF

MINUTES

60 55 50 45 40 35 30 25 20 15 10 5

START

15 minutes

END

PRESSURE (p.s.i.)

1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 11000 12000 13000 14000

FAT 9.0

MASTER FLO VALVE INC.

Complete System

W.O. # 53749

WITNESSED BY

SERIAL # HRV-865 ROT-3873

DATE SEPT. 07/10

CUSTOMER P.O. #

TESTED BY O.B.

CUSTOMER Newfield

TEST EQUIP. # 2096

HYDROSTATIC TEST CHARTS

P15000--1HR-MF

MINUTES

60 55 50 45 40 35 30 25 20 15 10 5

PRESSURE (p.s.i.)

1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 11000 12000 13000 14000

START

15 minutes

END

FAT 9.0

@ Complete System

MASTER VALVE INC.

WITNESSED BY

W.O. # 537-49

SERIAL # HRV-865

DATE SEPT. 07/10

CUSTOMER P.O. # ROT-3873

TESTED BY O. B.

CUSTOMER Newfield

TEST EQUIP. # 2096

HYDROSTATIC TEST CHARTS

P15000--1HR-MF

1 HOUR

15 MIN.

30 MIN.

45 MIN.

FAT 9.0

MASTER FLO VALVE INC.

Open Cylinder

WO # 53749	WITNESSED BY
DATE SEPT. 07/10	SERIAL # HRV-865
TESTED BY O.B.	CUSTOMER PO # RQT-3873
TEST EQUIP # 2769	CUSTOMER Newfield

HYDRO STATIC TEST CHARTS

P2000-1HR-MF

START

END

Burst

MADE IN CANADA

FAT 9.0

MASTER FLO VALVE INC.

Open Cylinder

W.O. # 53749	WITNESSED BY
DATE SEPT. 07/10	SERIAL # HRV-865
TESTED BY O.B.	RDT-3873
TEST EQUIP. # ~~2369~~ 3096	CUSTOMER P.O. #
	CUSTOMER Newfield

HYDROSTATIC TEST CHARTS

P15000--1HR-MF

MINUTES

PRESSURE (p.s.i.)

1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 11000 12000 13000 14000

60 5 10 15 20 25 30 35 40 45 50 55

6000 PSI 3 min. END

FAT 5.3

MASTER FLO VALVE INC.

3 min shell test

W.O. # 53749	WITNESSED BY
DATE 9-08-10	SERIAL # HRV-865
TESTED BY Time ~~9-08-10~~	CUSTOMER P.O. #
TEST EQUIP. # 1016	CUSTOMER Newfield Exploration

HYDROSTATIC TEST CHARTS

P30000--1HR-MF

MINUTES

PRESSURE (p.s.i.)

60 55 50 45 40 35 30 25 20 15 10 5

2000 4000 6000 8000 10000 12000 14000 16000 18000 20000 22000 24000 26000 28000

finish

start

FAT 5.3

MASTER FLO VALVE INC.

15 min shell Test

W.O. # 537489	WITNESSED BY
DATE 9-08-10	SERIAL # HRV-865
TESTED BY TimC	CUSTOMER P.O. #
TEST EQUIP. # 1016	CUSTOMER Newfield Exploration

HYDROSTATIC TEST CHARTS

P30000--1HR-MF

MINUTES

PRESSURE (p.s.i.)

MINUTES

60 55 50 45 40 35 30 25 20 15 10 5

PRESSURE (p.s.i.)

28000 26000 24000 22000 20000 18000 16000 14000 12000 10000 8000 6000 4000 2000

FAT 5.5

MASTER FLO VALVE INC.

3 min Start Test

W.O. # 53749

DATE 9-08-10

TESTED BY Tim C

TEST EQUIP. # 1016

WITNESSED BY

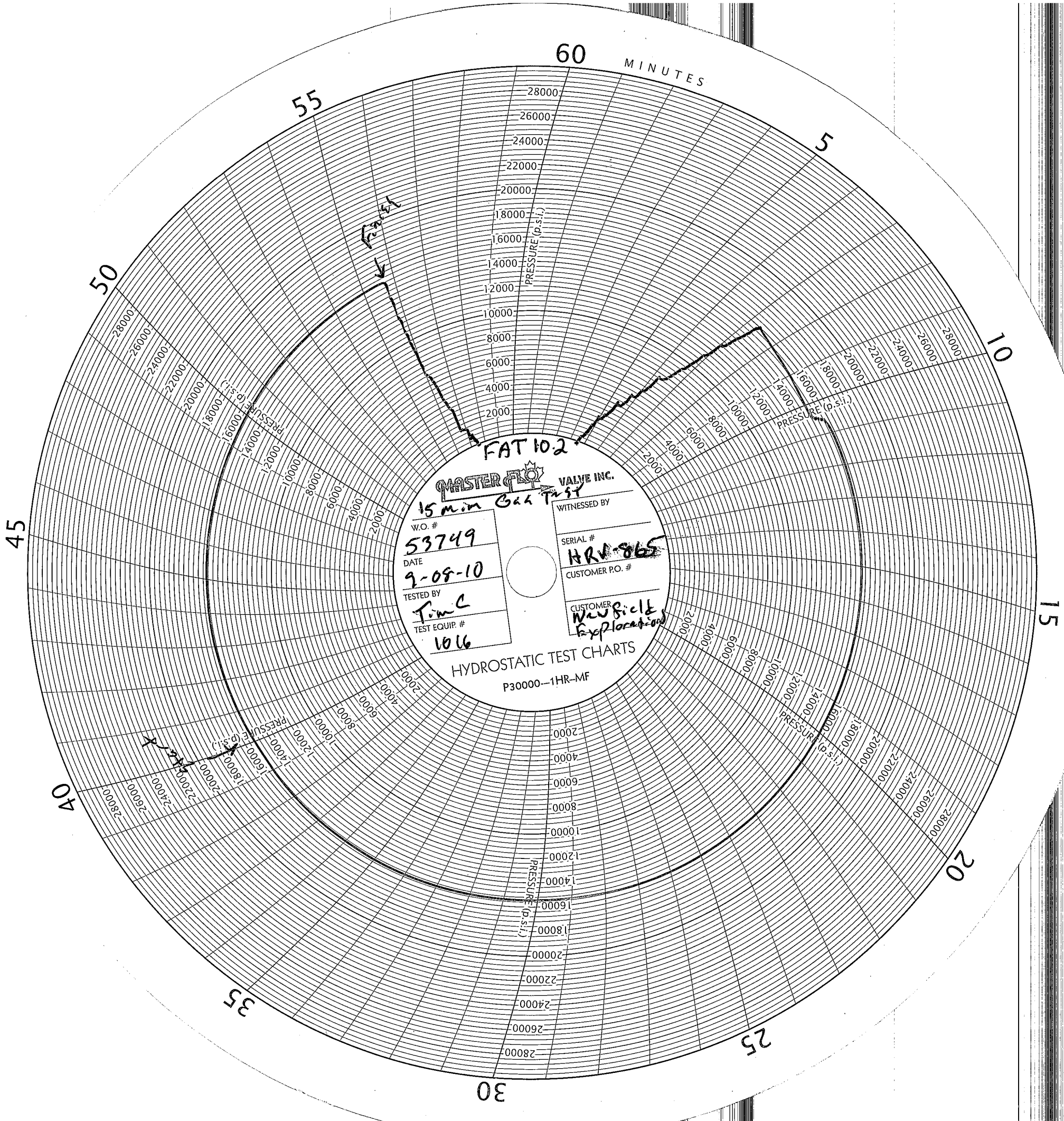
SERIAL # HRV-865

CUSTOMER P.O. #

CUSTOMER Newfield Exploration

HYDROSTATIC TEST CHARTS

P30000---1HR-MF


60
MINUTES
55
5
50
10
45
15
40
20
35
25
30
PRESSURE (p.s.i.)
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
FAT 10.2
MASTER FLO VALVE INC.
15 min Gas Test
W.O. # 53749
DATE 9-08-10
TESTED BY Tim C
TEST EQUIP. # 1016
WITNESSED BY
SERIAL # HRV-865
CUSTOMER P.O. #
CUSTOMER Newfield Exploration
HYDROSTATIC TEST CHARTS
P30000--1HR-MF

Form 1: Fluid Evaluation Report

Date: Sept. 08/10 Customer: Newfield Exploration

Act Serial No: ROT-3873 WO No: 53749

Valve Serial No: HRV-865 Hydraulic Fluid: HW 443

PARKER LCM20
S/N JX.84027.L

ON LINE TEST

TEST NUMBER 018
WO-53749 ROT3873
HRV-865 HW-443

	D M Y
Date	08-09-10
Time	18-06
~~NAS~~ CLASS	6(c)

SAE AS4059

Count/100ml

4/6µ	185136
6/14µ	10057
NAS CLASS	6(c)
14/21µ	71
NAS CLASS	1(c)
21/38µ	14
NAS CLASS	1(c)
38/70µ	0
>70µCLAS	0
NAS CLASS	00
NOTES	

O.B.

PARKER LCM20
S/N JX.84027.L

ON LINE TEST

TEST NUMBER 019
WO-53749 ROT3873
HRV-865 HW-443

	D M Y
Date	08-09-10
Time	18-21
~~NAS~~ CLASS	5(c)

SAE AS4059

Count/100ml

4/6µ	104421
6/14µ	7150
NAS CLASS	5(c)
14/21µ	50
NAS CLASS	1(c)
21/38µ	14
NAS CLASS	1(c)
38/70µ	0
>70µCLAS	0
NAS CLASS	00
NOTES	

O.B.

PARKER LCM20
S/N JX.84027.L

ON LINE TEST

TEST NUMBER 020
WO-53749 ROT3873
HRV-865 HW-443

	D M Y
Date	08-09-10
Time	18-35
~~NAS~~ CLASS	5(c)

SAE AS4059

Count/100ml

4/6µ	78778
6/14µ	5550
NAS CLASS	5(c)
14/21µ	50
NAS CLASS	1(c)
21/38µ	0
38/70µAS	0
>70µCLAS	0
NAS CLASS	00
NOTES	

O.B.

The above sample has been tested to the requirements of SAE AS 4059 with a Hiac Royco ABS2/8000A Particle Analyzer.

Technician: OSCAR B. Date: Sept. 08/10

4.2. Open the latest version of the Master Flo oil verification calculator located in O:\Engineering\Oil Fill Verification, or by double clicking on the following attachment icon when viewing this document from Globalnet. Enter the input numbers into the blue input cells. Ensure all input cells are correct. For field service, ensure that the latest version of the calculator is obtained by one of the above two methods as the calculator may be updated without notice.

4.3. Enter the depth rating obtained from the calculator into the FAT if applicable or in Table 2 below. Note: if not specified in the FAT, use the depth rating from Row "C" of the calculator. Enter the version number of the oil verification calculator used.

4.4. Obtain Q.A. Review. If Tables below are used, attach to the FAT.

SECTION	REF SECTION	RESULT	UNITS
4.5. Choke Stem sealing diameter	N/A	1.375	[in²]
4.6. Choke Stem thread pitch	N/A	6	[TPI]
4.7. Initial Volume in graduated cylinder, V_i	Section 3.7	390	[mL]
4.8. Final Volume in graduated cylinder, V_f	Section 3.8	365	[mL]
4.9. Number of turns to the nearest tenth, N	Section 3.10	9	[-]
4.10. Pressure reading, P_g	Section 3.10	30	[PSI]
4.11. Ambient temperature at oil fill	Section 3.11	70	°F

Table 1: Input Values

SECTION	OIL VERIFICATION CALCULATOR VERSION NO.	REF SECTION	RESULT	UNITS
4.12. Depth Rating	1.2	Depth calculator Row "C"	11,318	[ft]

Table 2: Depth Rating

Acceptance Criteria: Min. 10,000 ft. unless otherwise specified on the FAT.

Q.A. Reviewl: SSM Date: Sep 9/10

	Mobilgear 600 XP68		Oil: Choose from drop down list
	Single		Compensation: Single or Dual bladder
	P35 HRV		Choke Size: Choose from drop down list.
T_{fill}	70	°F	Temperature during actuator oil fill
d	1.375	in	Choke Stem Diameter. Choose from drop down list. Consult Engineering if unsure
tpi	6		Choke Stem Threads Per Inch. Choose from drop down list. Consult Engineering if unsure.
V_i	390	mL	Initial graduated cylinder reading (with vaccum)
V_f	365	mL	Final graduated cylinder reading (atmospheric)
N	9		Number of turns to reach pressure P_g
P_g	30	PSI	Pressure after N turns

μ	0.0004	(vol/vol)/°F	Oil Thermal Expansion
V_{max}	28.88	in^3	Maximum Bladder Volume
V_{act}	460	in^3	Total Actuator Internal Void Volume
	2.66	in	Choke travel
	3.95	in^3	Choke stem swept volume
V_b	25	mL	Bladder volume used with choke closed (mL)
V_{bin}	1.53	in^3	Bladder volume used with choke closed in (in^3)
V_{air}	3.32	in^3	Volume of Trapped air in Actuator

C	11318	Depth rating: 150°F Storage temp with choke fully closed
D	6254	Depth rating: 150°F Storage temp with choke fully open
	150	Temperature rating of the actuator subsea

MASTER FLO VALVE INC.
Head Office
4611 - 74 Avenue
Edmonton, Alberta
Canada, T6B 2H5

PAINTING PROCEDURE

MASTER FLO	PS NO. 04-A-004
PRODUCTION STANDARD	DATE: Nov 25, 1998
	REVISION: I (11/08)

TITLE: PAINT PROCEDURE FOR IMMERSION SERVICE – NON INSULATED

1.0 SCOPE:

This specification covers the surface preparation and coating of all Master Flo products intended for immersion service. The maximum rated temperature on the exterior of the choke for this paint system is 140°F (60°C) in an immersed environment and 250°F (121°C) in a non-immersed environment. This paint system is not intended for use with thermal insulation.

2.0 GENERAL REQUIREMENTS:

2.1 Painted coatings shall be of a high build Epoxy Mastic type.
2.2 The final color is to be White unless otherwise specified on work order referenced paint drawings (as applicable).
2.3 Wet film and dry film thickness gauges are to be provided and operated.
2.4 A pressure gauge shall be provided and operated suitable for checking abrasive blasting pressures.
2.5 Suitable air thermometers and a hygrometer shall be provided and operated in order to ensure that the temperatures, relative humidity, and dew point are within the specified parameters during the surface preparation, application, and curing periods.
2.6 Surface preparation shall be carried to SIS 05 59 00. A surface profile comparator and/or a press-o-film micrometer shall be provided and operated to ensure that the surface profile is to the specified standard.

3.0 SURFACE PREPARATION:

3.1 Parts to be painted shall be free of rust, dirt, scale, grease, salt, oil, or other contaminants. Contaminated areas shall be solvent cleaned per SSPC-SP-1 (Society For Protective Coatings).
3.2 Parts are then to be masked to protect machined surfaces, stems and other areas that could be damaged by abrasion. Flange mating faces shall be protected with metal covers to protect internal components and machined faces. Any cleaned surfaces left overnight without coating shall be-blasted before application of coating.
3.3 Pressure containing components (body, bonnets, flange, etc) to be abrasive cleaned to white metal blast per SSPC-SP5 (NACE 1, ISO 8501-1 Sa 3). Surface preparation for other components to be abrasive cleaned to near white metal blast per SSPC-SP10 (NACE 2, ISO 8501-1 Sa 2 1/2). Blast profile to be 40-75 microns. Blasting abrasive will be Aluminum Oxide.
3.4 The compressed air supply used for blasting shall be free of water and oil. Operating pressure at blast nozzle shall be a minimum of 90 psig. Dead-man valve shall be fitted at the blast nozzle.
3.5 If the relative humidity exceeds 85% or surface temperature is within 5°F of the dew point, all blasting shall be suspended.
3.6 Parts shall be cleaned of all dust and sand by brushing, industrial vacuum or blowing with clean, dry, oil-free air.

4.0 APPLICATION INSTRUCTIONS:

4.1 Parts shall be primed within four (4)hours of blasting, and not be allowed to cool within 5°F above dew point during this time.
4.2 The length of the material hose between pressure pot and spray gun shall not exceed 50 feet. The mixed coating shall be continuously stirred by mechanical spray pot agitators or other approved means.
4.2.1 Mixing & applications of paint shall be in accordance with manufacturers recommendations.

4.3 Primer technique shall be applied per section 5.0 and 5.1, including application, temperature, dew point, and proper thinner-to-paint ratio.
4.4 Wet film thickness shall be inspected with a wet film thickness gauge.
4.5 After the primer coat has dried, it shall be inspected with a dry film thickness gauge.
4.6 The high build coat shall be applied after the primer coat has dried, per section 5.0 and 5.1.
4.7 Wet film thickness shall be inspected with a wet film thickness gauge.
4.8 After the high build coat has dried, it shall be inspected with a dry film thickness gauge.
4.9 The finish coat shall be applied after the high build coat has dried, per section 5.
4.10 Wet film thickness shall be inspected with a wet film thickness gauge.
4.11 Total dry film thickness of the three coats shall be inspected

5.0 COATING SPECIFICATIONS:

Master Flo Preferred (Carboline)

COAT	PRIMER	HIGH BUILD	FINISH
TYPE	HIGH BUILD EPOXY MASTIC	HIGH BUILD EPOXY MASTIC	HIGH BUILD EPOXY MASTIC
PAINT NAME	CARBOLINE 890 PTA	CARBOLINE 890 PTA	CARBOLINE 890 PTA
CURING AGENT	CARBOLINE 890 PTB	CARBOLINE 890 PTB	CARBOLINE 890 PTB
VOLUME MIX RATIO (PAINT-TO-CONVERTER)	1:1	1:1	1:1
THINNER	#2	#2	#2
THINNER-TO-PAINT RATIO (MAX.)	10%	10%	10%
MIN. APPLICATION TEMP.	10°C	10°C	10°C
RELATIVE HUMIDITY (MAX.)	85%	85%	85%
WET FILM THICKNESS MIN. MICRONS (MILS) MAX. MICRONS (MILS)	150-225 (6.0-10.0)	150-225 (6.0-10.0)	150-225 (6.0-10.0)
DRY FILM THICKNESS MIN. MICRONS (MILS) MAX. MICRONS (MILS)	100-150 (4.0-6.0)	100-150 (4.0-6.0)	100-150 (4.0-6.0)
MIN. DRY TIME @ 75°F	4 HOURS	4 HOURS	8 HOURS
MAX. TIME BETWEEN COATS	30 DAYS	30 DAYS	30 DAYS
MINIMUM TOTAL DRY FILM THICKNESS, MICRONS (MILS) = 350 (14.0)			

5.1 Coating Specification: Optional (International Paints)

COAT	PRIMER	HIGH BUILD
TYPE	SURFACE TOLERANT EPOXY	SURFACE TOLERANT EPOXY
PAINT NAME	INTERSEAL 670 HS PART A	INTERSEAL 670 HS PART A
CURING AGENT	INTERSEAL 670 HS PART B	INTERSEAL 670 HS PART B
VOLUME MIX RATIO (PAINT-TO-CONVERTER)	5.67 : 1	5.67 : 1
THINNER	INTERNATIONAL GTA 415	INTERNATIONAL GTA 415
THINNER-TO-PAINT RATIO (MAX.)	10%	10%
MIN. APPLICATION TEMP.	10°C	10°C
RELATIVE HUMIDITY (MAX.)	85%	85%
WET FILM THICKNESS MIN. MICRONS (MILS) MAX. MICRONS (MILS)	213(8.5) 244 (9.8)	213 (8.5) 244 (9.8)
DRY FILM THICKNESS MIN. MICRONS (MILS) MAX. MICRONS (MILS)	175 (7.0) 200 (8.0)	175(7.0) 200 (8.0)
MIN. DRY TIME @ 75°F	16 HOURS	16 HOURS
MAX. TIME BETWEEN COATS	14 DAYS	14 DAYS
MINIMUM TOTAL DRY FILM THICKNESS, MICRONS (MILS) = 350 (14.0)		

6.0 CERTIFICATION OF COMPLIANCE:

A Master Flo paint certification stating that parts were painted according to this procedure shall be completed.

PAINT CERTIFICATION

CUSTOMER:		SERIAL NUMBER:	
DESCRIPTION:		QUANTITY:	
WORK ORDER :		DATE:	

1. CLEANING	DATE COMPLETED	
	ACTUAL BLAST PROFILE	
	RELATIVE HUMIDITY	
2. FIRST COAT	DATE APPLIED	
	TEMPERATURE	
	CURING TIME	
	WET THICKNESS	
	DRY THICKNESS	
	BATCH NO./PAINT	
	BATCH NO./THINNER	
3. SECOND COAT	DATE APPLIED	
	TEMPERATURE	
	CURING TIME	
	WET THICKNESS	
	DRY THICKNESS	
	BATCH NO./PAINT	
	BATCH NO./THINNER	
4. THIRD COAT (SYSTEM 5.0)	DATE APPLIED	
	TEMPERATURE	
	CURING TIME	
	WET THICKNESS	
	DRY THICKNESS	
	BATCH NO./PAINT	
	BATCH NO./THINNER	
	FINAL COAT THICKNESS	
	Q.A ACCEPTANCE:	
	DATE:	

TITLE: REVISION RECORD

REVISION	DATE	DESCRIPTION	PREPARED	APPROVED
0	3/98	INITIAL APPROVAL, WAS ES-112	MS	DS
A	11/98	ADD TO 5.0	MS	DS
B	1/99	ADD 4.12, ADD TO TABLE	KM	DS
C	10/00	MODIFIED RATIOS IN SEC 5.1	AB	DS
D	05/08	MODIFIED SECTION 3.1, 3.3, 3.5, 4.1 & 4.12. 5.0 TABLE, MODIFIED DRY FILM THICKNESS & WET FILM THICKNESS. AND REMOVED SECTION 7.0, 7.11 & 7.12	AK	PB
E	05/08	MODIFIED SECTION 5.1 TABLE	AK	PB
F	07/08	MODIFIED TITLE AND SECTION 1.0	AK	PB
G	09/08	REMOVED SECTION 4.12	AK	PB
H	09/08	REMOVED SECTION 5.0 (HOLIDAY TEST) FROM PAINT CERTIFICATION	AK	PB
I	11/08	MODIFIED SECTION 3.3.	AK	***PB***

MASTER FLO VALVE INC.
Head Office
4611 - 74 Avenue
Edmonton, Alberta
Canada, T6B 2H5

PAINT CERTIFICATION

MASTER FLO

PS NO. 04-A-004
DATE: Nov 25, 1998
REVISION: 1 (11/08)

PRODUCTION STANDARD

TITLE: PAINT PROCEDURE FOR IMMERSION SERVICE – NON INSULATED

PAINT CERTIFICATION

CUSTOMER: MFV US / NEWFIELD / MC506 SERIAL NUMBER:
DESCRIPTION: FUNNEL + B. PLATE QUANTITY: 1+1
WORK ORDER: 53749 DATE: SEPT. 1/2010

1. CLEANING	DATE COMPLETED	SEPT. 1/2010
	ACTUAL BLAST PROFILE	2.3 MILS
	RELATIVE HUMIDITY	27%
2. FIRST COAT	DATE APPLIED	SEPT. 1/2010
	TEMPERATURE	20°C
	CURING TIME	4 HOURS
	WET THICKNESS	8-10 MILS
	DRY THICKNESS	4.9-6.1 MILS
	BATCH NO./PAINT	10CD0307B - CARBOLINE 890 YELLOW
	BATCH NO./THINNER	LD0233 UHH3
3. SECOND COAT	DATE APPLIED	SEPT. 1/2010
	TEMPERATURE	20°C
	CURING TIME	4 HOURS
	WET THICKNESS	7-9 MILS
	DRY THICKNESS	4.4-5.6 MILS
	BATCH NO./PAINT	10CD0307B - CARBOLINE 890 YELLOW
	BATCH NO./THINNER	LD0233 UHH3
4. THIRD COAT (SYSTEM 5.0)	DATE APPLIED	SEPT. 2/2010
	TEMPERATURE	20°C
	CURING TIME	8 HOURS
	WET THICKNESS	8-10 MILS
	DRY THICKNESS	4.9-6.1 MILS
	BATCH NO./PAINT	10CD0307B - CARBOLINE 890 YELLOW
	BATCH NO./THINNER	LD2143 UHH3
	FINAL COAT THICKNESS	14.2 – 17.8 MILS
	Q.A ACCEPTANCE:	SSM
	DATE:	Sep 9/10

MARIN

PRESS-O-FILM™ Made in U.S.A.
No. 9-6
Reading 20.7
Gage less 2.0 mils or 50 µm
TESTEX NEWARK, DE 19715 USA
X COARSE (1.5 to 4.5 mils) or (40 to 115 µm)

MASTER FLO

PS NO. 04-A-004

PRODUCTION STANDARD

DATE: Nov 25, 1998

REVISION: 1 (11/08)

TITLE: PAINT PROCEDURE FOR IMMERSION SERVICE – NON INSULATED

PAINT CERTIFICATION

CUSTOMER: MFV US/NEWFIELD/MC506 SERIAL NUMBER:

DESCRIPTION: INSERT + TR. BODY QUANTITY: 1+1

WORK ORDER: 53749 DATE: SEPT. 1/2010

1. CLEANING	DATE COMPLETED	SEPT. 1/2010
	ACTUAL BLAST PROFILE	2.6 MILS
	RELATIVE HUMIDITY	21%
2. FIRST COAT	DATE APPLIED	SEPT. 1/2010
	TEMPERATURE	20°C
	CURING TIME	4 HOURS
	WET THICKNESS	9-10 MILS
	DRY THICKNESS	5.4-6.1 MILS
	BATCH NO./PAINT	10CD0307 B-CARBOLINE 890 YELLOW
	BATCH NO./THINNER	LD0233 UHW3
3. SECOND COAT	DATE APPLIED	SEPT. 1/2010
	TEMPERATURE	20°C
	CURING TIME	4 HOURS
	WET THICKNESS	7-10 MILS
	DRY THICKNESS	4.4-6.1 MILS
	BATCH NO./PAINT	10CD0307 B-CARBOLINE 890 YELLOW
	BATCH NO./THINNER	LD ~~0307~~ 0233 UHW3
4. THIRD COAT (SYSTEM 5.0)	DATE APPLIED	SEPT. 2/2010
	TEMPERATURE	20°C
	CURING TIME	8 HOURS
	WET THICKNESS	8-10 MILS
	DRY THICKNESS	4.9-6.1 MILS
	BATCH NO./PAINT	10CD0307 B-CARBOLINE 890 YELLOW
	BATCH NO./THINNER	LG2143 UHW3
	FINAL COAT THICKNESS	14.7 – 18.3 MILS
	Q.A ACCEPTANCE:	
	DATE:	

MARIN

PRESS-O-FILM™ Made in U.S.A.
No. 2.6
Reading Gage less 2.0 mils or 50 µm
TESTEX NEWARK, DE 19715 USA
X COARSE (1.5 to 4.5 mils) or (40 to 115 µm)

MASTER FLO VALVE INC.
Head Office
4611 - 74 Avenue
Edmonton, Alberta
Canada, T6B 2H5

STORAGE PROCEDURE

1.0 SCOPE:

To define the process utilized for handling, storing, packaging and shipping of products to customers and within Master Flo Valve Inc.

2.0 RESPONSIBILITY:

2.1 DOMESTIC SHIPMENTS

It is the responsibility of the manufacturing personnel to ensure all required areas are lubricated/coated for corrosion resistance. The manufacturing personnel must also affix the appropriate protectors on flanges, threads or exposed seal areas.

It is the responsibility of the shipper/receiver and/or delegate to package the product appropriately to ensure damage does not occur under normal handling and delivery conditions.

2.2 INTERNATIONAL SHIPMENTS

It is the responsibility of the manufacturing personnel to ensure all required areas are lubricated and coated for corrosion resistance. The manufacturing personnel must also affix the appropriate protectors on flange or hub faces, butt-weld prep surfaces, threads or exposed seal surfaces. All valves except HRV's will be delivered to shipping in a horizontal position by the paint department. HRV's will be delivered to shipping in a vertical position with the outlet facing down.

It is the responsibility of the exporter and/or delegate to have the product packaged appropriately to ensure damage does not occur under normal to adverse handling/delivery conditions.

2.3 HANDLING OF STORED PRODUCTS

It shall be the responsibility of manufacturing, warehouse, QC & receiving personnel to ensure against damage and deterioration within Master Flo facility.

3.0 PACKAGING/STORAGE/ PRESERVATION:

3.1 ASSEMBLED PRODUCTS

All valves after completion of hydrostatic testing shall be dried thoroughly including body cavity. All required areas of Master Flo products shall be lubricated with the following for corrosion resistance.

a) Molydisulphide lubricant (AP-5) shall be applied with a grease gun to areas fitted with standard grease zirks.

b) Inlet and outlet bore areas and flange or hub faces shall be lubricated with LPS 3 Premium Rust Inhibitor per section PS 01-A-002.

All areas required to be covered to prevent deterioration or contamination shall be protected with the appropriate materials.

c) Flange or hub faces are to be covered by plastic, wood or masonite covers. All other inlet and outlet connections shall be adequately protected.

d) Exhaust or inlet ports are to be plugged by proper plugs or caps.

e) All valves except HRV's will be delivered to shipping in a horizontal position by the paint department. HRV's will be delivered to shipping in a vertical position with the outlet facing down.

3.2 COMPONENT PARTS

Component parts shall be packaged by the vendor in vendor supplied packaging or in specialized Master Flo packaging containers to prevent damage or deterioration. All packages shall indicate product part number. Critical areas of component parts and packaging types are detailed in the following Matrix. All shipping containers / pallets shall be lined by suitable means to ensure components are sufficiently protected. Vendors and Master Flo receiving are responsible to ensure these guidelines are enforced. Master Flo QC and warehouse personnel are to ensure the packaging is reinstalled after inspection or storage of the components.

3.2.1 PACKAGING MATRIX

Component Part	Packaging Type
SURFACE CHOKE / CONTROL VALVES:	
* Body (Acme Threads)	Plastic Cap
* End Connections (Sealing Face)	Plastic / Wood Flange Protector
**Collar (Sealing Face & Balance Sleeve Seal area)	Individually boxed with foam or paper liner
**Nozzle (OD & Face)	Individually boxed with foam or paper liner
Stem (OD & Threads)	Heavy Plastic Netting
Bonnet (Sealing Faces)	Low Adhesive Tape
Balance Sleeve (Sealing Faces)	Plastic Caps
Studs / Capscrews (Threads)	For Sizes Up To And Including ½" Nominal Diameter: Boxed.
	For Sizes Larger Than ½" Nominal Diameter: Individually Boxed, Individually Wrapped or Plastic Netting.
**Seat (Seal Angle)	Individually boxed with foam or paper liner
PNEUMATIC PISTON ACTUATORS:	
Stem Extension (OD & Gear Teeth)	Heavy Plastic Netting
Adjusting Screws (Threads)	Heavy Plastic Netting
Positioning Gears / Shafts (OD, Threads & Teeth)	Plastic Netting or Shrink Wrap to cardboard base
Positioning / Feedback Devices	Individually Boxed
LINEAR HYDRAULIC ACTUATORS:	
Cylinder (Sealing Faces)	Plastic Cap
Piston (Sealing OD)	Heavy Plastic Netting
Stem Extension (Threads)	Heavy Plastic Netting
Indicator Drive Shaft (Gear Teeth)	Individually Shrink Wrap to cardboard base
Positioning Gears / Shafts (OD, Threads & Teeth)	Individually Shrink Wrap to cardboard base (MF)
Positioning / Feedback Devices	Individually Boxed
ROTARY STEPPING ACTUATORS:	
Piston (Sealing OD)	Heavy Plastic Netting or Individually wrapped on cardboard base
Stem (OD)	Heavy Plastic Netting
Cylinder Barrel (Sealing Face)	Plastic Cap
Cylinder Cap (Sealing Faces)	Plastic Cap
Drive Shaft (Sealing OD's & Slot Edges)	Heavy Plastic Netting
SUBSEA PRODUCTS	
* HRV Body (Inlet, Outlet and Main Bore)	*Plastic Flange Protectors
HRV Main Seal	Individually Boxed
Bean Seal / Straight Bore Metal Body Seal	Individually Boxed
Sub Sea Stem	Wrapped in foam or paper packaging then inserted into a cardboard box or wrapped in cardboard
Flow Trim Components	Individually Boxed
Metal Stem Seal	Heavy Plastic Netting or Individually Boxed
HRV Bonnet	Plastic Cap on External Threads
HRV Canister	Foam Wrapping on Bean Seal Area
Wear Sleeves	Individually Boxed

* Flange faces and Bodies with Integral Flanges should be protected with appropriate means before shipping to outside processes. For HRV bodies with butt-weld prep surfaces instead of flanges: The butt-weld prep surfaces shall be adequately protected.

** Each box shall be labeled with the following as a minimum: Part Number, Revision, PO Number and Line Number (if applicable).

3.3 SEAL KIT PACKAGING

Seal kits packaging, or storage of the components, are to be assembled and packaged in the following manner.

a) Parts picked as per OP 02-01-004.
b) QC sign off of parts before final packaging, parts must be clearly marked and laid out for easy identification. Any parts that are not already packaged must be and clearly identified with the part number and quantity.
c) All components are to be packaged in a seal kit box, M4 (6 7/8 L x 6 1/8 W x 2 1/2 H) is common for majority of seal kits, B5 (9 5/8 W x 10 1/2 L x 2 1/2 H) is utilized for larger kits. eg. 23120-003.
d) Boxes are then tagged with appropriate part numbers and description, tagging to be placed on the 2 1/2 high end. Box is then shrink wrapped to avoid tampering.

3.4 PRODUCTS BEING SHIPPED

All metal parts are to be packaged utilizing moisture resistant paper, wrapped properly in protective packaging material, boxed and tagged with part number & heat number. Boxes will then be shrink wrapped, when size permits, according to machine limitations.

All products being delivered to the shipping department by the parts department must be packaged in this fashion, the shipping department may refuse packaging if deemed unsatisfactory for shipping.

3.5 PRODUCTS TO BE SHIPPED

3.5.1 DOMESTIC SHIPMENTS

3.5.1.1 Assembled Products

Smaller products up to 75 lbs shall be boxed in appropriately sized cardboard boxes and securely taped to prevent damage.

Larger products shall be palletized and strapped with metal banding or shrink wrapped to pallet to prevent movement and damage during transport.

Larger single products that are protected to prevent damage to inlet and outlet areas may be shipped loose, providing valve can be handled easily without causing damage.

Domestic air shipments must be crated or boxed in enclosed containers.

3.5.1.2 Component Parts

Component parts shall remain in it's protective and boxed in a larger shipping container to prevent damage or deterioration. All packages shall indicate product part number. This encompasses products being shipped or stored.

3.5.2 INTERNATIONAL SHIPMENTS

Packaging of products and components shipped internationally shall be crated in a wood container unless due to size and weight (up to 50 lbs), it can be packaged in a cardboard box.

Smaller shipments that may be handled by hand shall be crated in wood boxes without bases for forklift entry.

Larger shipments shall be palletized on a base or crated in containers that are constructed per the following from kiln dried wood when specified and subject to order requirements.

a) Base

The base shall be constructed from wood planks no less than 1 1/2" thick supported by 4" x 4" skids. The skids shall be positioned for easy entry and pickup by a forklift or other method. Affixed to the top of the base shall be construction grade tar paper.

b) Walls & Lid

Walls and lid shall be constructed with plywood no less than 1/2" thick and shall be reinforced by studs 1 1/2" x 3 1/2" minimum.

Products up to and including 2 1/2" shall be secured to the base by a minimum 3/4" metal strapping. 3" and up will be secured by 1 1/4" metal strapping. All products will be held in place by minimum 2” x 4” blocking to prevent movement.

Once secured, the product shall be water proofed by enclosing it with 6 mil (minimum) plastic wrap.

After water proofing, a minimum of two sides shall be nailed directly to the skid and the other two nailed in place using reverse end wall system to add strength.

The lid shall then be installed by nailing to the 4 sides and metal strapping to the skid with minimum of 3/4" metal strap.

c) Actuator Packing

Due to the fragile nature of this product, unmounted stepping actuators will be laid flat and strapped with 1 1/4" banding. 2” x 4” blocking will be used to hold the product in place.

4.0 MARKING

All containers used for packaging shall indicate at a minimum on two faces Master Flo Valve company name and origin.

Also on two sides, the destination including company name, address, and contract name (when applicable) shall be detailed per the DS tickets, ship to address or attached documents detailing the product destination.

All crates will indicate this side up and handle with care stenciled on two sides.

For international shipments, the gross weight and crate and purchase order number shall be indicated.

TITLE: REVISION RECORD

REVISION	DATE	DESCRIPTION	PREPARED	APPROVED
0	05/97	INITIAL APPROVAL, WAS QAS-025	KB	KS
A	05/99	ADD TO 3.2, 3.3.1.2, 3.3.2, 4.0	MB	MB
B	05/01	ADD TO 3.2 & 3.3	KS	DS
C	05/05	REVISE SEC. 2.2 & 3.1 TO ADD NOTE	SC	SS
D	05/05	REDEFINE CHOKE TRIM REQUIREMENTS REMOVE SECTION 3.2.1 FOR PIG BALL VALVES	LK	SS
E	09/06	REDEFINE STUD TO CAPSCREW THREAD AS REQUIREMENTS IN SECTION 3.2.1	AS	PB
F	05/08	REVISE SECTION 3.1 (B)	AK	PB
G	03/09	REVISED SECTION 3.1	SW	IH
H	12/09	REVISED SECTION 3.1 (B)	CD	PB
I	01/10	REVISED SECTIONS 2.2, 3 AND 3.2.1 TO ACCOUNT FOR VERTICAL SHIPPING POSITION OF HRV'S AND BUTT-WELD PREP SURFACES	MY	***PB***

MASTER FLO VALVE INC.
Head Office
4611 - 74 Avenue
Edmonton, Alberta
Canada, T6B 2H5

MAINTENANCE MANUAL

MAINTENANCE INSTRUCTIONS

P35-15K HRV INSERT RETRIEVABLE CHOKE AND RUNNING TOOL

TABLE OF CONTENTS

SECTIONS:

1.0 Description of Operation
2.0 Technical Specifications
3.0 Handling, Transport and Storage
4.0 Insert Preparation, Installation and Removal and Running Tool Storage
5.0 Monitoring
6.0 Maintenance
7.0 Parts List & Assembly Drawings
  7.1 Insert Retrievable Choke
  7.2 Running Tool
8.0 Cv Chart

1.0 DESCRIPTION OF OPERATION

1.1 Subsea Production Choke

The Master Flo production choke offers maximum control throughout the operating range with the use of a trim configuration, which produces equal percentage flow characteristics. The Master Flo trim is of a cage with an external sliding sleeve design. With two sets of two ports in the cage, the Master Flo trim achieves accurate, long life control. The lower set consists of two small ports providing the initial 15% control range while the upper set are large ports that provide the overall capacity. The cage port configuration also incorporates an exceptionally high turn-down ratio, providing a wide control range and excellent versatility. The choke is designed to accommodate special service conditions and reduce wear problems associated with harsh environments. It's design, use of materials and use of metal seals all contribute to extending the choke service life.

1.2 Hydraulic Subsea Stepping SL Actuator

The choke is operated using a SL stepping actuator with top mounted manual override. Refer to the SL actuator maintenance manual for actuator information.

1.3 Insert

The actuator and internals of the valve are contained in a removable insert. The insert is separable from the body by use of an ROV and a running tool (see section 1.4). All seals and replaceable parts are contained in the removable insert.

The insert is clamped to the body with three clamp sections operated by a threaded stem, as shown in Figure 1.1. The stem contains an API 17D ROV receptacle for ROV operation. Rotating the stem clockwise moves the two sections together closing the clamp, while counter-clockwise rotation separates the sections opening the clamp. The taper of the clamp sections causes the bonnet to press into the body when the stem is tightened resulting in a preload being applied to the insert-body metal seal for seal energization. As the clamp is opened this seal preload results in the insert being lifted out of the body as the seal preload is relaxed. This lift is sufficient to release all insert seals resulting in the insert being free to be removed from the body. Standard configuration is side drive as per figure 1.1. A top drive configuration with a 3:1 gear ratio or a 4:1 gear ratio is optionally available.

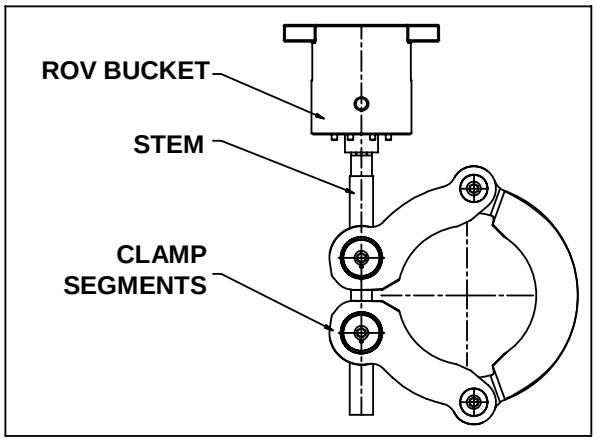


Figure 1.1: Clamp (Direct Drive)

1.4 Running Tool

The insert is installed or retrieved by means of an unmanned mechanical intervention running tool. The running tool contains a guide cage, which aligns inside a funnel permanently mounted around the choke body (see Figure 1-2). The guide frame incorporates a rotational guidance system for angular alignment of the insert to the valve body and the funnel provides positional alignment. The rotational and positional alignment is 120° and 6.5", respectively. The cage extends below the insert to ensure that the insert is fully protected from damage during handling.

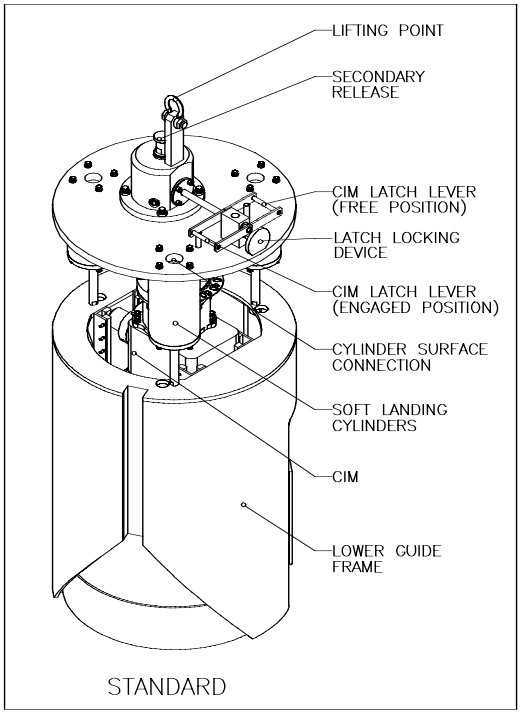


Figure 1.2: Running Tool

1.4.1 Latch Assembly

The latch assembly on the tool is a mechanically operated unit that latches the tool to the insert. Balls that are driven radially outwards to engage in an internal groove within an API 17D bucket provide the latching function on the insert. The position of the latch lever is utilized to verify if the tool is latched to or released from the insert. An ROV-operable lock mechanism on the handle prevents unwanted disengagement of the clamp.

1.4.2 Secondary Release Mechanism

The running tool incorporates a secondary release mechanism, which can be utilized to release the tool from the insert in the case that the operating handle on the latch mechanism becomes non-functional. Lifting the secondary release will release the insert from the tool (see Figure 1-3).

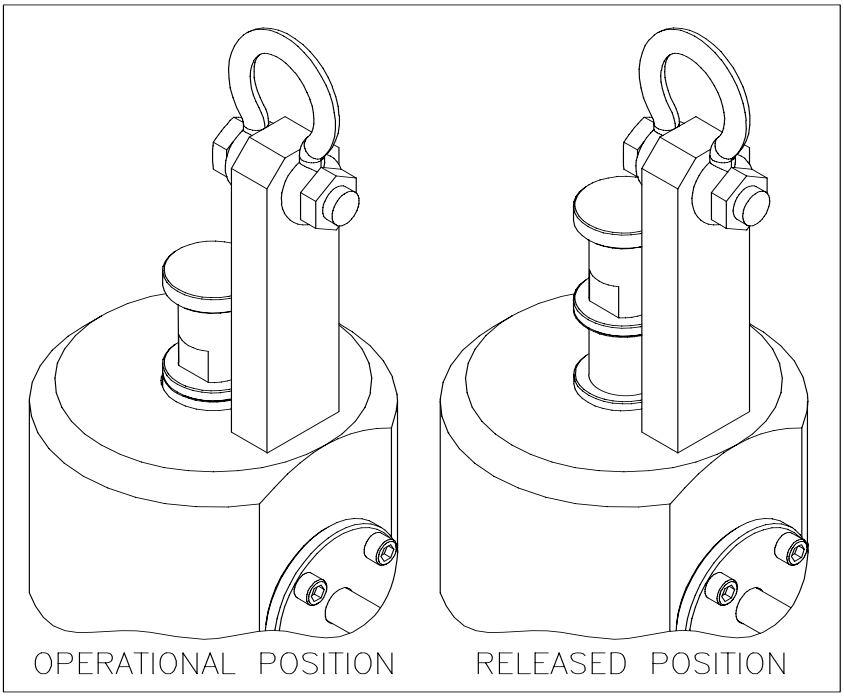


Figure 1.3: Released and Engaged Positions of Emergency Release

1.4.3 Soft Landing Cylinders

The running tool contains soft-landing cylinders between the tool latch assembly and the guide frame. These cylinders utilize controlled flow of seawater to provide a soft-landing for the final 4 inches of insert travel when landing in the valve body. The cylinders incorporate a quick extension feature so the guide frame is immediately extended whenever the tool is lifted. This feature ensures that soft landing will occur regardless of the previous loading that the tool has experienced.

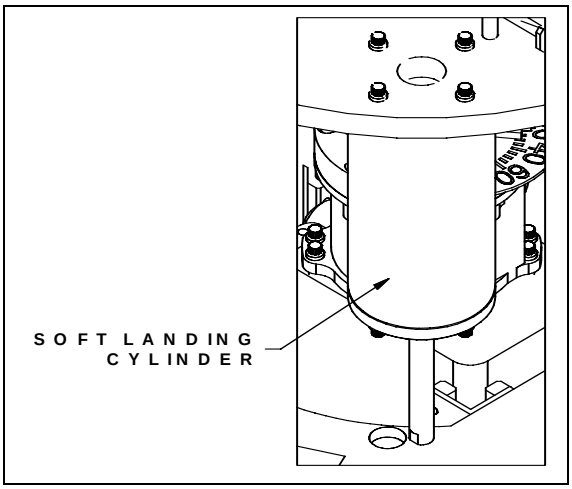


Figure 1.4: Soft-Landing Cylinders

1.5 Shipping/Test Skid

The shipping/test skid contains equipment required for testing and preparing the insert. The skid contains a test body, which is used to confirm actuator and clamp operation and pressure sealing capabilities of the insert. The shipping/test skid also contains a water system for running tool soft-landing cylinder operation.

A toolbox on the shipping/test skid contains equipment required for changing main and bean seals, and equipment required for testing the insert clamp mechanism and actuator override. Spare seals and the water hoses for the soft-landing cylinders are stored in the toolbox.

Included with the shipping/test skid is a removable transport body. This body is used to transport an insert to and from Master Flo Valve Inc. if maintenance other than main seal or bean seal replacement is required.

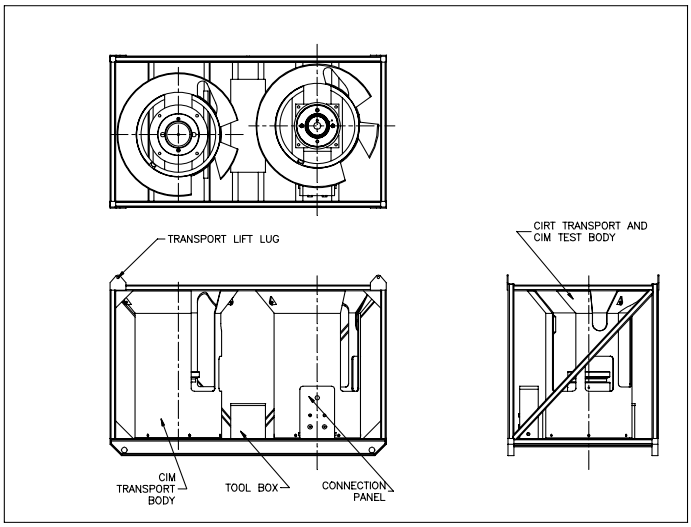


Figure 1.5: Shipping/Test Skid

2.0 TECHNICAL SPECIFICATIONS

2.1 Choke

Design Pressure (psig):	15,000
Test Pressure (psig):	22,500
Seat Differential Pressure (psig):	15,000
C_v Maximum:	92
Bean Size (Maximum):	153
Steps from Full Open to Full Close:	160
Override Turns Open to Close	16
Override Operation	cw-close, ccw-open
Override Torque (Maximum, ft-lb)	600 (standard assembly)

2.2 Clamp Assembly

2.2.1 Direct (Standard) Clamp Drive

Table 1 - Direct Drive Clamp

Max. Choke Rated Pressure (psig)	API 17D Bucket Class	Connect Torque (ft-lb)	*Disconnect Torque (ft-lb)	Test Pressure (psig)
15,000	5	2500 - 3000	<3000	22,500

* Disconnect torque will be less than the connect torque supplied.

2.3 Running Tool

Recommended Landing Speed	4 in/second
Entry Angle	6° Offset from Vertical
Rotational Alignment	±60°
Positional Alignment	6.5” Radial Offset Capture Range
Maximum Landing Speed:	24 in/second
Weight (including insert, in air):	1837 lb

2.4 Shipping Skid

Weight (Including Insert & Running Tool):	4,650 lb
Length (in)	96.5
Height (in)	53
Width (in)	63

2.5 Environmental Data

Design Water Depth	18,000 feet
Operating Temperature (°F)	-20 to + 350
Sea Temperature (°F)	+28 to +90

3.0 HANDLING, TRANSPORT AND STORAGE

1. Protect hydraulic and electrical connectors from damage. Hydraulic ports should be capped off to keep operating fluid clean.
2. Protect insert-body metal seals (items 31 and 46) from damage.
3. Choke should be in the fully closed position during handling and storage.
4. Insert should always be in the transportation body with the clamp securely fastened during transport or storage.
5. Protect inlet and outlet flange faces on body from damage.

4.0 INSERT PREPARATION, INSTALLATION AND REMOVAL AND RUNNING TOOL STORAGE

Refer to Technical Bulletin TB 120 for insert preparation, installation and removal and for running tool storage procedures.

Liberally apply Jetlube AP-1 to all sealing surfaces when installing an insert.

5.0 MONITORING

5.1 Remote Monitoring

The choke is equipped with a remote indicator in the form of an LVDT. The LVDT is located inside the actuator and is preset for a linear range of 4.0 mA at the fully closed position to 20.0 mA at fully opened position. The LVDT connections are externally accessible through the electrical connector. Recalibration of the LVDT should be performed by authorized personnel only. Please contact Master Flo Valve Inc.

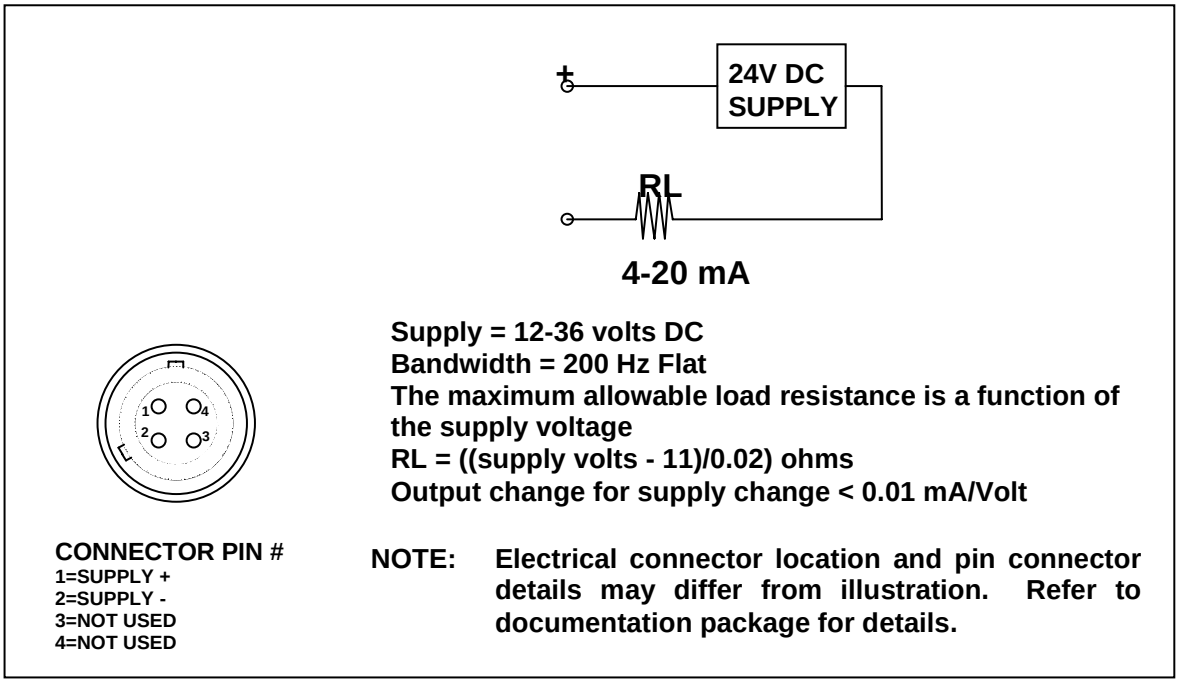


Figure 5.1: Typical LVDT Connections

5.2 Alternative Choke Monitoring

Alternatively remote monitoring of the choke position can be accomplished by counting operational steps. The reference point is the fully seated (closed) position. This reference is established by operating the choke a minimum of the total number of steps to close plus 5 in the closing direction. Thus regardless of initial position, valve will now be fully closed, and the zero reference point reestablished. The choke and actuator are designed for continuous stepping against the seat. Alternatively the full open position may be utilized for calibration but the valves' total number of steps must be known to then obtain the zero reference. EX: step open 165 times (min), input chokes' actual number of steps as current position (155 to 165).

5.3 Visual Indicator

The choke is also equipped with an external visual indicator mounted on the actuator. The visual indicator consists of an indicator plate with markings indicating percent stem travel. A mechanical pointer indicates percent stem travel against the plate.

6.0 MAINTENANCE

All choke and actuator maintenance, with the exception of bean seal and HLX seal replacement, is to be performed at Master Flo Valve Inc. The above two seals can be replaced using the tool kit contained on the shipping/test skid.

6.1 Tool Kit

The tool kit contains the items shown in drawing 01440-007. These items are:

Description	Quantity
Padlock: 5/16"	1
Stem Adapter - Class 5	1
Stem Adapter - Class 4	1
Receptacle Adapter - Class 5	1
Torque Wrench	1
Torque Multiplier	1
5/8" Combination Wrench	1
1 1/16" Combination Wrench	1
3/16" Allen Key Wrench	1
Bean Seal Tool	1
Container, Nickel 771 Anti-Seize	1
Container, Jetlube AP-1	1

6.2 Bean Seal

6.2.1 Removal

For removal of the bean seal (item 46), refer to applicable Assembly Drawing (section 7.0) and Figure 6.1 below and proceed as follows:

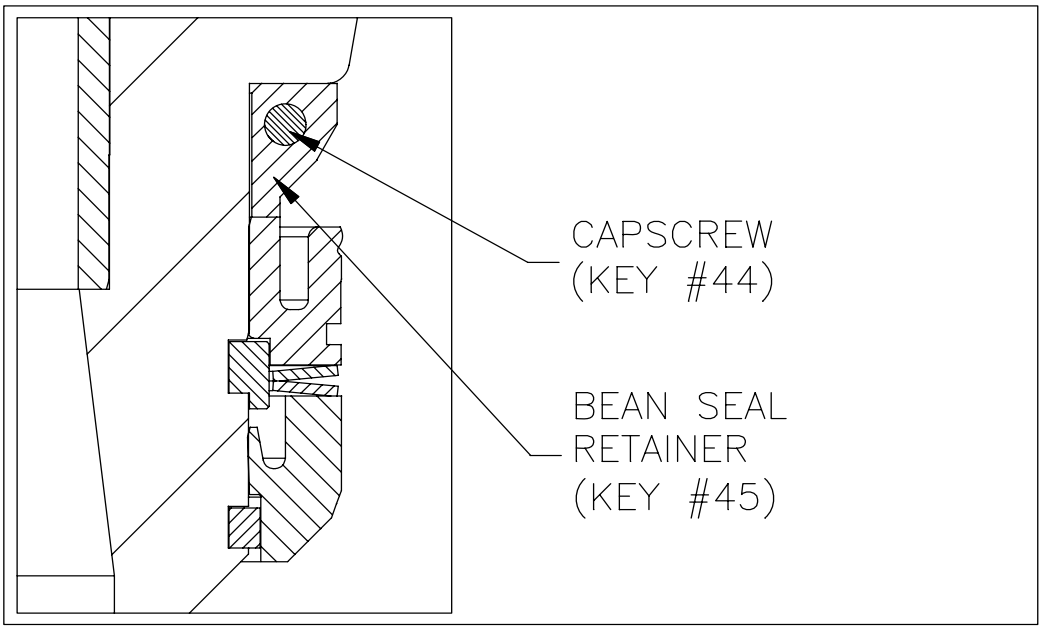


Figure 6.1: Bean Seal Alignment

1. Remove the two capscrews (item 44) on bean seal retainer (item 45) and slide bean seal retainer from choke cartridge. The bean seal retainer is a two-piece, split ring assembly.

2. Slide both segments of bean seal push ring (P/N: 80522) in slot on bottom of cartridge. Secure push ring with 5/8" – 11 x 1 ½" capscrews (P/N: 01031-031). The bean seal push ring and capscrews are supplied in the toolbox on the shipping/test skid.

Note: Do not tighten. (See Figure 6.2.)

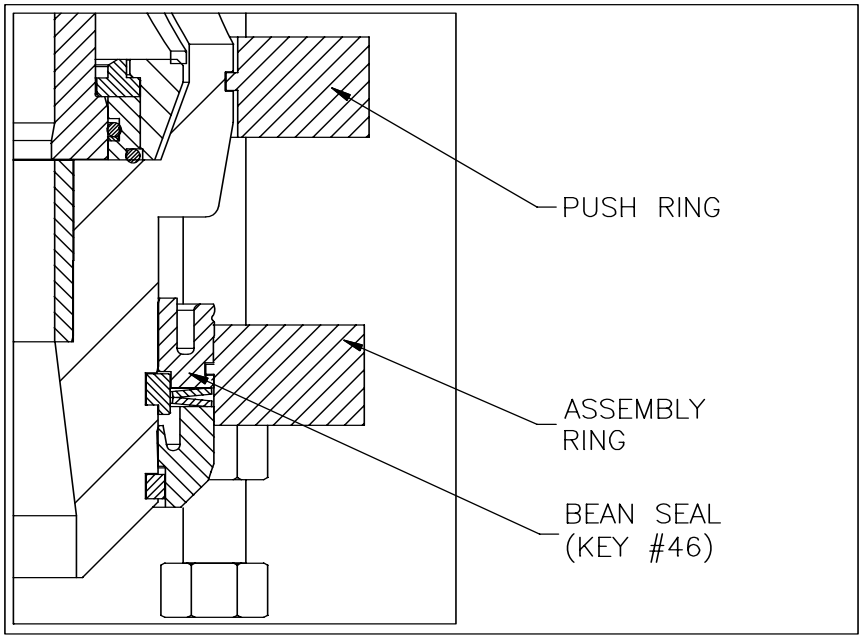


Figure 6.2: Tool Installation

3. Slide both segments of assembly ring (P/N: 80523) into slot in bean seal (item 46). Secure assembly ring with 5/8" – 11 x 1 ½" capscrews (P/N: 01031-031). (See Figure 6.2).

4. Thread the 4 hex nuts (P/N: 01017-002) onto the 5/8" studs (c/w welded on nut – P/N 80290). Place the studs through the untapped holes on the assembly ring and thread the studs into the push ring. Tighten the capscrews on the push ring. (See Figure 6.2).

5. Lubricate the area above the bean seal with Nickel 771 lubricant. Evenly tighten the 4 nuts to lift the bean seal. (See Figure 6.3).

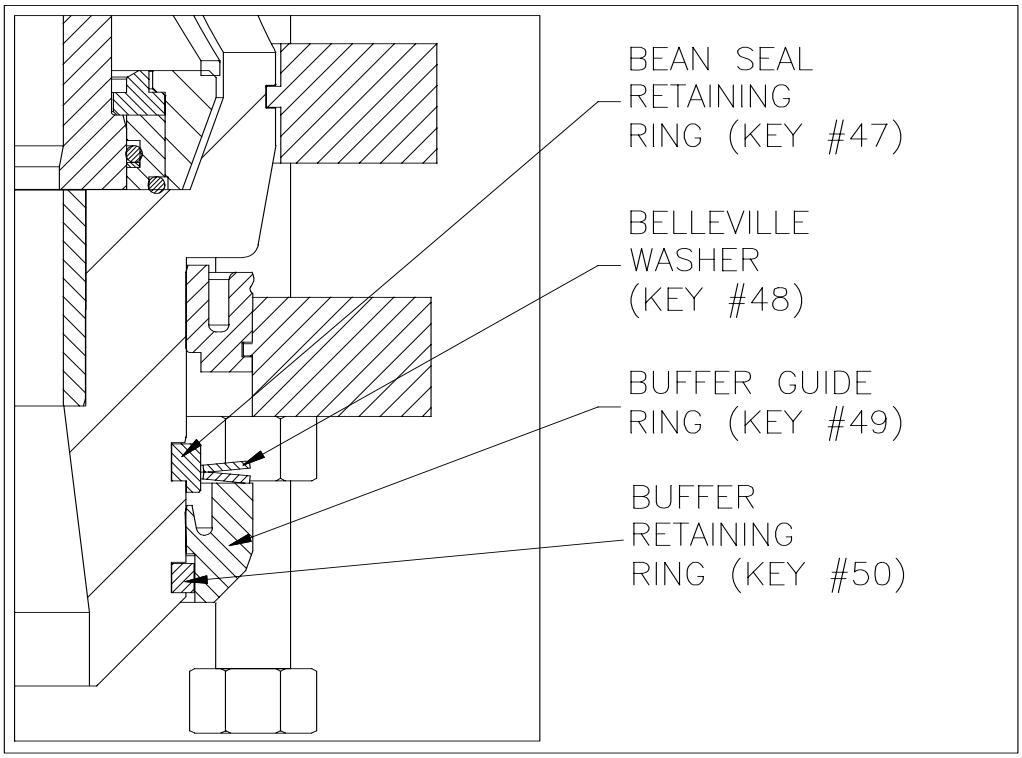


Figure 6.3: Buffer Ring Installation

6. Remove both segments of the bean seal retaining ring (item 47), which is a split ring assembly. (See Figure 6.3)

7. Lift the buffer ring (item 49) and remove both segments of the buffer retaining ring (item 50), which is a split ring assembly. (See figure 6.3)

8. Slide the buffer ring (item 49) from the insert and remove the Belleville washers (item 48). (See Figure 6.3)

9. Back the 4 nuts on the studs down to the welded nuts. Unthread the 4 studs from the push ring and thread them through the assembly ring against the push ring. Tighten the 4 studs evenly so that the bean seal is pushed off the insert. (See Figure 6.4)

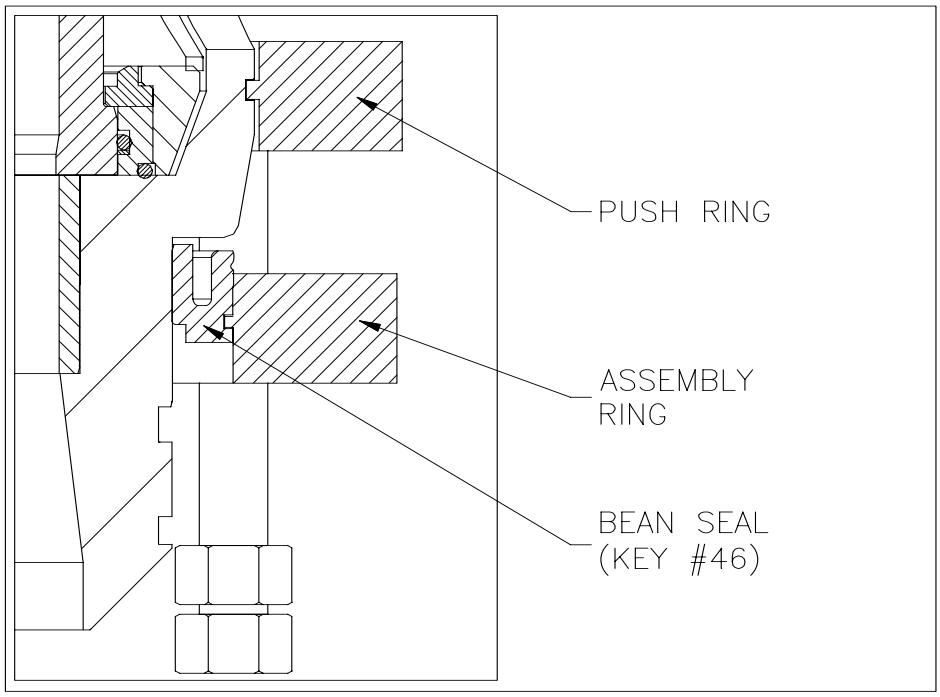


Figure 6.4: Bean Seal Installation

10. **Note**: Removal of the push ring is not necessary, as it will be required for re-assembly.

6.2.2 Inspection

1. Inspect bean seal for corrosion, pitting or scratches. Replace if any of these defects are present.

2. Inspect sealing surfaces on insert for corrosion, pitting or scratches.

3. Inspect all elastomeric seals for extrusion, splitting or debris. Replace if possible.

4. Inspect all other components for damage. Ensure all components are completely clean and free of debris.

6.2.3 Assembly

For installation of the bean seal, refer to applicable Assembly Drawing (section 7.0) and proceed as follows:

1. Lubricate the area that the bean seal will slide on with Nickel 771 lubricant. Install push ring (P/N: 80522) onto cartridge if required. (See Figure 6.4).

2. Install both segments of assembly ring (P/N 80523) into slot in bean seal (item 46). Secure with capscrews. (See Figure 6.4).

3. Thread the 4 hex nuts (P/N 01017-002) onto the 5/8" studs (c/w welded on nut - P/N 80290). Place the studs through the untapped holes on the assembly ring and thread the studs into the push ring. (See Figure 6.4).

4. Evenly tighten the 4 hex nuts to slide the bean seal onto the insert. Slide the bean seal far enough up so that the buffer guide ring can be installed. (See Figure 6.4).

5. Slide Belleville washers (item 48) onto insert in alignment as shown in figure 6.3.

6. Slide buffer ring (item 49) on to insert. (See Figure 6.3).

7. Install buffer guide ring retaining ring (item 50). (See Figure 6.3).

8. Slide buffer guide ring and Belleville washers down to retaining ring and install bean seal retaining ring (item 47). (See Figure 6.3).

9. Back the 4 nuts on the studs down to the welded nuts. Unthread the 4 studs from the push ring and thread through the threaded holes on the assembly ring so that they are contacting the push ring. Tighten the 4 studs evenly so that the bean seal is pushed down to the retaining ring.

10. Unthread and remove the 4 studs. Remove the assembly ring and push ring.

11. Install bean seal retainer (item 45) and secure with capscrews (item 44). Utilize loctite 271 threadlocker on capscrew threads. (See Figure 6.1). Torque to 4 ft-lbs.

12. Lubricate the bean seal with Jetlube AP-1 lubricant or equivalent.

6.3 HLX Seal

For removal and assembly of the HLX seal, please refer to Assembly Drawing (section 7.0) and Figure 6.5 below and proceed as follows:

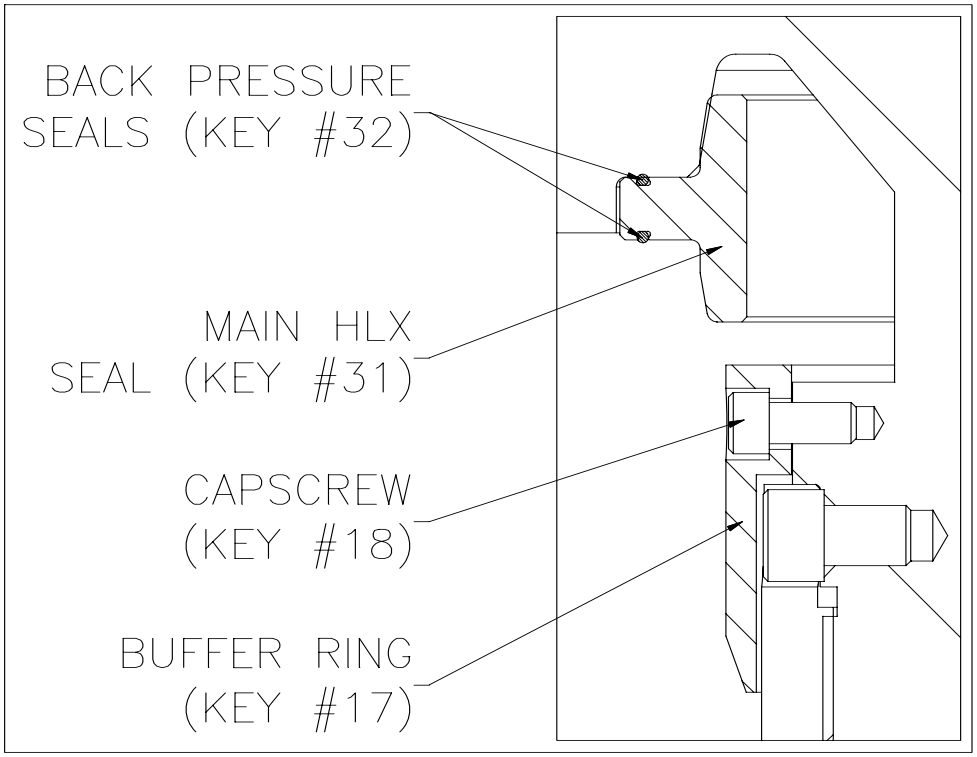


Figure 6.5: HLX Seal Replacement

6.3.1 Removal

1. Remove the four capscrews (item 18) retaining buffer ring (item 17) to insert. While supporting HLX seal (item 31), remove buffer ring (item 17), which is a two-piece, split ring assembly. Remove HLX seal (item 31). (See Figure 6.5).

6.3.2 Inspection

1. Inspect HLX seal for corrosion, pitting or scratches. Replace if any of these defects are present.
2. Inspect sealing area on bonnet for corrosion, pitting or scratches.
3. Inspect back pressure seals (item 32) for splitting, extrusion or debris.
4. Ensure bonnet and seal are completely free of dust or debris.

6.3.3 Assembly

1. Lubricate seal pocket in bonnet and back pressure seals with Jetlube AP-1 lubricant or equivalent.

2. Ensure back pressure seals (item 32) are installed into HLX seal (item 31). (See Figure 6-5)

3. Install HLX seal, being careful not to damage the outside diameter of the seal (See Figure 6-5).

4. Reinstall buffer ring (item 17), aligning holes in ring with corresponding holes in the canister. Secure with capscrews (item 18). Utilize loctite 271 threadlocker on capscrew threads. Torque capscrews to 4 ft-lbs. (See Figure 6-5).

6.4 Secondary Release Resetting

Should the emergency release on the running tool be activated, it will have to be reset before the running tool can be used again. To reset the mechanism refer to Figure 7.2 and proceed as follows:

1. Loosen the nuts (item 24) on the spring detents (item 23) and unthread the detents.

2. Lower the release rod (items 9 & 19). The latch mechanism balls (item 30) may be required to be positioned radially outward to facilitate lowering of the release rod.

3. Loosen set screws on detents (item 23) to release detent spring force.

4. Thread first detent into body (item 10) until detent is just contacting release rod.

5. Tighten detent lock nut (item 24).

6. Tighten the detent set screw until desired resistance is implemented. Resistance can be checked by lifting release rod. Release rod should not release when pulled manually, but should require minimal mechanical force to release. Note: The release rod must not be adjusted by more than 1/2” of travel or the detents will fully extend. The procedure must then be restarted from step 1.

7. Thread the other detents into the body and tighten detents to approximate compression of step 6.

8. Install and tighten the other detent lock nuts.

7.0 PARTS LISTS

7.1 Insert Retrievable Choke

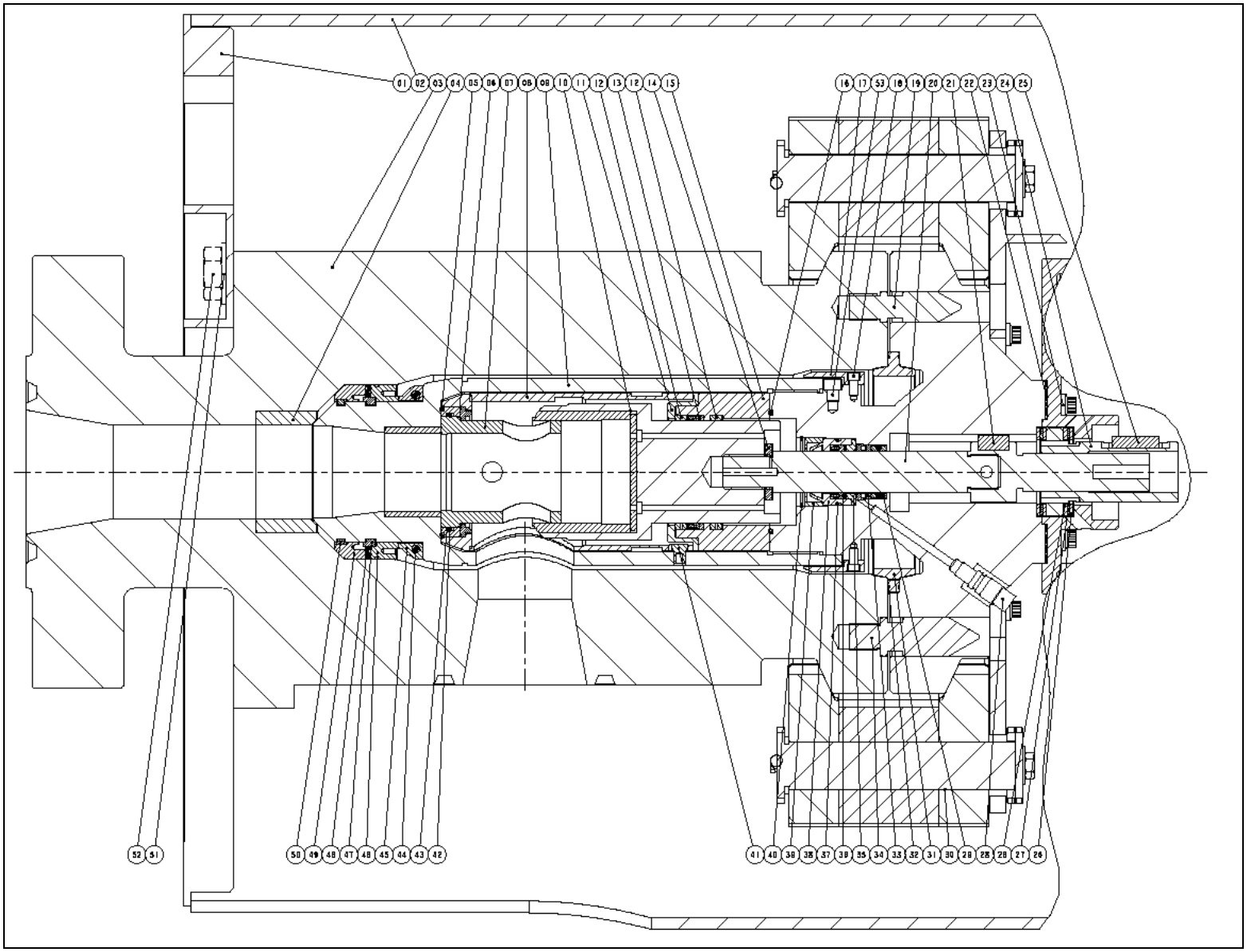
KEY	DESCRIPTION
1	BASE: GUIDE FUNNEL
2	GUIDE FUNNEL
3	BODY
4	WEAR SLEEVE
5	SEAL: SEAT - CARTRIDGE
6	SEAT
7	NOZZLE
8	RETAINING SLEEVE
9	CARTRIDGE ASSEMBLY
10	FLOW COLLAR
11	BALANCE SLEEVE SEAL RETAINER
12	BEARING: BALANCE SLEEVE - FLOW COLLAR
13	SEAL: FLOW COLLAR - BALANCE SLEEVE
14	LOCKWASHER
15	BALANCE SLEEVE
16	SEAL: BALANCE SLEEVE - CARTRIDGE
17	BUFFER RING
18	CAPSCREW: 1/4" - 20 X 5/8"
19	ALIGNMENT PIN - SMALL
20	STEM
21	KEY: 1/2" SQUARE X 1"
22	GASKET: ACTUATOR - BONNET
23	CAPSCREW: 1/2" - 20 X 1 1/2"
24	STEM NUT
25	KEY: 1/2" - 3/8 X 1 1/2"
26	THRUST WASHER
27	THRUST BEARING
28	CHECK VALVE
29	SEAL: STEM - BONNET
30	CLAMP ASSEMBLY
31	MAIN SEAL
32	SEAL: BACK PRESSURE
33	STEM SEAL SPACER
34	ALIGNMENT PIN - LARGE
35	SEAL RETAINER
36	SEAL: METAL SEAL - STEM
37	SEAL: METAL SEAL - BONNET
38	METAL SEAL: STEM - BONNET
39	SEAL RETAINER
40	RETAINING RING

7.1 Insert Retrievable Choke (con't)

KEY	DESCRIPTION
41	PIN: RETAINING SLEEVE
42	SEAL: NOZZLE - SEAT
43	BU - RING: NOZZLE - SEAT
44	CAPSCREW: 1/4" - 20 X 1"
45	RETAINER: BEAN SEAL
46	BEAN SEAL
47	RETAINING RING: BEAN SEAL
48	WASHER: BELLEVILLE
49	BUFFER GUIDE RING
50	RETAINING RING: BUFFER
51	WASHER
52	CAPSCREW: 1" - 8 X 2"
53	CAPSCREW: 3/8" – 16 X 3/8"

NOTE: FOR REFERENCE ONLY. REFER TO DOCUMENTATION PACKAGE FOR PARTS LIST.

Figure 7.1: Insert Retrievable Choke



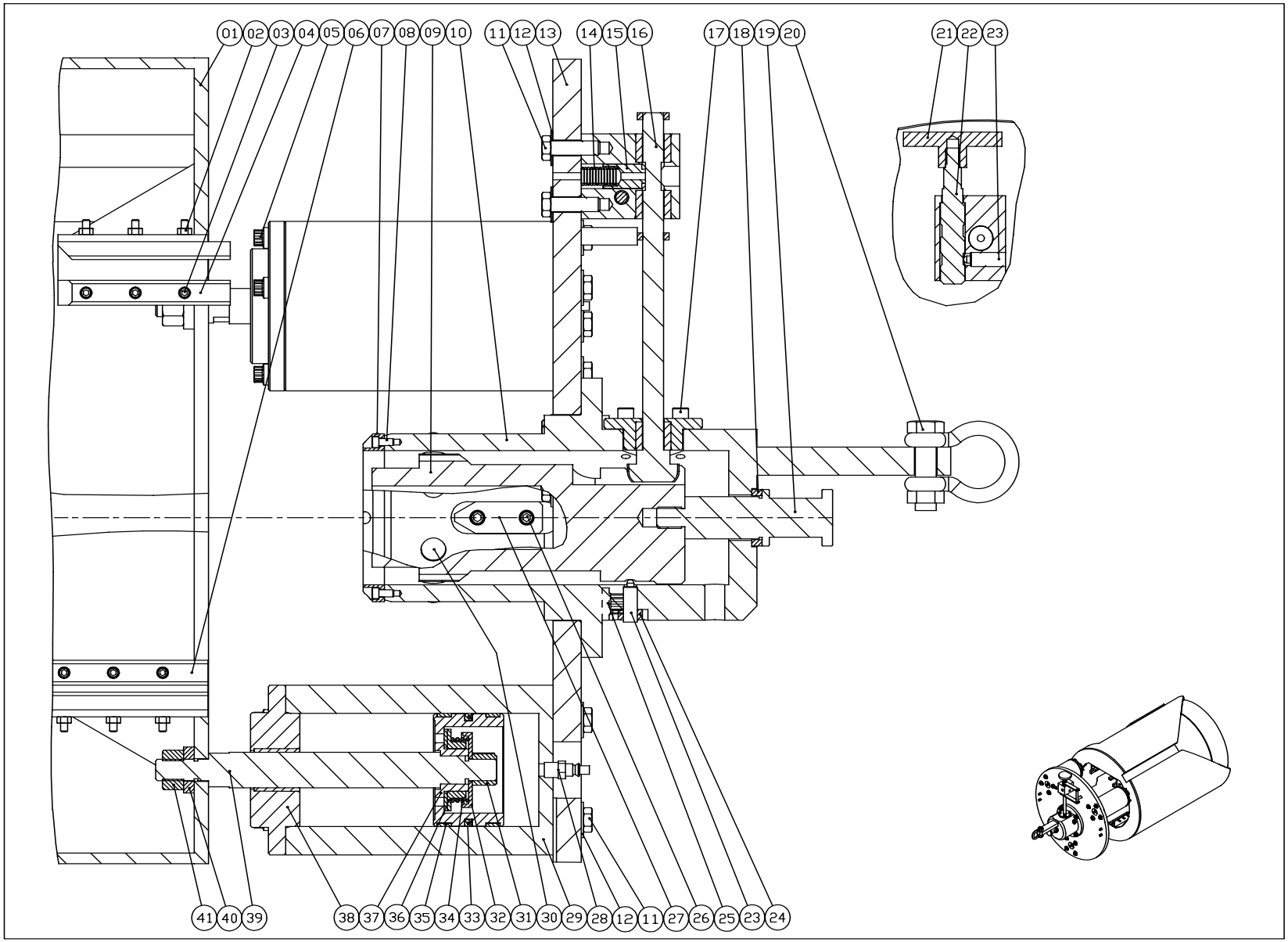
7.0 PARTS LISTS (con't)

7.2 Running Tool

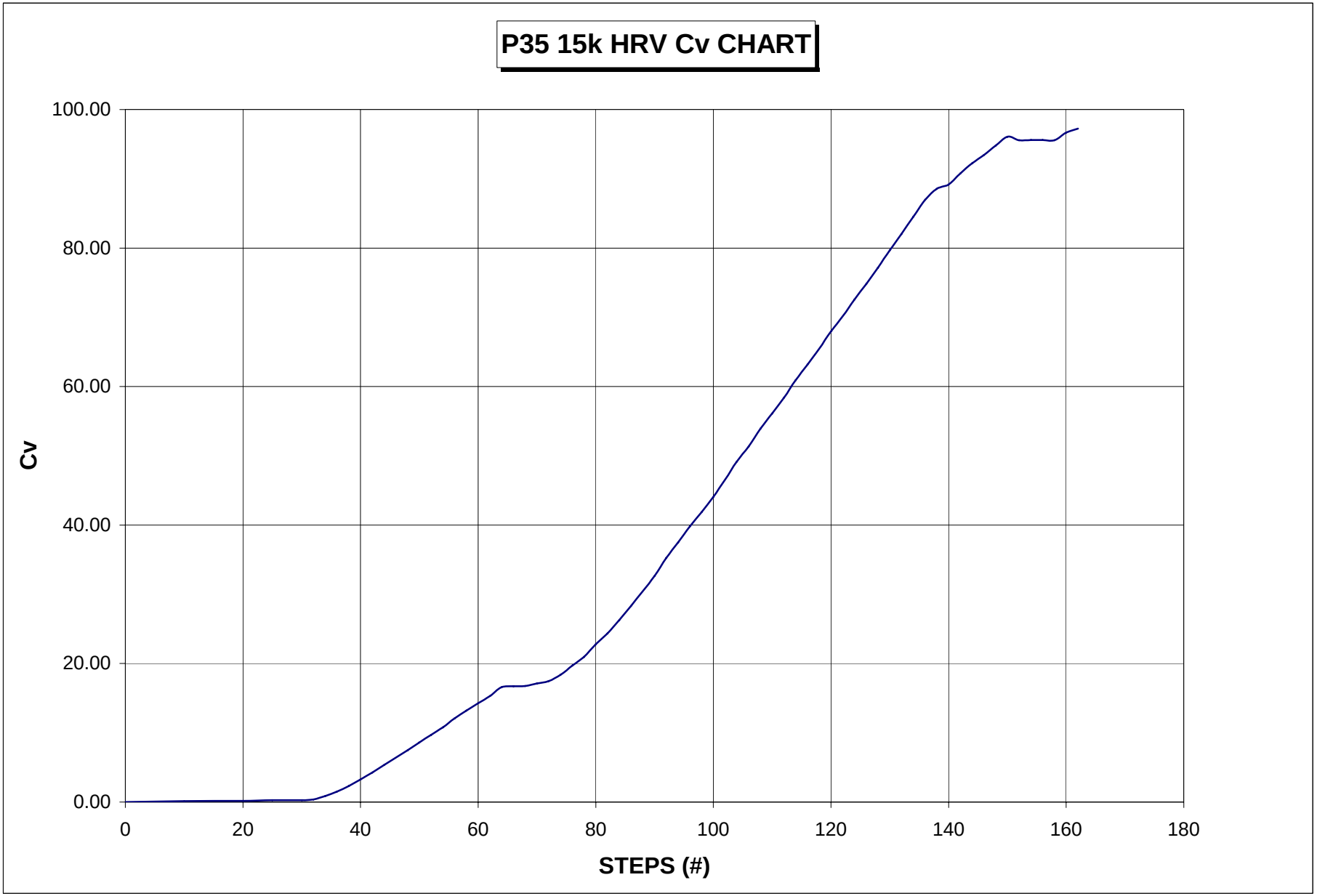
KEY	DESCRIPTION
1	GUIDE CAGE
2	NUT: 1/4" - 20
3	CAPSCREW: 1/4" - 20 X 1"
4	GUIDE BLOCK
5	CAPSCREW: 1/2" - 13 X 1.25"
6	GUIDE BLOCK
7	GUIDE RING
8	CAPSCREW: 1/4" - 20 X 1/2"
9	INSERT
10	BODY
11	CAPSCREW: 1/2" - 13 X 1 3/4"
12	WASHER
13	TOP PLATE ASSY
14	SPRING
15	PLUNGER
16	HANDLE ASSEMBLY
17	CAPSCREW: 3/8" - 16 X 3/4"
18	STOP WASHER
19	SECONDARY RELEASE LIFTING POST
20	SHACKLE
21	PLATE - LATCH LOCK
22	ROD - LATCH LOCK
23	SPRING PLUNGER
24	NUT: 1/2" - 13
25	CAPSCREW: 3/4" - 10 X 1 3/4"
26	CAPSCREW: 5/16" - 18 X 3/4"
27	BUCKET GUIDE BLOCK
28	1/4" AIR QUICK CONNECT
29	CYLINDER - SOFT LANDING
30	BALL
31	LOCK NUT: NYLOCK
32	RETAINING PLATE - SOFT LANDING
33	SEAL: PISTON - HOUSING
34	SPRING
35	WEAR RING: PISTON - HOUSING
36	SEAL ASSY - SOFT LANDING
37	PISTON - SOFT LANDING
38	COVER PLATE - SOFT LANDING
39	SHAFT - SOFT LANDING
40	SPHERICAL WASHER
41	NUT: 3/4" - 10

NOTE: FOR REFERENCE ONLY. REFER TO DOCUMENTATION PACKAGE FOR PARTS LIST.

Figure 7.2: Running Tool



8.0 Cv CHART


P35 15k HRV Cv CHART
100.00
80.00
60.00
40.00
20.00
0.00
Cv
0
20
40
60
80
100
120
140
160
180
STEPS (#)

MASTER FLO VALVE INC.
4611-74th Avenue
Edmonton, Alberta
Canada, T6B 2H5
Tel: 1-780-468-4433
Fax: 1-780-469-9853
Email: info@masterflo.com
Website: www.masterflo.com

Calgary, Alberta
Tel: (403) 237-5557
Fax: (403)266-3307

Houston, Texas
Phone: (713) 690-2789
Fax: (713) 690-3838

Abu Dhabi, United Arab Emirates
Phone: 971-2-6329150
Fax: 971-2-6321276

Pau, France
Phone: 33 (0)5 5992-8229
Fax: 33 (0)5 5992-8261

Aberdeen, Scotland
Phone: 44-1224-878999
Fax: 44-1224-878989

Jakarta, Indonesia
Phone: 62-21-7918-1234
Fax: 62-21-7918-2575

Rio de Janeiro, Brazil, 20031-201
Phone: 55 (0)21-2532-5618
Fax: 55 (0)21-2220-7677

Kuala Lumpur 50250 Malaysia
Phone: 60-3-2078-7688
Fax: 60-3-2078-7689

OPERATION AND MAINTENANCE MANUAL

SUBSEA SL ACTUATOR

WITH MANUAL OVERRIDE

TABLE OF CONTENTS

SECTIONS:

1.0 Description of Operation
- 2.0 Technical Specifications
- 2.1 Hydraulic Cylinders
  - 2.1.1 Single Acting Hydraulic Cylinders
  - 2.1.2 Double Acting Hydraulic Cylinders
  - 2.1.3 Hydraulic Connections
  - 2.1.4 Flushing Actuator Hydraulic Systems
- 2.2 Actuator Housing
- 2.3 Local Indicator
- 2.4 Remote Indicator
- 2.5 Manual Override
- 2.6 Actuator Operating Data
- 2.7 Choke Monitoring
- 2.8 Choke Operation

3.0 Handling and Storage
- 3.1 Handling and Transport
- 3.2 Storage
- 3.3 Inspection / Testing after Storage

4.0 Calibration Procedure
- 4.1 Visual Indicator
- 4.2 LVDT

5.0 Part List and Assembly Drawings
- 5.1 Top Mounted Manual Override, Setup for LVDT Feedback
- 5.2 Right / Left Hand Manual Override, Setup for LVDT Feedback
- 5.3 Single Acting Hydraulic Cylinder
- 5.4 Double Acting Hydraulic Cylinder

1.0 DESCRIPTION OF OPERATION

The Master Flo Subsea SL Actuator utilizes pulsating hydraulic fluid pressure to produce rotational movement. The precise, durable stepping system is accomplished by a ratchet pawl driving a ratchet wheel to directly operate the choke stem nut adapter. (See figure 1.1) The ratchet pawl is held in place by a collar around the ratchet wheel. The pawl is spring loaded to engage the ratchet wheel by dual torsion springs and is mechanically disengaged at the rest position to allow for reverse direction operation or manual operation. The actuator utilizes hydraulic spring return cylinders, operating the ratchet collar through a connecting rod. The actuator operates the valve through a precise 36 degree rotation per operating step. For the SL gearbox, the valve is operated directly with the manual override.

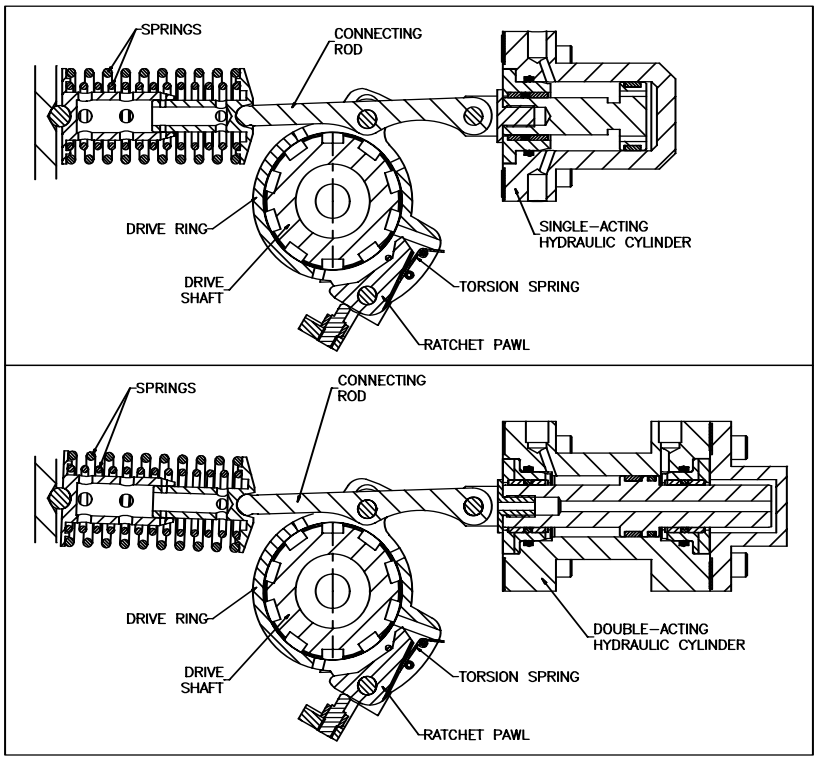


Figure 1.1: Stepping System

2.0 TECHNICAL SPECIFICATIONS

2.1 Hydraulic Cylinders (not applicable for SL gearbox)

Standard Hydraulic supply pressure*:

- Design Pressure 3300 psig
- Working Pressure 3000 psig
- Test Pressure 4950 psig

*Optional working pressure of 4000 psig or 5000 psig is available. Master Flo engineering must be consulted if this is desired, as testing, material and/or dimensional requirements will change. A system cannot be operated above the working pressure or damage to actuator and choke components may occur.

Hydraulic fluid consumption per operating step = 1.28 in^3 (single-acting 3000 psig)
= 1.37 in^3 (double-acting 3000 psig)

Hydraulic Operating Fluid Options:
- Marsten Bentley HW 540
- Marsten Bentley HW 525
- Marsten Bentley HW 443
- Brayco Micronic 864 HT/200
- Castrol Transaqua Ht

Operating Cylinder Construction: Stainless Steel

Stepping Cycle Time:
- Energize time - 0.185 seconds (Typical highest speed)/step
- De-Energize time - 0.065 seconds (Typical highest speed)/step
- Total time - 0.25 seconds (Typical highest speed)/complete step

Note: Actual time will vary with control system, restrictions and operational loads.

2.1.1 Single Acting Hydraulic Cylinders

Single acting hydraulic cylinders utilize pulsating hydraulic pressure to step the actuator. Applied pressure extends the cylinder and springs inside the actuator retract the cylinder when hydraulic pressure is reduced. The cylinder requires 100 psig (7 bar) effective hydraulic pressure to overcome initial spring forces and begin to stroke.

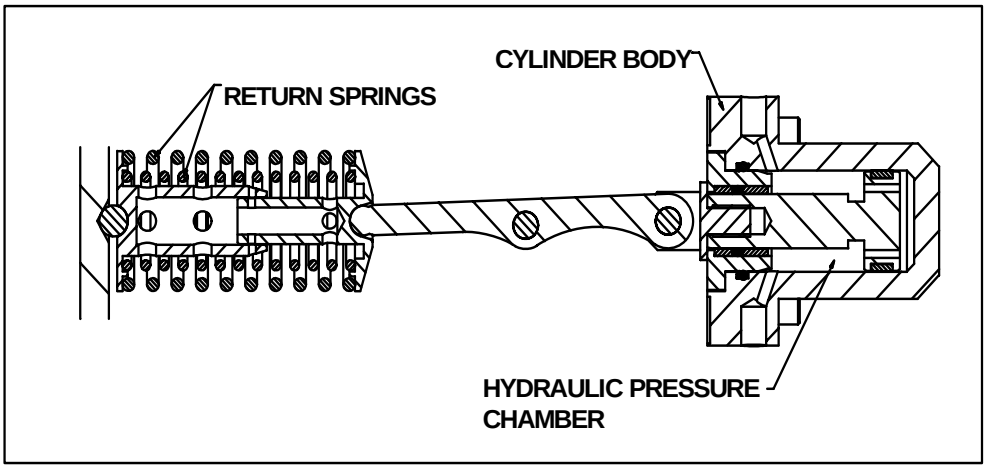


Figure 2.1: Single Acting Hydraulic Cylinder

2.1.2 Double Acting Hydraulic Cylinders

Double acting hydraulic cylinders utilize pulsating hydraulic pressure to step the actuator. Applied operating pressure extends the cylinder, and springs assisted by back pressure retract the cylinder when operating pressure is reduced. The cylinder requires 100 psig (7 bar) effective hydraulic pressure to overcome initial spring forces and begin to stroke.

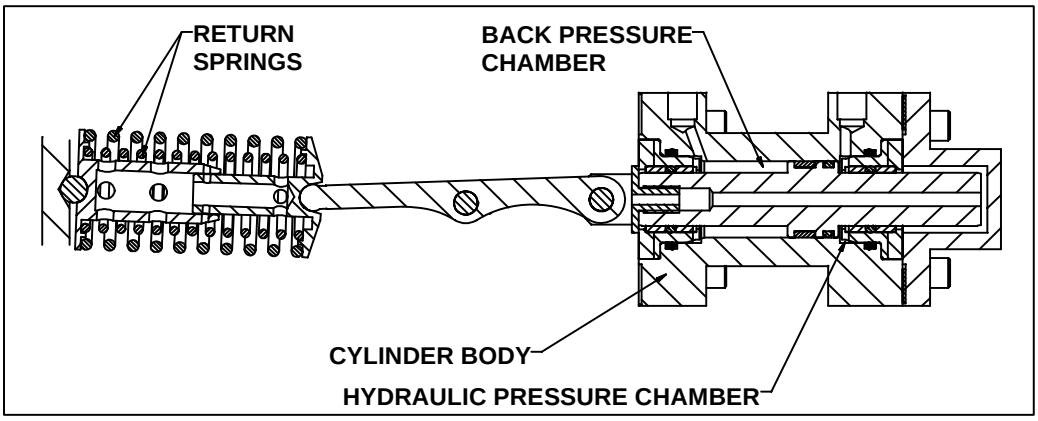


Figure 2.2: Double Acting Hydraulic Cylinder

2.1.3 Hydraulic Connections

- Standard connections are 3/8" stainless steel Swagelok tube connections and stainless steel tubing. Optional connections are available.

- Standard connection details are illustrated in Figure 2.3.

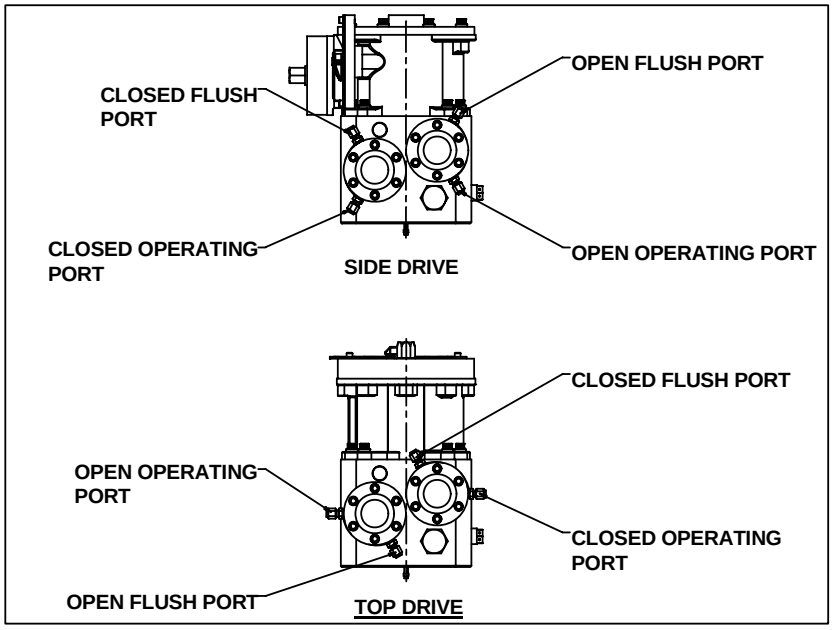


Figure 2.3a: Hydraulic Connections: Single Acting

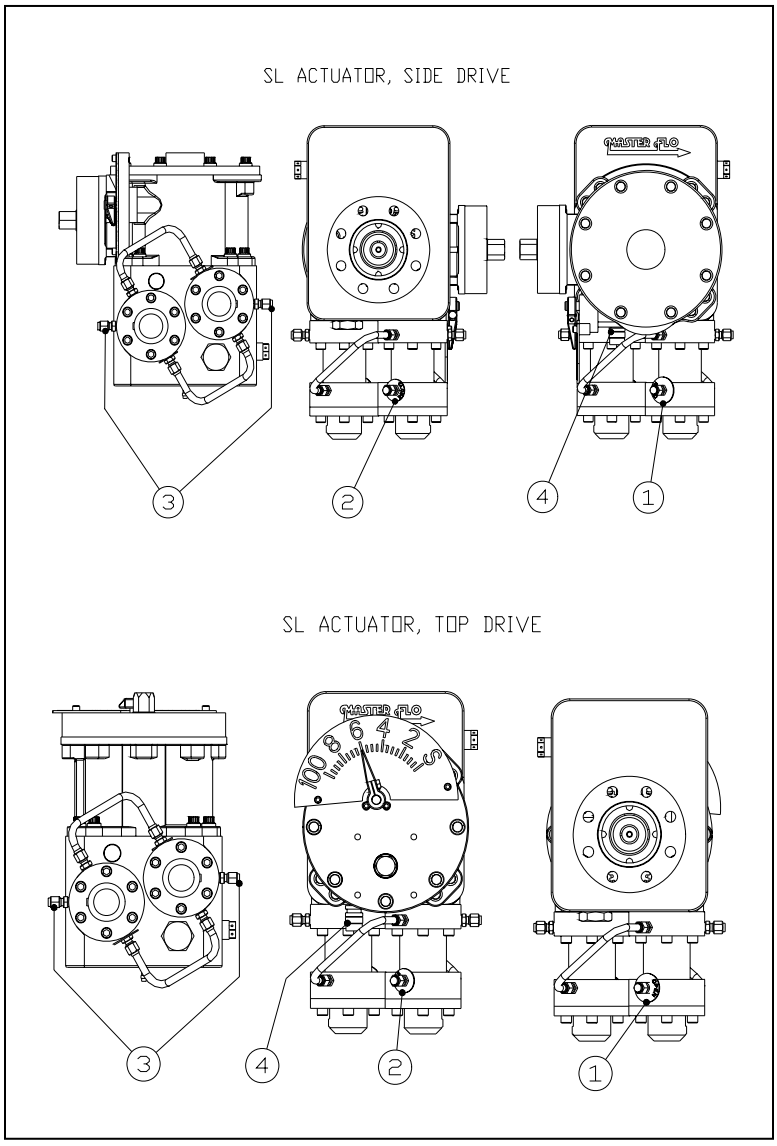


Figure 2.3b: Hydraulic Connections: Double Acting SL

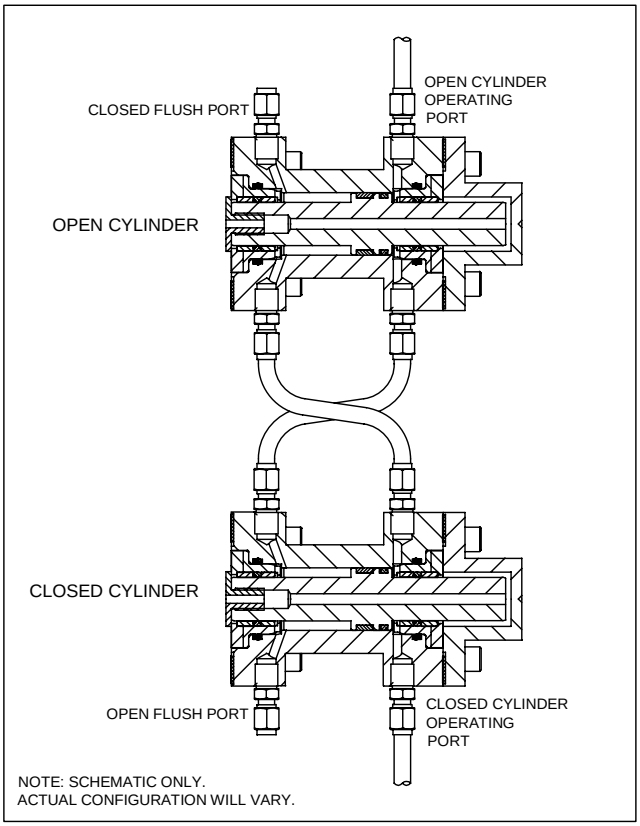


Figure 2.3c: Hydraulic Connection Schematic: Double Acting

#	Description
1	Open Port
2	Close Port
3	Flush Port
4	Check Valve

2.1.4 Flushing Actuator Hydraulic Systems

The actuator contains two independent hydraulic systems for single and double acting cylinders. These two systems are:

- Opening Hydraulics
- Closing Hydraulics

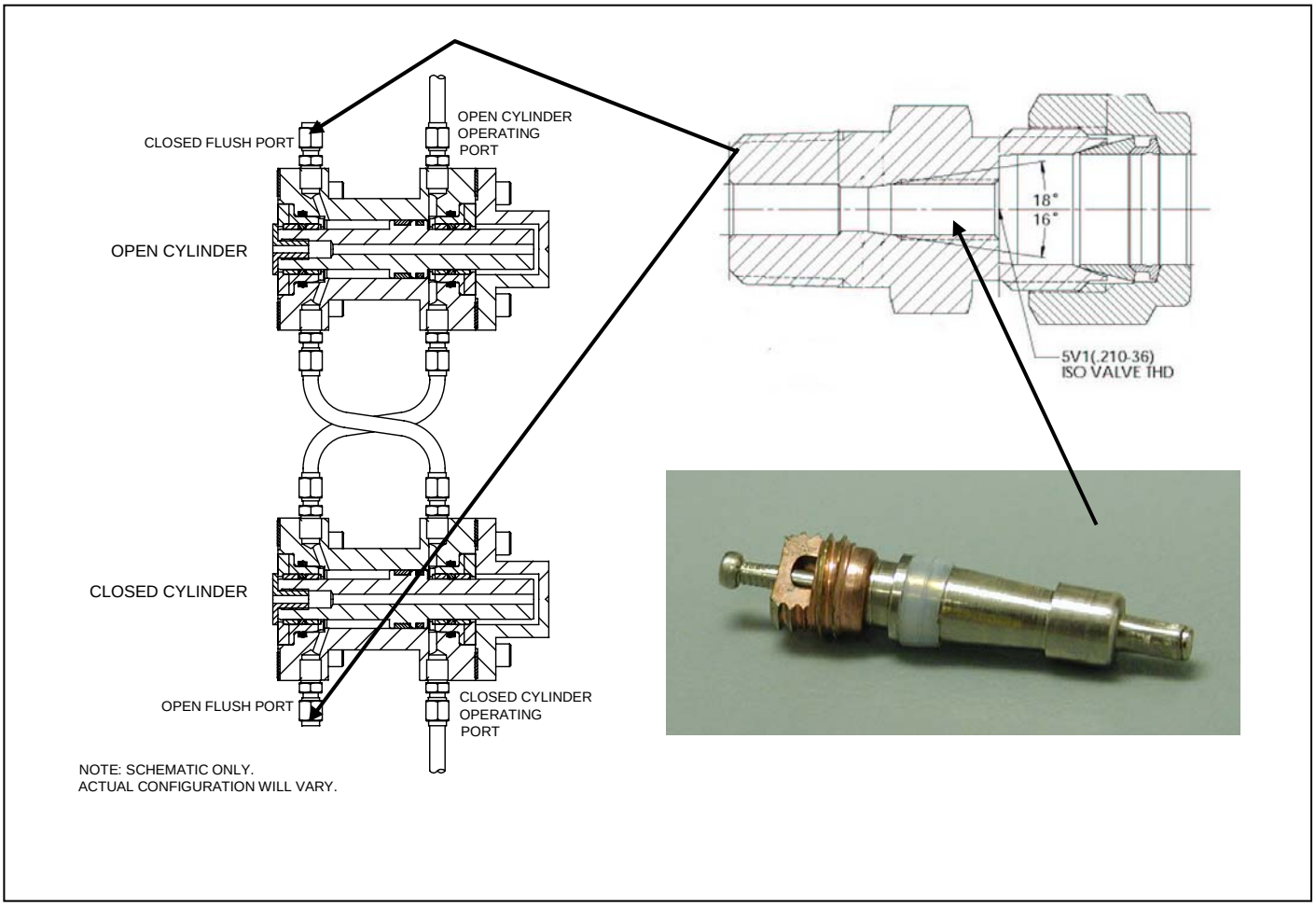
Each hydraulic system has two external connections shown in figure 2.3. Only one connector is required for operation of each system while the second connector is plugged off. Both connectors are required while flushing each hydraulic system.

For a double acting cylinder, the operating chamber flush port is connected to the back pressure supply port on the opposite cylinder. The operating chamber of a cylinder can then be simultaneously flushed as one unit with the back pressure chamber of the opposite cylinder. This results in only two systems which must be flushed for both single and double acting cylinder actuators.

→

The actuators have been factory flushed to SAE AS4059 REV-D Class 6 B-F minimum and operating fluid must conform to the same class as the actuator is flushed to.

Note: For any actuator that is attached to an HRV insert retrievable valve the check valve cores on the flush ports must be removed before flushing and then reinstalled after flushing.



Check valve cores can be installed and removed using the suplied tool that is depicted below (For further information on running procedures please see Master Flo TB-120)

Check Valve Core Installation and Removal Tool (P/N 01544)

2.2 Actuator Housing

The actuator housing is pressure and volume compensated utilizing an internal accumulator bladder (29 cu. in. volume)

Actuator Lubricant:

Lubricating fluid utilized within the actuator housing is Mobilgear 626 or Mobilube SHC 626 Lubricating Oil.

Note: The actuator housing is completely filled with fluid and at no time should the actuator housing be opened or covering plates loosened.

Actuator Housing Pressure, Double Acting Cylinders:
- 33 - 37 psig differential test pressure
- 50 psig relief included (above external pressure)

Actuator Housing Pressure, Single Acting Cylinders:
- 100 psig differential test pressure
- 240 psig relief included (above external pressure)

2.3 Local Indicator

- located on the same plane as the manual override
- linear percent stem travel indication through variable rotary output indicator dependent on choke size and stem travel
- indicated by an indicator plate with percent travel markings and a mechanical pointer against the plate

2.4 Remote Indicator

If the actuator is fitted with an optional remote indicator, remote indication is accomplished with the use of an LVDT (Linear Variable Differential Transformer).

The LVDT is located in the actuator internals and is preset for a linear range of 4.0 mA at the fully closed position to 20.0 mA at the fully opened position. The LVDT measures stem travel directly. LVDT connections are accessible at the actuator housing through a connector. If the LVDT requires re-calibration this requires the actuator to be opened which should only be performed by authorized personnel. Refer to figure 2.4.1 for LVDT Connections.

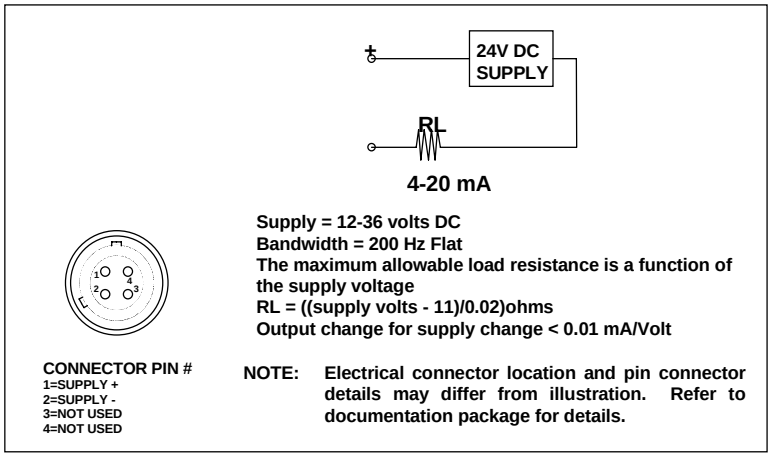


Figure 2.4.1: Typical LVDT Connections

2.4.1 Remote Indicator: Optional CANBUS Feedback

A CANBUS protocol feedback system is also available. This system utilizes the same LVDT as described above. The CANBUS feedback unit converts the LVDT 4 to 20 mA signal into CANBUS protocol output. Connections are again available at the actuator housing through a connector. Refer to Figure 2.4.2 for connections for the CANBUS unit.

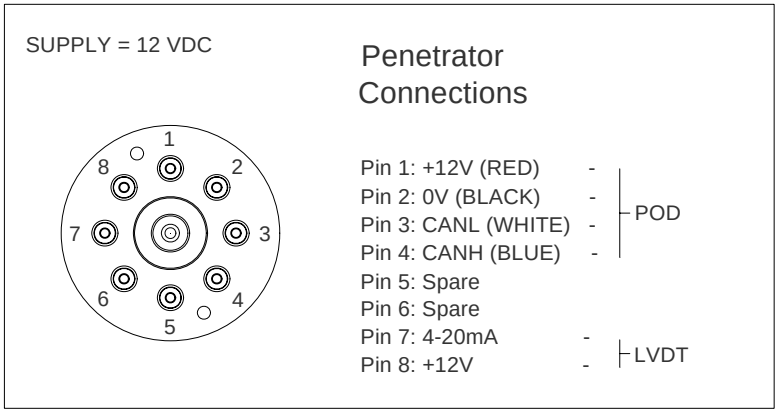


Figure 2.4.2: CANBUS LVDT Connections

2.5 Manual Override

The actuator is equipped with a manual override in the form of a shaft with a 1 inch hex which allows for override operation. Optional adapters include API 17D drive bucket suited for 300 ft–lb input torque tool and API 17D Class 3 drive interface. The override can be side mounted or be top mounted. The override can be oriented in 90° increments around the actuator and the actuator can be mounted in 45° increments around the choke.

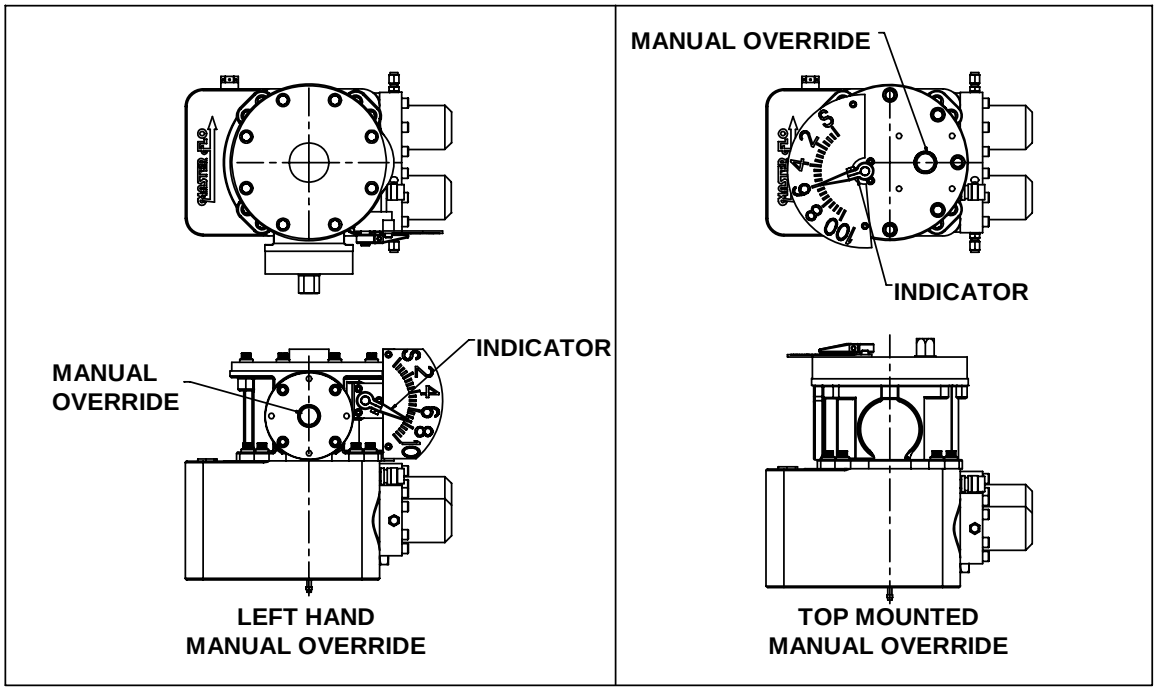


Figure 2.5: Override Alignment

Drive input torque:

- 300 ft-lb nominal
- For maximum values see table
- ccw rotation to open
- cw rotation to close

MAXIMUM DRIVE INPUT

VALVE SIZE	BOLTED BONNET	DIVER CLAMP	HRV
P2	500 ft-lb	500 ft-lb	-
P25	-	-	600 ft-lb
P3	600 ft-lb	600 ft-lb	-
P35	-	-	600 ft-lb
P4	600 ft-lb	600 ft-lb	600 ft-lb
P5	600 ft-lb	600 ft-lb	600 ft-lb

Seat Breakout Torque

- Seat breakout torque is dependent on the closing torque used to seat the valve. The required seat breakaway torque will be less than the closing torque utilized in seating the valve.

2.6 Actuator Operational Data

- 36 degree operation per step
- actuator torque output versus override input indicated in figure 2.6

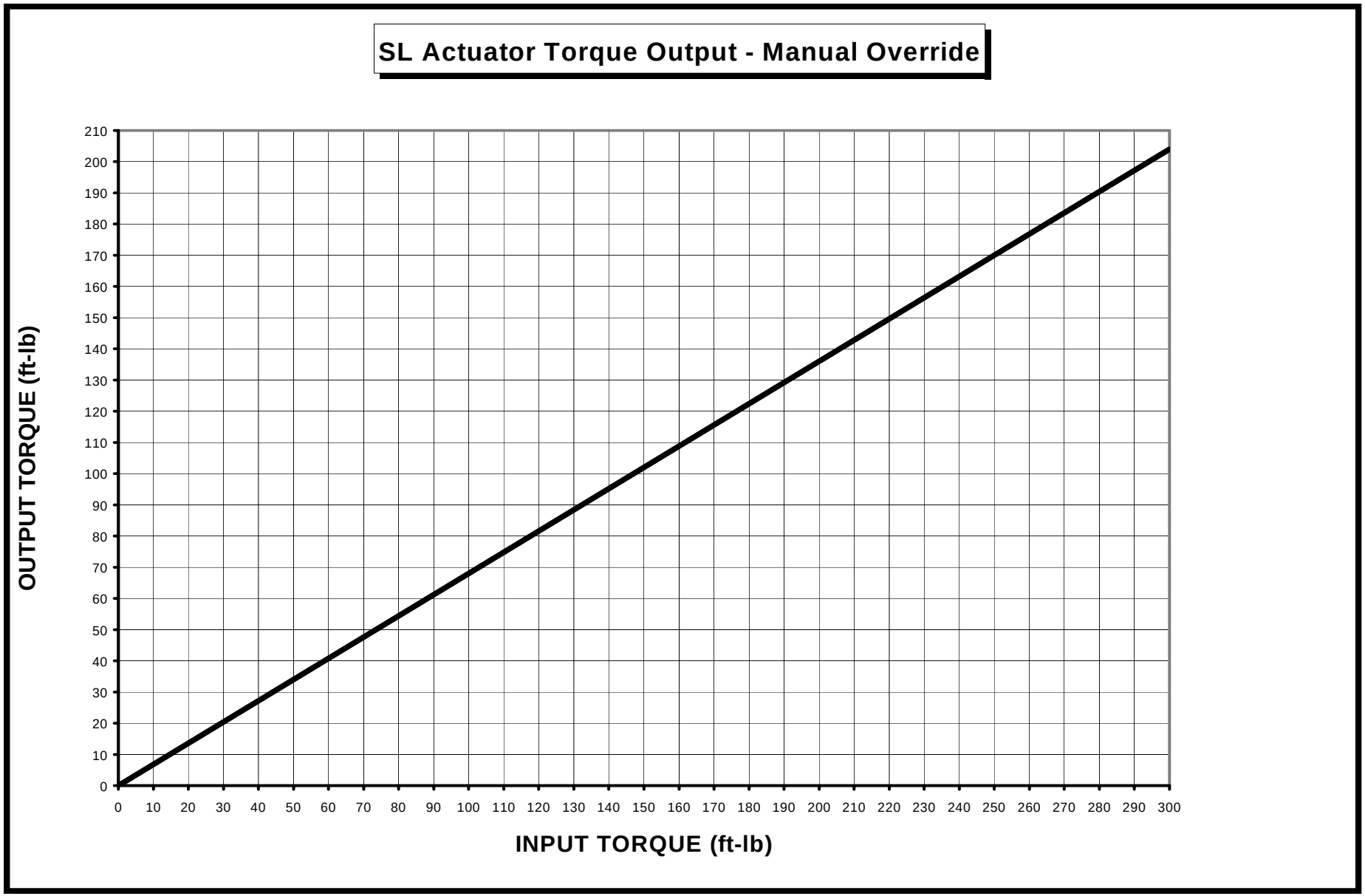

SL Actuator Torque Output - Manual Override
OUTPUT TORQUE (ft-lb)
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300
INPUT TORQUE (ft-lb)

Figure 2.6

2.7 Choke Monitoring

The choke position can be monitored through the actuator by utilizing either the local indicator, the remote indicator if equipped, or an alternative remote monitoring system of the choke position can be accomplished by counting the actuators' operational steps. (This method cannot be used for the SL gearbox.) For this method the reference point is the fully seated (closed) position. This reference is established by operating the choke a minimum of the total number of steps for complete travel of the choke in the closing direction. Thus regardless of the initial position the valve will now be fully closed and the zero reference point reestablished. The choke and actuator package are designed for continuous stepping against the seat. Alternatively the full open position may be utilized for calibration but the valves' specific total number of steps must be known to then obtain the full open reference. IE. To use full closed as the zero reference, step the valve closed the valve sizes nominal number of steps plus 5 steps to ensure full closed position. Input number of steps at this point to be zero. Count operational steps open from this point. Alternatively, to use full open as the reference, step the valve open the valve sizes nominal number of steps plus 5 steps to ensure full open position. Input valves specific number of steps from closed position as current position.

2.8 Choke Operation

The choke can be operated by two independent systems

1. The actuator hydraulic system (not applicable for SL gearbox)

- Application of sufficient hydraulic pressure to either one of the open or close hydraulic ports will rotate the stem nut 1/10th of a turn in it's respective direction. Only one port should be pressurized at a time. Pulsing of the pressure will continue to step the actuator.

2. The manual override

- Application of sufficient torque onto the override will directly turn the stem nut through a 1:1 ratio.

  Operation of both systems in the same direction is possible, however operation of the override in the opposite direction of the hydraulic system is not possible. Operation of both systems in the same direction may be required if one system is unable to rotate the stem nut alone.

3.0 HANDLING AND STORAGE

Note: The actuator housing is completely filled with fluid and at no time should the actuator housing be opened.

3.1 Handling And Transport

- Protect hydraulic* and electrical connectors from damage.
- Choke should be in the full closed position during handling.

3.2 Storage

- Choke should be stored in the fully closed position.
- Hydraulic* and electrical ports should be fully protected from damage.
- Hydraulic supply ports should be capped off in order to keep operating fluid clean*.

3.3 Inspection/Testing After Storage

- Visually inspect for damage.
- Operate valve fully open and fully closed through the manual override several times to ensure correct operation. Operation should be smooth throughout, not jerky or stiff.
- Inspect for oil leaks from actuator housing.
- Pressure test hydraulic system to working pressure*.
- Operate actuator hydraulics and ensure actuator correct operation*.
- Flush hydraulic systems to ensure cleanliness level*.

*Not applicable for SL gearbox

4.0 CALIBRATION PROCEDURE

4.1 Visual Indicator

- Close the choke fully
- Loosen clamp bolt on visual indicator pointer
- Position pointer to read fully closed
- Tighten clamp bolt, torque to 9 ft-lb

4.2 LVDT

- If the LVDT requires re-calibration this requires the actuator to be opened which should only be performed by authorized service personnel. Contact Master Flo Valve for service.

5.0 PART LIST & ASSEMBLY DRAWING

5.1 Top Mounted Manual Override, Setup For LVDT Feedback

ITEM	DESCRIPTION
*1	BALL: 1/2”
*2	SPRING BUTTON - OUTER
*3	SPRING - INNER
*4	SPRING - OUTER
*5	SPRING BUTTON - INNER
6	BLADDER NUT
*7	CONNECTING ROD
*8	ACTUATOR PIN
9	HOUSING ASSEMBLY
*10	CYLINDER (SEE SECTION 5.3 OR 5.4)
*19	SPRING PIN: 1/8” X 1”
*20	TORSION SPRING
*21	SPRING PIN: 3/16” X 1”
*22	ACTUATOR PAWL
*23	HEX NUT: 3/8” - 16
*24	ADJUSTMENT SCREW
*25	PAWL BRACKET
26	BLADDER
27	BLADDER PROTECTOR
*28	DRIVE RING
29	DRIVE SHAFT
30	LVDT
31	SEAL: HOUSING COVER - HOUSING
32	HOUSING COVER
33	GEARBOX
34	LVDT MOUNT PLATE
35	CAPSCREW: 5/16” X 1/2”
36	CAPSCREW: GEARBOX MOUNT #8 - 32 X 1/2”
37	CAPSCREW: 1/4” - 20 X 1 1/4”
38	LVDT CLAMP
39	CAPSCREW: 1/4” - 20 X 3/4”
40	CAPSCREW: 1/2” - 13 X 1”
41	CALIBRATION PLATE
42	CAPSCREW: 1/4” - 20 X 1/2”
43	SEAL: DRIVE STEM
44	COVER PLATE
45	BEARING: DRIVE STEM
46	GASKET: COVER PLATE

***Not applicable for SL gearbox**

5.0 PART LIST & ASSEMBLY DRAWING

5.1 Top Mounted Manual Override, Setup For LVDT Feedback (Con't)

ITEM	DESCRIPTION
47	LOCKNUT
48	BEARING CONE
49	BEARING CUP
50	DRIVE STEM
51	CAPSCREW: 3/8" - 16 X 1 3/4"
52	OIL PLUG
53	SPRING PIN: 3/32" X 1/2"
54	BUSHING: INDICATOR SHAFT
55	SEAL: INDICATOR SHAFT
56	INDICATOR FLANGE
57	INDICATOR FLANGE GASKET
58	CAPSCREW: 1/4" - 20 X 5/8"
59	INDICATOR POINTER
60	INDICATOR SHAFT
	CHECK VALVE
A5	ROV: RECEPTACLE
A4	ROV: ADAPTER
A3	SPRING
A1	BUSHING
A2	CAPSCREW: 3/8" - 16 X 1 3/4"

NOTE: FOR REFERENCE ONLY. SEE DOCUMENT PACKAGE FOR PARTS LIST.

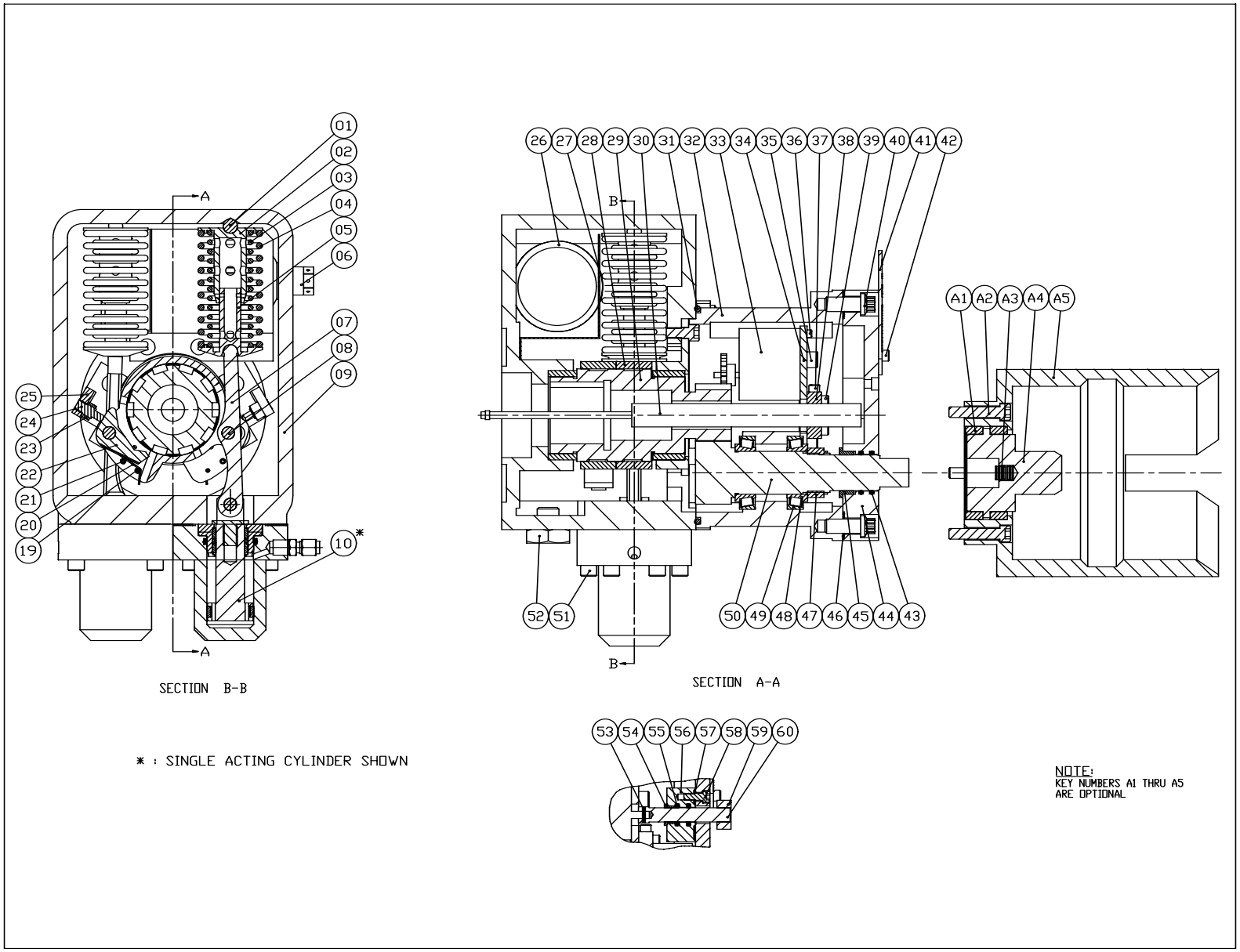


Figure 5.1: Assembly Drawing

5.0 PART LIST & ASSEMBLY DRAWING

5.2 Right/Left Hand Manual Override, Setup For LVDT Feedback

ITEM	DESCRIPTION
*01	BALL: 1/2”
*02	SPRING BUTTON - OUTER
*03	SPRING: INNER
*04	SPRING: OUTER
05	SEAL: BLADDER NUT
06	BLADDER NUT
07	BLADDER
08	BLADDER PROTECTOR
*09	SPRING BUTTON – INNER
*10	CONNECTING ROD
*11	ACTUATOR PIN
12	HOUSING ASSEMBLY
*13	CYLINDER (SEE SECTION 5.3 OR 5.4)
*24	SPRING PIN: 1/8” X 1”
*25	TORSION SPRING
*26	SPRING PIN: 3/16” X 1”
*27	ACTUATOR PAWL
*28	HEX NUT: 3/8” - 16
*29	ADJUSTMENT SCREW
*30	PAWL BRACKET
31	OIL PLUG
*32	DRIVE RING
33	DRIVE SHAFT
34	LVDT
35	SHIM
36	MITER GEAR
37	SEAL: HOUSING COVER – HOUSING
38	INDICATOR DRIVE GEAR
39	HOUSING COVER
40	CAPSCREW: 1/4” – 20 X 1 1/4”
41	MOUNT PLATE
42	LVDT CLAMP
43	LVDT AMP CLAMP
44	GASKET: COVER PLATE
45	CAPSCREW: 1/2” – 13 X 1”
46	COVER PLATE
47	KEY: 3/8” SQUARE X 3/4”
48	MITER GEAR
49	BEARING CONE

***Not applicable for SL gearbox**

5.0 PART LIST & ASSEMBLY DRAWING

5.2 Right/Left Hand Manual Override, Setup For LVDT Feedback (Con't)

ITEM	DESCRIPTION
50	BEARING CUP
51	DRIVE STEM
52	WASHER
53	GASKET: DRIVE STEM COVER
54	LOCKNUT
55	DRIVE STEM COVER
56	CAPSCREW: 3/8" - 16 X 1 1/4"
57	SEAL: DRIVE STEM - COVER
58	CAPSCREW: 5/16" - 18 X 5/8"
59	CAPSCREW: 1/4" – 20 X 1 3/4"
60	CAPSCREW: 1/4" – 20 X 3/4"
61	CAPSCREW: 1/4" – 20 X 1/2"
62	CAPSCREW: #8 – 32 X 3/8"
63	L-BRACKET
64	INDICATOR GEARBOX ASSY
65	CHECK VALVE
66	CALIBRATION PLATE
67	INDICATOR FLANGE
68	CAPSCREW: 1/4" - 20 X 1/2"
69	CAPSCREW: 1/4" - 20 X 1 1/4"
70	CAPSCREW: 1/4" - 20 X 5/8"
71	POINTER
72	INDICATOR SHAFT
73	SEAL: INDICATOR SHAFT
74	BUSHING
75	SEAL: INDICATOR LANGE
76	SPRING P/N: 3/32" X 1/2"

NOTE: FOR REFERENCE ONLY. SEE DOCUMENT PACKAGE FOR PARTS LIST.

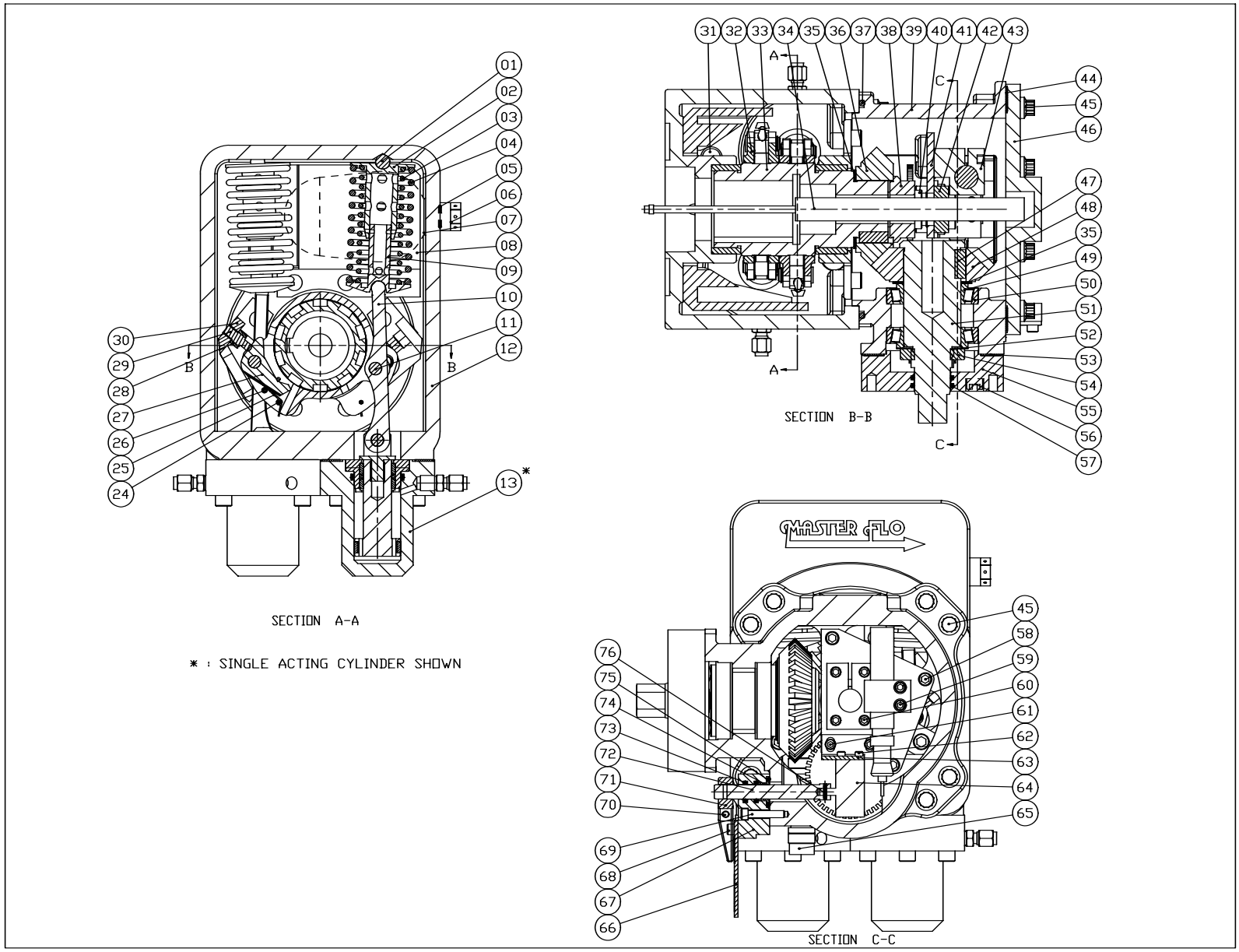


Figure 5.2: Assembly Drawing

5.0 PART LIST & ASSEMBLY DRAWING

5.3 Single Acting Hydraulic Cylinder (not applicable for SL gearbox)

ITEM	DESCRIPTION
01	ACTUATOR STEM
02	GASKET: CYLINDER - HOUSING
03	BEARING HOUSING ASSY
04	BU RING: CYLINDER - BEARING HOUSING
05	SEAL: CYLINDER - BEARING HOUSING
06	SWAGELOK CONNECTOR
07	SEAL: PISTON - BEARING HOUSING
08	CAPSCREW: 3/8” - 16 X 1 3/4”
09	CYLINDER
10	PISTON
11	WEAR RING

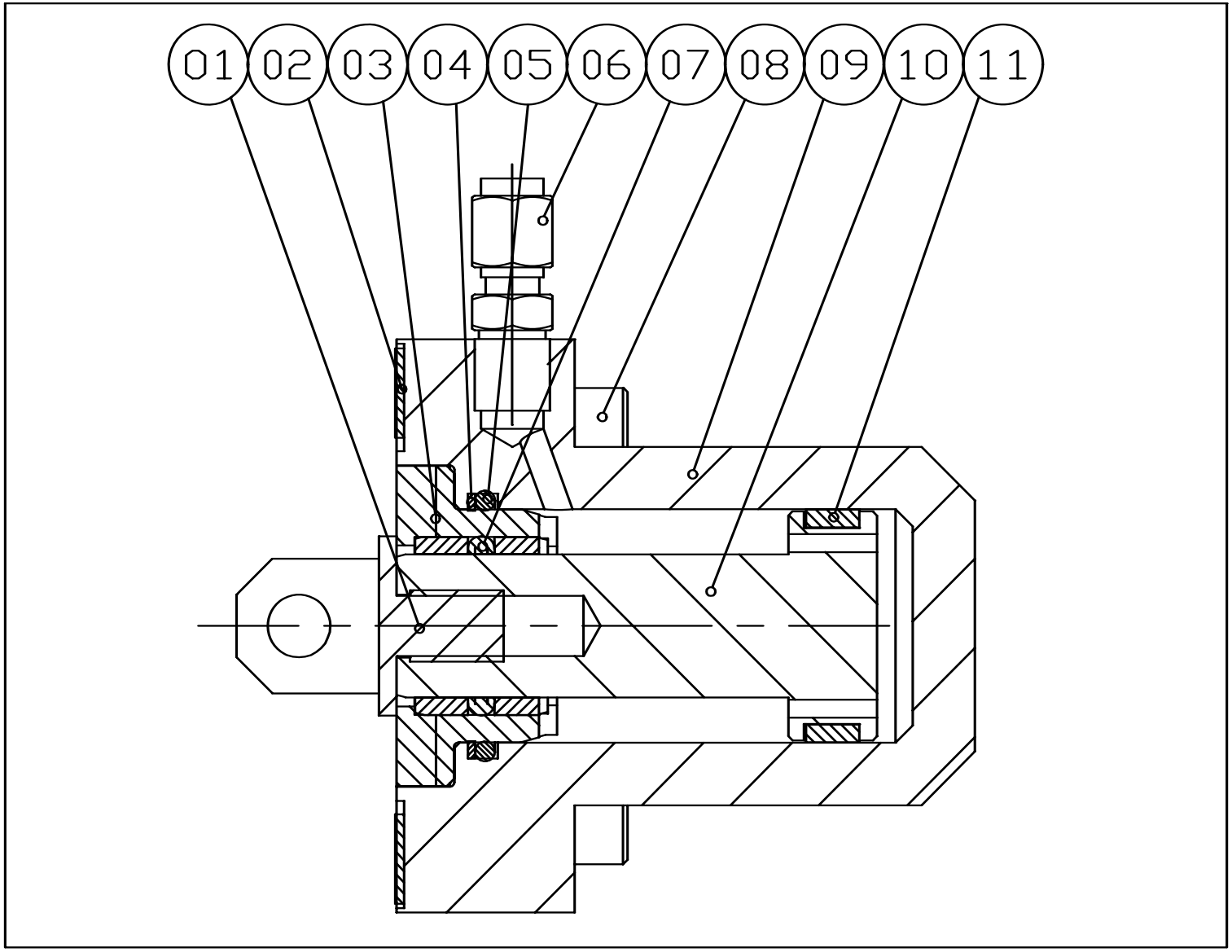


Figure 5.3: Assembly Drawing

5.0 PART LIST & ASSEMBLY DRAWING

5.4 Double Acting Hydraulic Cylinder (not applicable for SL gearbox)

ITEM	DESCRIPTION
01	ACTUATOR STEM
02	BEARING HOUSING ASSY
03	BU RING: CYLINDER - BEARING HOUSING
04	SWAGELOK CONNECTOR
05	SEAL: CYLINDER - BEARING HOUSING
06	CAPSCREW: 3/8” - 16 X 1 3/4”
07	WEAR RING
08	SEAL: PISTON - CYLINDER
09	SEAL: PISTON - BEARING HOUSING
10	CYLINDER
11	GASKET: CYLINDER - HOUSING
12	PISTON
13	CAPSCREW
14	CYLINDER CAP

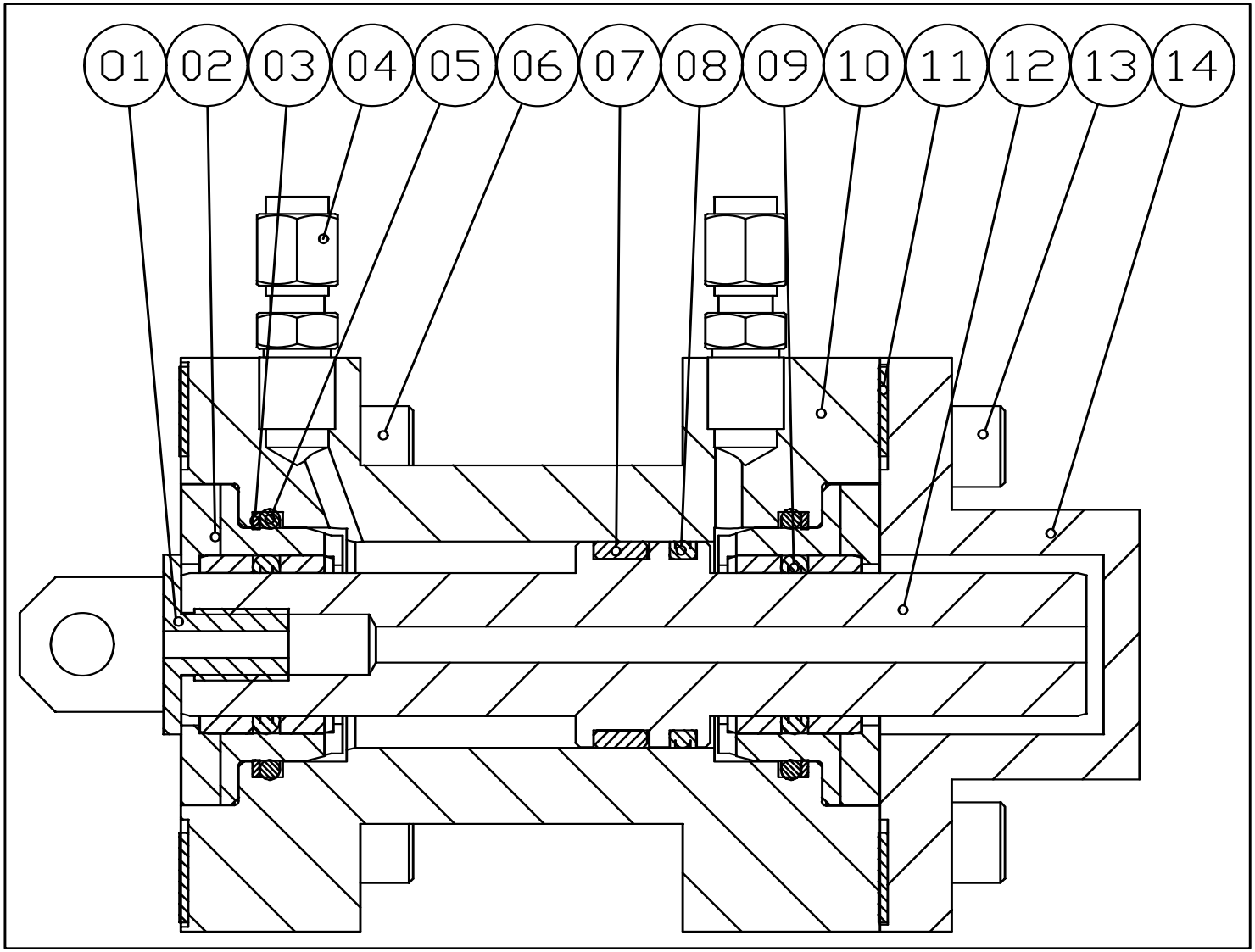


Figure 5.4: Assembly Drawing

MASTER FLO VALVE INC.
4611-74th Avenue
Edmonton, Alberta
Canada, T6B 2H5
Tel: 1-780-468-4433
Fax: 1-780-469-9853
Email: info@masterflo.com
Website: www.masterflo.com

Calgary, Alberta
Tel: (403) 237-5557
Fax: (403)266-3307

Houston, Texas
Phone: (713) 690-2789
Fax: (713) 690-3838

Abu Dhabi, United Arab Emirates
Phone: 971-2-6329150
Fax: 971-2-6321276

Pau, France
Phone: 33 (0)5 5992-8229
Fax: 33 (0)5 5992-8261

Aberdeen, Scotland
Phone: 44-1224-878999
Fax: 44-1224-878989

Jakarta, Indonesia
Phone: 62-21-7918-1234
Fax: 62-21-7918-2575

Rio de Janeiro, Brazil, 20031-201
Phone: 55 (0)21-2532-5618
Fax: 55 (0)21-2220-7677

Kuala Lumpur 50250 Malaysia
Phone: 60-3-2078-7688
Fax: 60-3-2078-7689

MASTER FLO VALVE INC.
Head Office
4611 - 74 Avenue
Edmonton, Alberta
Canada, T6B 2H5

PACKING LIST

MASTER FLO VALVE INC.
Head Office
4611 - 74 Avenue
Edmonton, Alberta
Canada, T6B 2H5

Packing list

Date:	September 10, 2010	Pieces:	1 crate
D.S. #:	65746	Dimensions:	56 x 52 x 63 inch
P.O.#:	N/A Customer PO #: MC506-281	Weight:	969 kg
Quote #:	30755/H7032	Freight:	Collect
MFV GST #:	R103556536 RM0001		

Sold To:	MASTER FLO VALVE (USA) INC. 8726 FALLBROOK DRIVE HOUSTON TX 77064 USA Tel. 713-690-2789	Ship To:	NEWFIELD EXPLORATION COMPANY 363 N. SAM HOUSTON PARKWAY EAST SUITE 2020 HOUSTON, TX -- 77060-3593 USA
Federal ID #:	98-0354106		

Qty	Part Number	HS Tariff	Description
1	42005-011-01 Serial #: HRV-865 & ROT-3873	8481.9000	P35-15K HRV INSERT FOR 42005-011
1	*CERT	4901.9900	CERTIFICATE OF CONFORMANCE
1	*CERT	4901.9900	PSL 3 CERTIFICATION PACKAGE

Via: Waggoners

Province of Origin: Alberta XA

We certify the above to be true and correct to the best of our knowledge.

Authorized Signature: _____

O:\Shipping\Commercial Invoices\C-65746 MF Houston.doc

MASTER FLO VALVE INC.
Head Office
4611 - 74 Avenue
Edmonton, Alberta
Canada, T6B 2H5

COMMERCIAL DOCUMENT LIST

MASTER FLO VALVE INC.
Head Office
4611 - 74 Avenue
Edmonton, Alberta
Canada, T6B 2H5

COMMERCIAL INVOICE

(Do Not Pay / For Customs Use Only)

Date:	September 10, 2010	Pieces:	1 crate
D.S. #:	65746	Dimensions:	56 x 52 x 63 inch
P.O.#:	N/A Customer PO #: MC506-281	Weight:	969 kg
Quote #:	30755/H7032	Freight:	Collect
MFV GST #:	R103556536 RM0001		

Sold To:	MASTER FLO VALVE (USA) INC. 8726 FALLBROOK DRIVE HOUSTON TX 77064 USA Tel. 713-690-2789	Ship To:	NEWFIELD EXPLORATION COMPANY 363 N. SAM HOUSTON PARKWAY EAST SUITE 2020 HOUSTON, TX -- 77060-3593 USA
Federal ID #:	98-0354106		

Qty	Part Number	HS Tariff	Description	Price	Extension
1	42005-011-01 Serial #: HRV-865 & ROT-3873	8481.9000	P35-15K HRV INSERT FOR 42005-011	144,900.00	144,900.00
1	*CERT	4901.9900	CERTIFICATE OF CONFORMANCE	Included	0.00
1	*CERT	4901.9900	PSL 3 CERTIFICATION PACKAGE	Included	0.00

Total US Dollars: $144,900.00

Via: Waggoners

Province of Origin: Alberta XA

We certify the above to be true and correct to the best of our knowledge.

Authorized Signature: _____

O:\Shipping\Commercial Invoices\C-65746 MF Houston.doc