

Field Commissioning Binder

**Encana Corporation
Unit # 060433**

EFX Unit Number: 060433

Field Commissioning Binder Instructions:

- Document Control will ensure that the Field Commissioning Binder is properly completed with the above documentation. **Note that all drawings must be As-Built drawings.**
- Document Control will ensure that the Field Commissioning Binder is placed in the unit in a secured envelope to be opened only by the Commissioning Technician. The binder will be held in a document holder attached to the unit wall or door.
- If shipping requirements precludes placing the binder on the unit, the binders will be forwarded to the appropriate commissioning branch Attn: Service Manager.
- The Commissioning Technician will complete the forms in Part B as appropriate for the equipment being commissioned. **The FCD forms are mandatory and must be completed by the technician.** The binder will be brought back to the PAMCO-Jiro branch following commissioning.
- Upon completion, the branch Service Manager or Service Coordinator will ensure that the completed forms from **Part B** are sent by fax (403.236.1729), mail or e-mail (scanned) to EFX Compression Customer Service Attn: Customer Service Manager.
- The Service Manager/Coordinator will forward the applicable start-up forms to the engine/compressor OEM's as appropriate.
- The Field Commissioning Binder will then be held within the branch for future reference.
- The Customer Service Manager will ensure that the returned forms are stored electronically in the project folders and that all follow-up actions (NCR's, ECR's) are completed.
- Note that any warranty invoices to the branch will not be processed until the start-up reports are received by Customer Service.

Please direct any concerns to EFX Customer Service at 403.236.6800

Field Commissioning Binder

Table of Contents

Encana Corporation # 060433		
SECTION	CONTENTS	VDRL CODE
FCD-50646	<ul style="list-style-type: none"> • Field Commissioning Binder Instructions • Table of Contents 	
Part A – Project Documentation	<ul style="list-style-type: none"> • Unit Commissioning Data (UCD) • Compressor Performance Summary • Compressor Lubrication Sheet • Compressor Balance Sheet • Panel Shutdown Key (11x17) • Scope Summary • PF – 50 P&ID • Cooler Data Sheet • GA – General Arrangement • SF – 20 Compressor Oil System • SF – 21 Packing Vent and Drain • SF – 22 Fuel and Start Gas • SF – 24 Engine Glycol System • SF – 26 Air and Exhaust • SF – 27 Engine Oil • SF – 28 Drive Train Equipment • SF – 70 Building Equipment • SF – 72 Building Heaters • SF – 74 Crane Equipment • Fuel Gas Analysis 	
MSDA	<ul style="list-style-type: none"> • Compressor Oil MSDS • Paint MSDS • Engine Oil MSDA • Coolant MSDS 	
Part B – Field Commissioning Documents	<ul style="list-style-type: none"> • FCD-50648 Start-Up Checklist • FCD-50467 Field Commissioning Equipment and Deficiency List • Ariel ER-10.4.1 Start-Up Checklist-RG Rotary Compressors • Ariel Reciprocating Compressor Warranty • Ariel ER-10.4.0 Start-Up Reciprocating 	

Field Commissioning Binder

Table of Contents

	<p>Compressors</p> <ul style="list-style-type: none"> • Waukesha Field Start-Up Report • Caterpillar Engine Service Delivery Record • Caterpillar G3500 Industrial Engine Field Commissioning Report • Dresser-Rand – Warranty Initiation • Dresser-Rand – Startup Notification • PAMCO Start-Up Compressor Report And Clearance Record • PAMCO-005A Engine Alignment Report • Rotating Equipment Alignment Form 	
<p>Service Bulletins</p>	<ul style="list-style-type: none"> • Mechanical Service Bulletin Heat Growth • Waukesha SB5-2306A • Waukesha SB1-2620D 	

Part A – Project Documentation

SCREW COMPRESSOR PERFORMANCE MAP

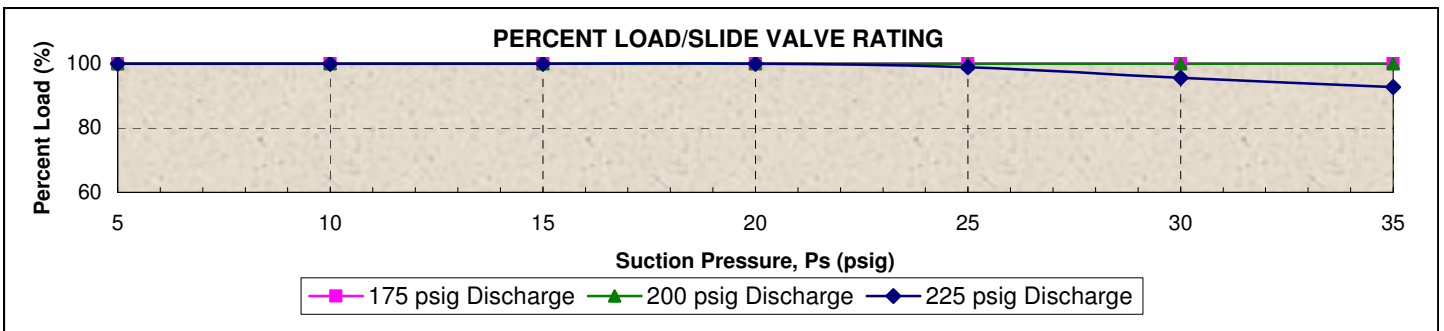
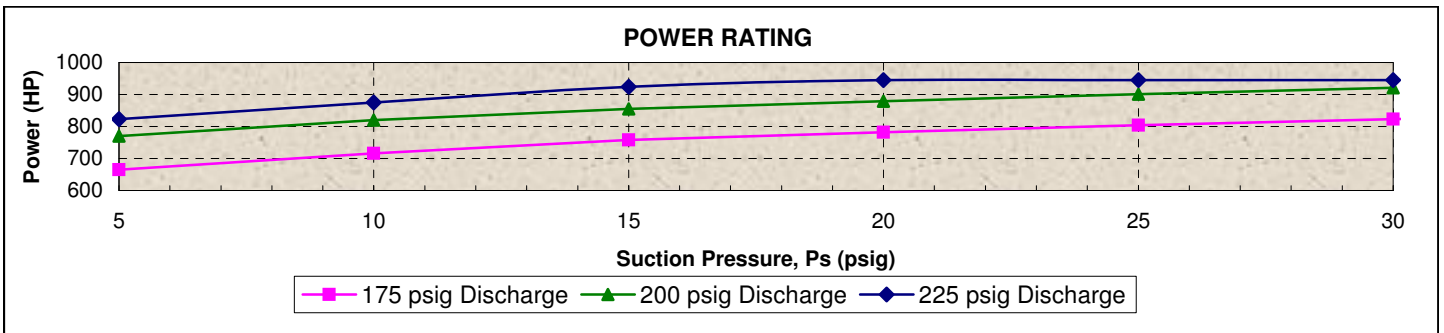
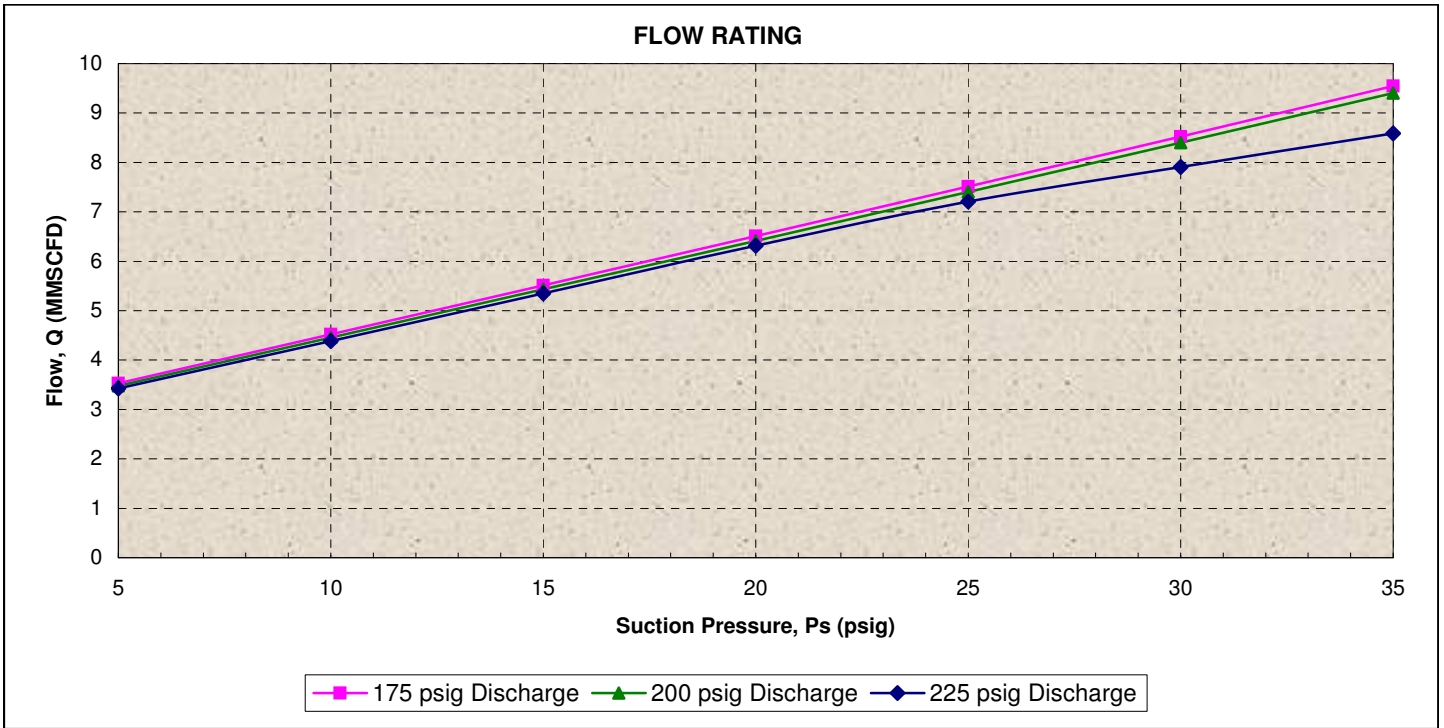
MAJOR EQUIPMENT DETAILS:

Model: SA1005
 Driver: Cat 3512LE AFRC
 Compressor: Ariel RG357M
 Gear Ratio: 1

Driver Speed: 1400 rpm
 Comp. Speed: 1400 rpm
 VI Type: Variable
 Oil Pump: Yes

PROCESS DESIGN:

Suction Temperature: 60 °F
 Ambient Temperature: 95 °F
 Elevation: 2500 ft
 Specific Gravity: 0.65



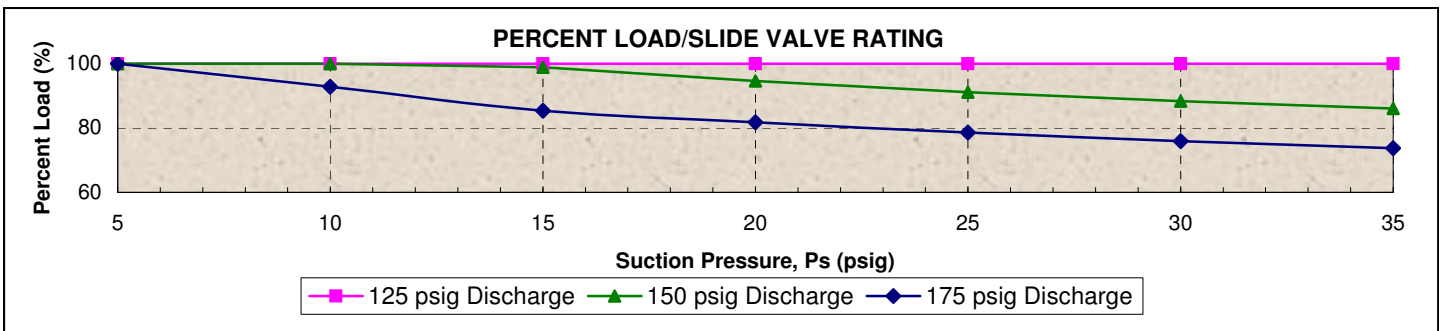
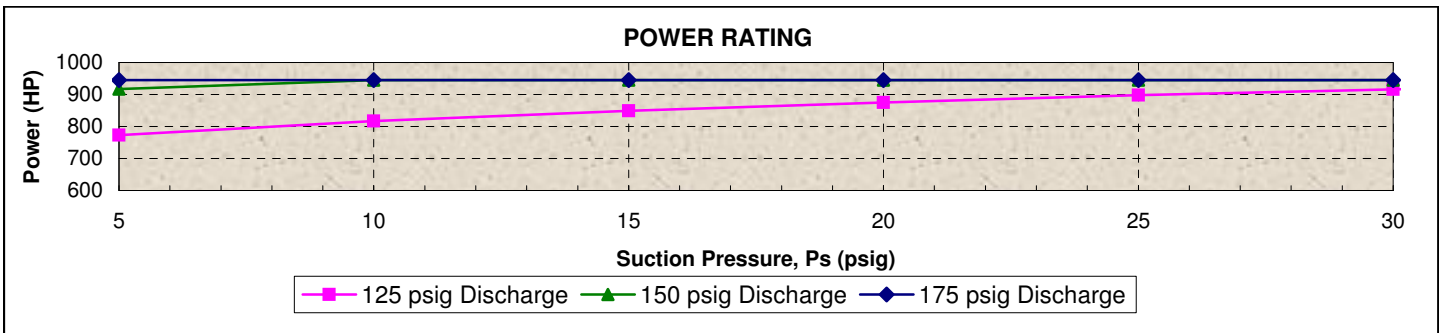
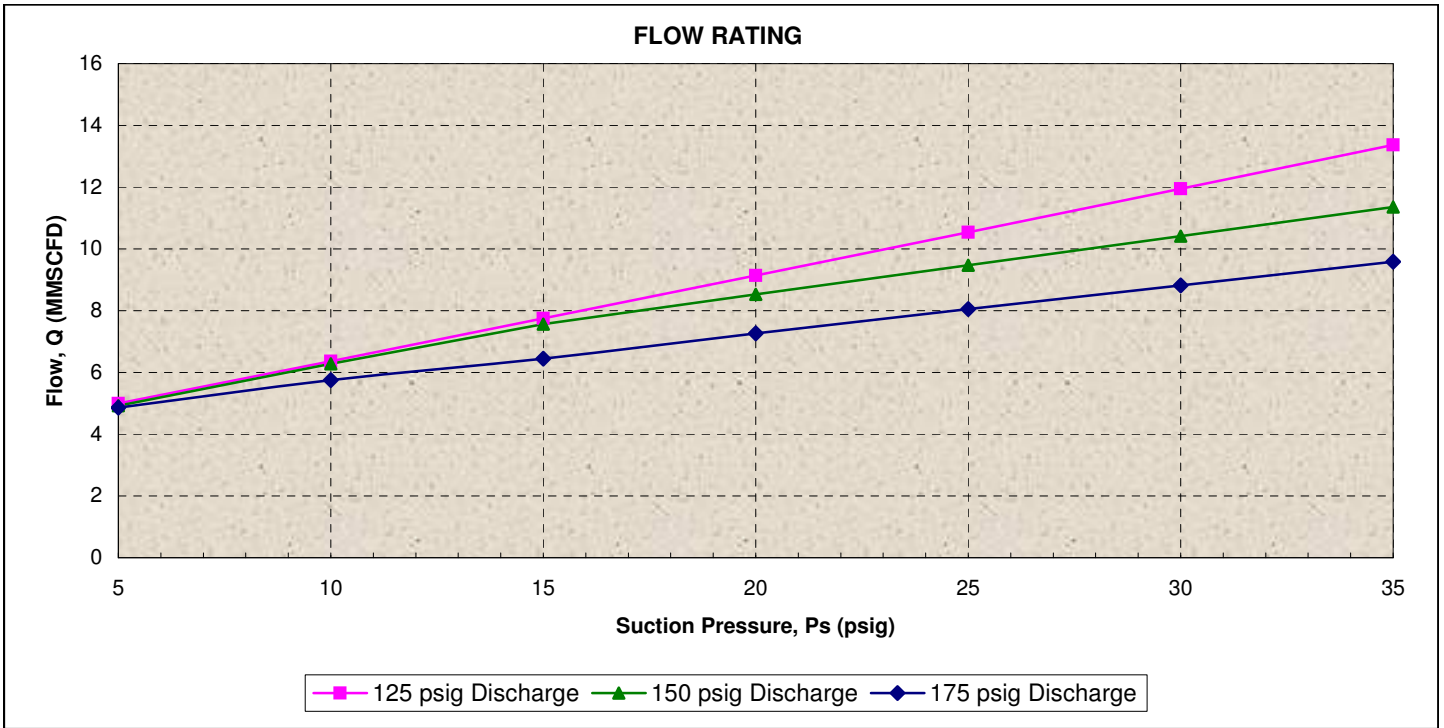
SCREW COMPRESSOR PERFORMANCE MAP

MAJOR EQUIPMENT DETAILS:

Model:	SA1005	Driver Speed:	1400 rpm
Driver:	Cat 3512LE AFRC	Comp. Speed:	1897 rpm
Compressor:	Ariel RG357M	VI Type:	Variable
Gear Ratio:	1.355	Oil Pump:	Yes

PROCESS DESIGN:

Suction Temperature:	60 °F
Ambient Temperature:	95 °F
Elevation:	2500 ft
Specific Gravity:	0.65



SCREW COMPRESSOR PERFORMANCE MAP

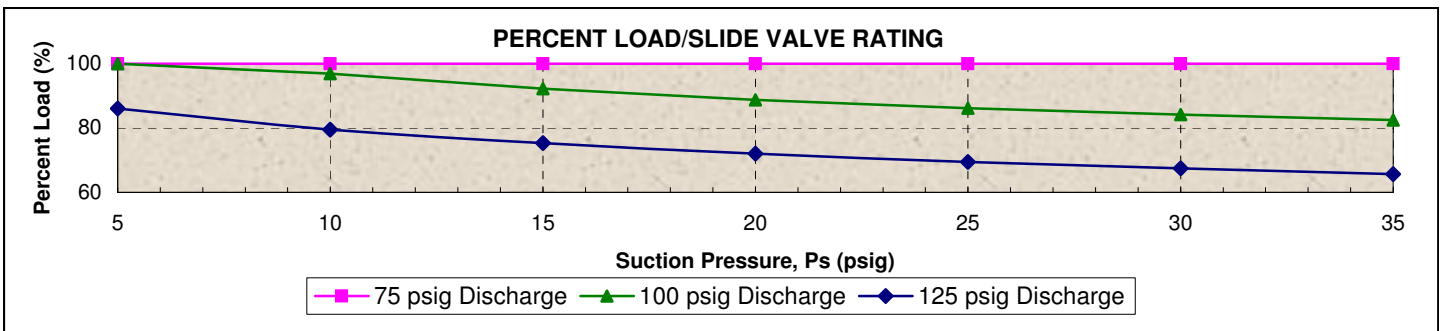
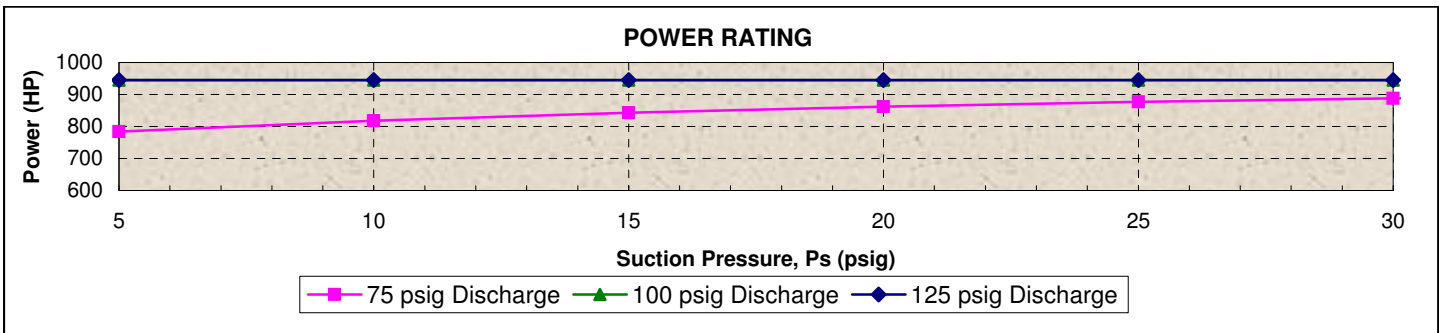
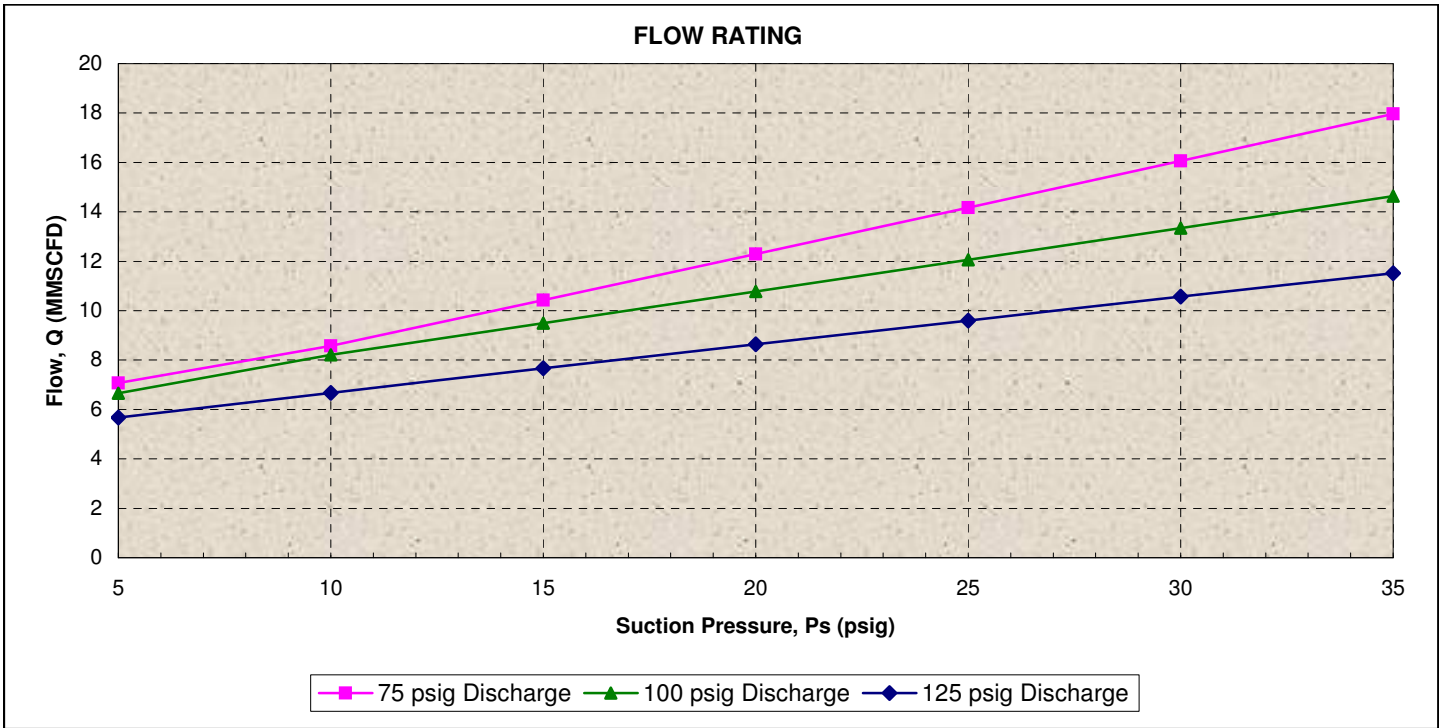
MAJOR EQUIPMENT DETAILS:

Model: SA1005
 Driver: Cat 3512LE AFRC
 Compressor: Ariel RG357M
 Gear Ratio: 1.769

Driver Speed: 1400 rpm
 Comp. Speed: 2477 rpm
 VI Type: Variable
 Oil Pump: Yes

PROCESS DESIGN:

Suction Temperature: 60 °F
 Ambient Temperature: 95 °F
 Elevation: 2500 ft
 Specific Gravity: 0.65





Configuration

Company: Ariel Corporation
Quote:

Customer: EnCana Corporation
Inquiry:



7.5.2.2 Case 1: Ps = 10 psig, Pd = 150 psig 1005 hp

Project: Chinook Booster

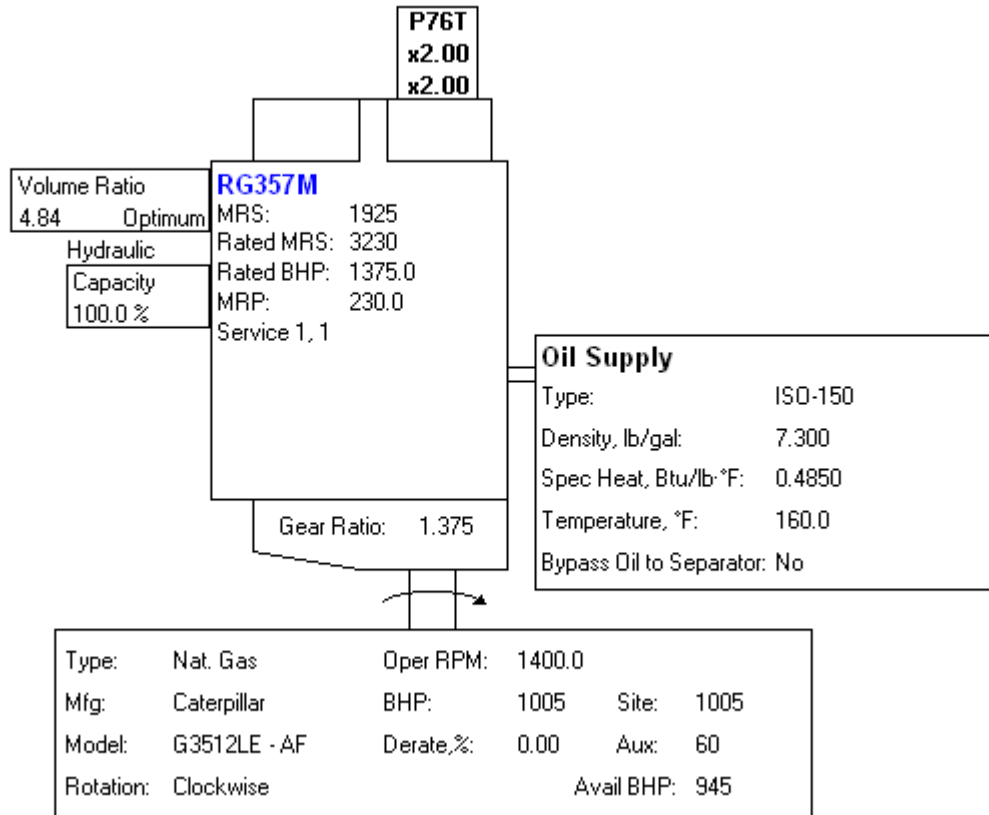
Elevation,ft: 2000.0

Barmtr,psia: 13.651

Ambient,°F: 95.00

Service: Service 1
 Flow,MMSCFD: 5.365
 Ps Line, psig: 10.00
 Ps Loss, psi: 0.00
 Suct Temp, °F: 60.00
 Pd Line, psig: 150.00
 Gas Model: Hall
 Gas Analysis: No
 Specific Gravity: 0.6500
 Remove Water: Yes
 Calc Press Loss: Yes
 Enter Oper Params: No

Stage: 1
 Enabled: Yes
 Press Loss, psi: 4.91
 Cooler Temp, °F: 120.00
 Calc N&Z: Yes
 N: 1.2454
 Zs: 0.9955
 Zd: 0.9938
 Condensate,%: N/A
 Enter Gas: No





Ariel Rotary Compressor Data Sheet

Model: RG357M

Vi: Optimum



Capacity: 1320 - 5150 CFM
 Max Rated Power: 1375.0 BHP
 Male Rotor Speed: 840 - 3230 rpm
 Rated Input Speed: 1800 rpm
 Max. Case Static Press: 300.00 psig

Rotor:

Male Rotor Dia: 357 mm
 L/D Ratio: 2.10

Flanges:

Suction: 16"- 300 FF
 Discharge: 10"- 300 FF

Pressure Ratings*:

Max Suction: 50.0 psig
 MRVS: 300.0 psig
 MRP: 230.0 psig
 HTP: 450.0 psig

* For extended operating pressures see operator's manual.

Available Gear Ratios:

1.000 1.375 1.566 1.778 2.040 2.304 2.667

Available Volume Ratios:

Steplessly adjustable from 2.50 to 5.00

Dimensions:

Maximum Height:	45.00 in	With Bellhousing:		Without Bellhousing:	
Maximum Width:		Maximum Length:	109.00 in	Maximum Length:	97.20 in
Hydraulic Controls:	72.10 in	Maximum Weight:	9850 lbs	Maximum Weight:	9000 lbs
Handwheel Controls:	72.10 in				

Bearings:

Compressor -	Axial:	Angular contact ball bearings
	Radial:	Hydrodynamic - Suction and discharge sides
Gearbox -	Axial/Radial:	Taper roller bearings and cylindrical roller bearing

Material Specifications:

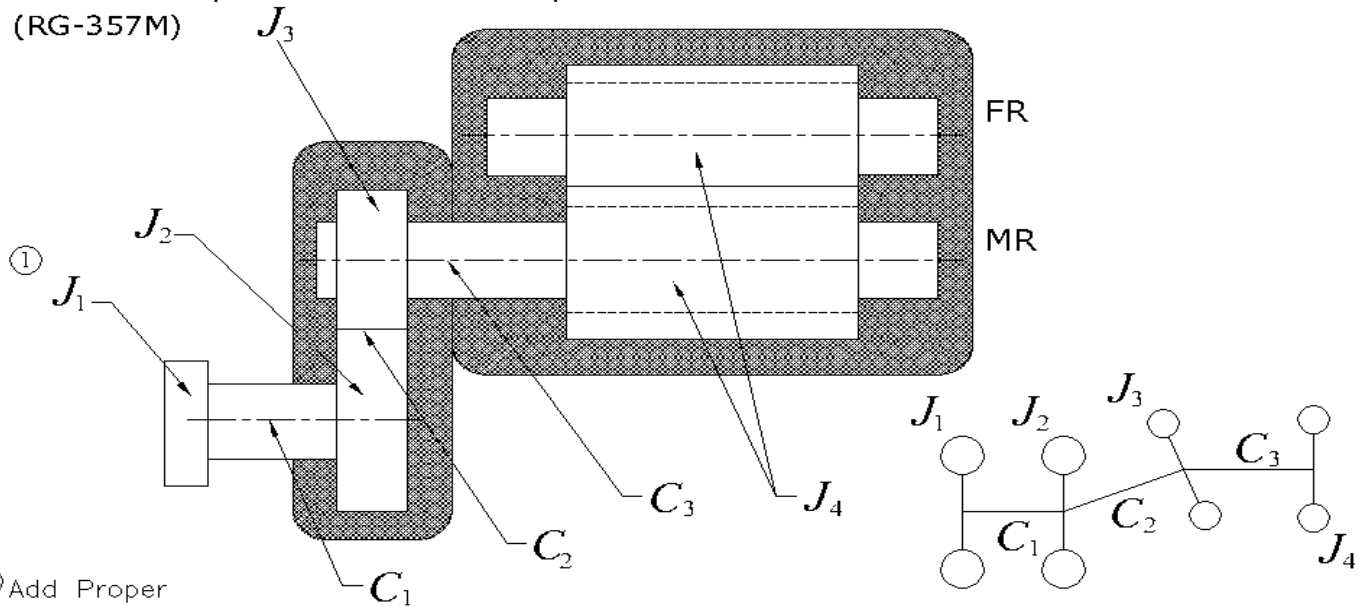
Rotor Housing:	Ductile Iron	14D	(ASTM A395 Grade 60-40-18)
Discharge Housing:	Ductile Iron	14D	(ASTM A395 Grade 60-40-18)
Gearbox Housing:	Ductile Iron	14D	(ASTM A395 Grade 60-40-18)
Discharge Cover:	Ductile Iron	14D	(ASTM A395 Grade 60-40-18)
Rotors:	Forged Carbon Steel	15C	(AISI 1045)
Slide Plate, Vi:	Ductile Iron	16D	(ASTM A536 Grade 65-45-12)
Slide Plate Stem, Vi:	303 Stainless		(303 Stainless Steel)
Slide Plate, Capacity:	Ductile Iron	16D	(ASTM A536 Grade 65-45-12)
Slide Plate Stem, Capacity:	303 Stainless		(303 Stainless Steel)
Stem Seal:	Viton		(V4208A90 Fluorcarbon)
Gears:	Alloy Steel		(AISI 4320H)
Gear Shaft:	Forged Alloy Steel	13N,15N	(AISI 4340)
Radial Bearings:	Steel Backed Babbit		(Steel Backed Babbit)
Mechanical Seal:	Silicon carbide/carbon		(Silicon carbide/carbon)
O-Rings:	Viton	10E	(ASTM D2000)

Outline Drawings:

RG Series Electrical Connection Schematic	002273
RG Series Oil Schematic - Handwheel Control - Sheet 1	001838s1
RG Series Oil Schematic - Handwheel Control - Sheet2	001838s2
RG Series Oil Schematic - Handwheel Control - Sheet3	001838s3
RG Series Oil Schematic - Hydraulic Control - Sheet 1	002234s1
RG Series Oil Schematic - Hydraulic Control - Sheet2	002234s2
RG Series Oil Schematic - Hydraulic Control - Sheet3	002234s3
Outline	002140s1
Outline with SAE 00 Bell Housing	002172s1
Outline - Sheet 2	002140s2
Outline with SAE 00 Bell Housing - Sheet 2	002172s2
Outline - Sheet 3	002140s3
Outline with SAE 00 Bell Housing - Sheet 3	002172s3

GAS COMPRESSORS

Substitute System for Torsion Analysis
(RG-357M)



① Add Proper Coupling Moment of Inertia

ALL DATA REFERENCED TO ITS OWN SPEED, EXCEPT FEMALE ROTOR. GEAR TOOTH STIFFNESS C2 IS REFERENCED TO JACKSHAFT SPEED.

Gear Ratio	① J_1	C_1	J_2	C_2	J_3	C_3	J_4
	Jackshaft Moment of Inertia kg-m ² [lb-in ²]	Jackshaft Stiffness N-m/rad [lb-in/rad]	Jackshaft & Gear Moment of Inertia kg-m ² [lb-in ²]	Gear Tooth Stiffness N-m/rad [lb-in/rad]	Pinion Moment of Inertia kg-m ² [lb-in ²]	Male Rotor Stiffness N-m/rad [lb-in/rad]	Male & Female* Rotors Moment of Inertia kg-m ² [lb-in ²]
1.000	0.012 [40]	2.204*10 ⁶ [1.951*10 ⁷]	0.463 [1,584]	1.705*10 ⁷ [1.509*10 ⁸]	0.270 [922]	7.553*10 ⁶ [6.685*10 ⁷]	*Referenced To Male Rotor Speed 5.869 [20,055]
1.375			0.673 [2,301]	2.352*10 ⁷ [2.082*10 ⁸]	0.134 [458]		
1.567			0.785 [2,682]	2.632*10 ⁷ [2.330*10 ⁸]	0.097 [332]		
1.778			0.907 [3,098]	2.901*10 ⁷ [2.567*10 ⁸]	0.070 [239]		
2.040			1.054 [3,601]	3.176*10 ⁷ [2.811*10 ⁸]	0.048 [163]		
2.304			1.196 [4,086]	3.389*10 ⁷ [3.000*10 ⁸]	0.033 [114]		
2.667			1.378 [4,709]	3.576*10 ⁷ [3.165*10 ⁸]	0.021 [71]		



Ariel Rotary Performance



Company: Ariel Corporation
Quote:

Customer: EnCana Corporation
Inquiry:

7.5.2.2

Case 1: Ps = 10 psig, Pd = 150 psig 1005 hp

Project: Chinook Booster

Compressor Data:

Elevation,ft:	2000.0	Barmtr,psia:	13.651	Ambient,°F:	95.00
Model:	<u>RG357M</u>	Installed Vi:	Optimum	Gear Ratio:	1.375
Oil Pump:	P76Tx2.00x2.00				
Rated RPM:	1800	Rated BHP:	1375.0	Rated MRS:	3230
Oper RPM:	1400.0	Calc BHP:	929	Calc MRS:	1925

Driver Data:

Type:	Nat. Gas
Mfg:	Caterpillar
Model:	G3512LE - AFRC
BHP:	1005
Avail:	945 (60)

Services

Service 1

Stage Data:

#1

Flow Req'd, MMSCFD	5.365
Flow Calc, MMSCFD	6.764
BHP per Stage	926.8
Specific Gravity	0.65
Ratio of Sp Ht (N)	1.2454
Comp Suct (Zs)	0.9955
Comp Disch (Zd)	0.9938
Pres Suct Line, psig	10.00
Pres Suct Flg, psig	10.00
Pres Disch Flg, psig	154.91
Pres Disch Line, psig	150.00
Pres Ratio F/F	7.127
Temp Suct, °F	60.00
Temp Clr Disch, °F	120.00

Compressor Data:

Model	<u>RG357M</u>
Male Rotor Dia, mm	357
MRP, psig	230.0
MRVS, psig	300.0
Capacity, %	100.0
Volume Ratio	4.84
Adiabatic Eff, %	78.0
Volumetric Eff, %	89.4
Temp Disch, °F	205.00
Male Rotor Tip Spd, m/s	35.98
Male Rotor Torque, ft-lbs	2528.7
Clr Gas Heat, BTU/h	609171

Oil Data:

Oil Pump	P76Tx2.00x2.00
Brg & Seal Flow, GPM	60.0
Req'd Pump Flow, GPM	78.0
Pump Flow, GPM	91.1
Rotor Inj Flow, GPM	47.1
Total Oil Flow, GPM	138.2
Oil Temp, °F	160.0
Oil Density, lb/gal	7.300
Oil Sp Ht, Btu/lb·°F	0.4850
Oil Heat, BTU/h	1321179
Bypass Oil to Separator	No



Company: Ariel Corporation
 Quote:

Oil Pump Report

Customer: EnCana Corporation



7.5.2.2

Case 1: Ps = 10 psig, Pd = 150 psig 1005 hp

Inquiry:

Project: Chinook Booster

Compressor Type	<u>RG357M</u>
Gear Ratio	1.375
Suction Pressure, psig	10.00
Discharge Pressure, psig	154.91
Oper Speed, rpm	1400.0
Male Rotor Speed, rpm	1925
Required Oil Flow (Brg,Seal,Shaft), GPM	60.0
Required Pump Flow, GPM	78.0

Pump Model	Pump Flow, GPM
P75Sx2.25	51.3
P75Sx2.50	56.9
P75Sx2.75	62.7
P75Sx3.00	68.3
P76Tx1.75x1.50	74.1
P76Tx1.75x1.75	79.8
P76Tx2.00x1.75	85.4
P76Tx2.00x2.00	91.1
P76Tx2.25x2.00	96.8
P76Tx2.25x2.25	102.6
P76Tx2.50x2.50	113.9
P76Tx2.75x2.50	119.6
P76Tx3.00x3.00	136.7



Ariel Performance Information



Company: Ariel Corporation Customer: EnCana Corporation
Quote: Inquiry:
7.5.2.2 Case 1: Ps = 10 psig, Pd = 150 psig 1005 hp Project: Chinook Booster

Cmpr: RG357M

IN DEVELOPMENT - Preliminary Performance, please Contact Application Engineering for Verification.

Gear Ratio: 1.375

Installed Volume Ratio: 4.84 (Optimum)

Service 1 - Service 1

Service 1 - Stage 1

Oil Pump: P76Tx2.00x2.00

Notes:

BOLD = Out of Limits, Compressor will NOT operate with these errors.

ITALIC = Special Application, Contact Ariel Engineering for Approval.

**C-1
SCREW COMPRESSOR**

MAKE: ARIEL
MODEL: RG357M
MAX. RUNNING PRESSURE: 1586 kPag @ 149°C
MAX. CASING PRESSURE: 2068 kPag @ 149°C
S/N: R10378

**E-2
AERIAL COOLER**

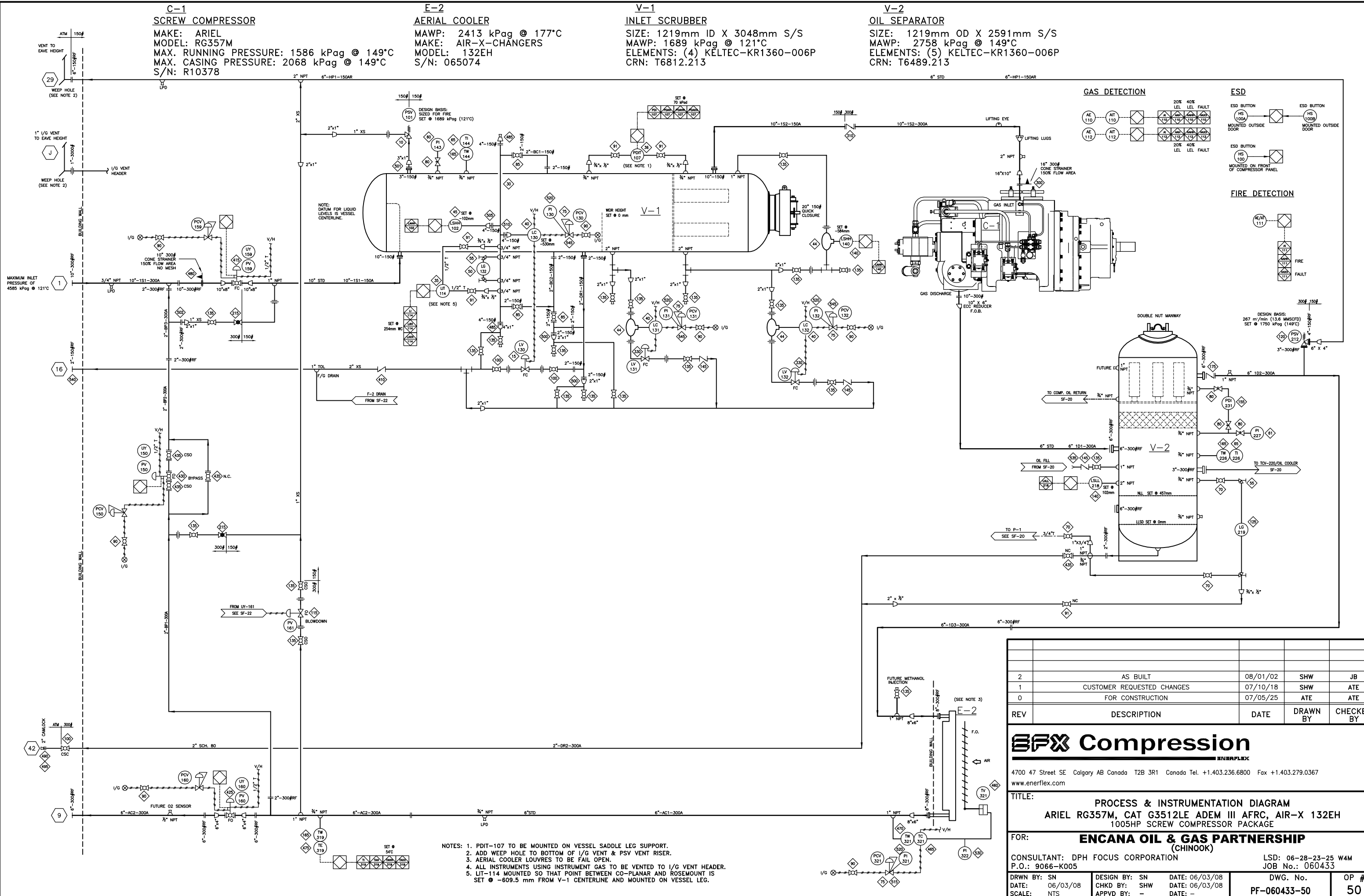
MAWP: 2413 kPag @ 177°C
MAKE: AIR-X-CHANGERS
MODEL: 132EH
S/N: 065074

**V-1
INLET SCRUBBER**

SIZE: 1219mm ID X 3048mm S/S
MAWP: 1689 kPag @ 121°C
ELEMENTS: (4) KELTEC-KR1360-006P
CRN: T6812.213

**V-2
OIL SEPARATOR**

SIZE: 1219mm OD X 2591mm S/S
MAWP: 2758 kPag @ 149°C
ELEMENTS: (5) KELTEC-KR1360-006P
CRN: T6489.213



- NOTES:
1. PDIT-107 TO BE MOUNTED ON VESSEL SADDLE LEG SUPPORT.
 2. ADD WEEP HOLE TO BOTTOM OF I/G VENT & PSV VENT RISER.
 3. AERIAL COOLER LOUVRES TO BE FAIL OPEN.
 4. ALL INSTRUMENTS USING INSTRUMENT GAS TO BE VENTED TO I/G VENT HEADER.
 5. LIT-114 MOUNTED SO THAT POINT BETWEEN CO-PLANAR AND ROSEMOUNT IS SET @ -609.5 mm FROM V-1 CENTERLINE AND MOUNTED ON VESSEL LEG.

REV	DESCRIPTION	DATE	DRAWN BY	CHECKED BY
2	AS BUILT	08/01/02	SHW	JB
1	CUSTOMER REQUESTED CHANGES	07/10/18	SHW	ATE
0	FOR CONSTRUCTION	07/05/25	ATE	ATE

BFX Compression
ENERFLEX

4700 47 Street SE Calgary AB Canada T2B 3R1 Canada Tel. +1.403.236.6800 Fax +1.403.279.0367
www.enerflex.com

TITLE: **PROCESS & INSTRUMENTATION DIAGRAM**
ARIEL RG357M, CAT G3512LE ADEM III AFRC, AIR-X 132EH
1005HP SCREW COMPRESSOR PACKAGE

FOR: **ENCANA OIL & GAS PARTNERSHIP**
(CHINOOK)

CONSULTANT: DPH FOCUS CORPORATION
P.O.: 9066-K005

DESIGN BY: SN
DATE: 06/03/08
SCALE: NTS

CHKD BY: SHW
DATE: 06/03/08
APPVD BY: -

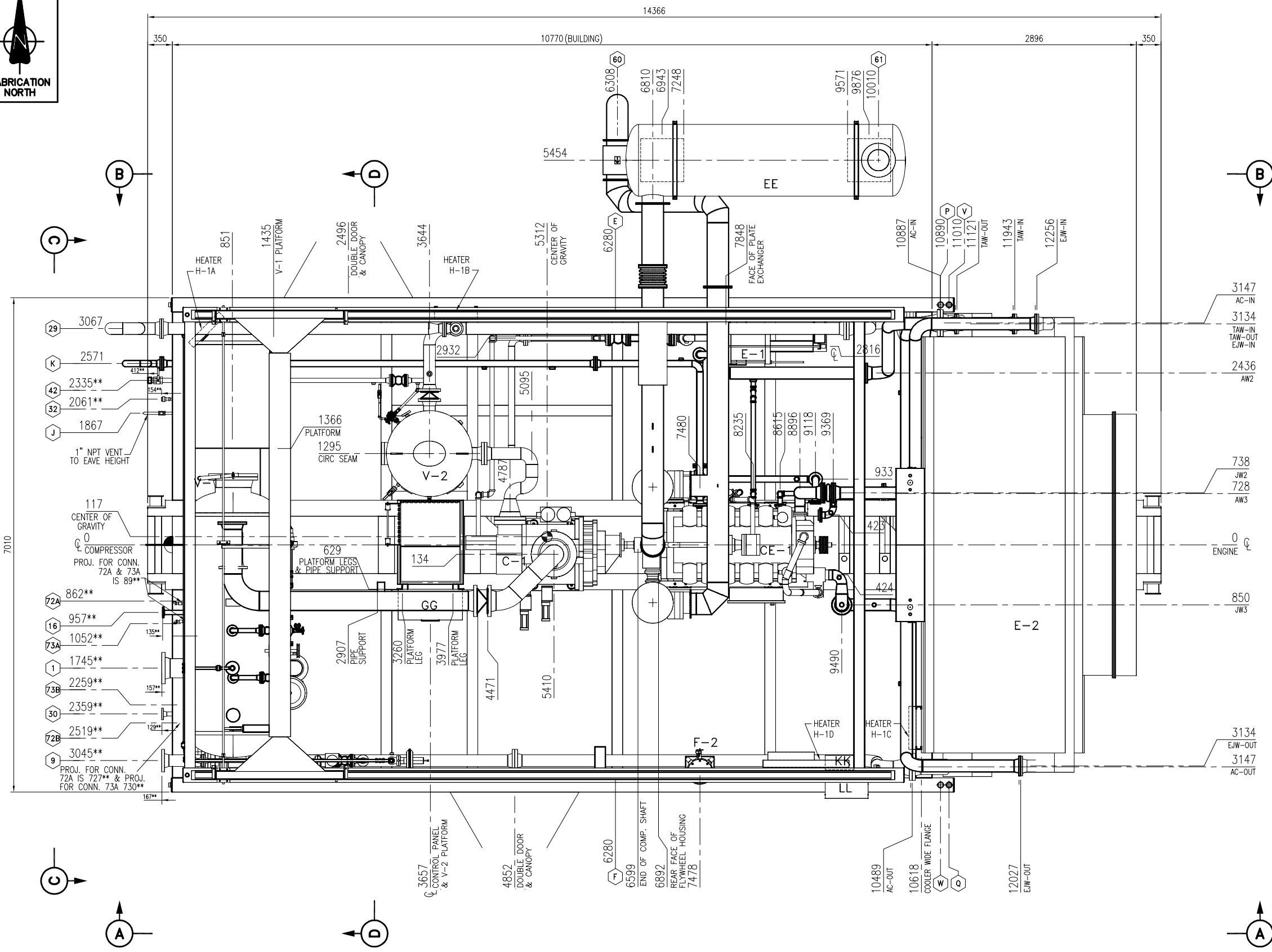
DATE: 06/28-23-25 W4M
JOB No.: 060433

DESIGN BY: SN
DATE: 06/03/08
DATE: -

DWG. No. **PF-060433-50**

OP # **50**

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PLAN VIEW

CUSTOMER CONNECTIONS		
NO.	DESCRIPTION	SIZE
1	INLET	10"-300# RFWN
9	DISCHARGE	6"-300# RFWN
16	INLET SCRUBBER DRAIN	2"-150# RFWN
29	PSV VENT HEADER	6"-150# RFWN
30	FUEL / START GAS SUPPLY	2"-300# RFWN
32	OFF-SKID INSTRUMENT GAS SUPPLY	1" 3000#
42	OIL SEPARATOR DRAIN	2"-CAMLOCK
60	ENGINE AIR INLET	12" TUBING
61	ENGINE EXHAUST	12" TUBING
72A/B	HEAT TRACE SUPPLY	1/2" 3000#
73A/B	HEAT TRACE RETURN	1/2" 3000#

OTHER CUSTOMER LOCAL CONNECTIONS & VENTS		
LETTER	DESCRIPTION	SIZE
E	ENGINE OIL TANK FILL	1" NPT
F	ENGINE OIL TANK FILL	1" NPT
J	INSTRUMENT GAS VENT	1" NPT
K	START GAS VENT	3"-150# RFWN
P	WASTE OIL TANK VENT	2" NPT
Q	GLYCOL TANK VENT	2" NPT
V	WASTE OIL TANK PUMP OUT	2" NPT
W	GLYCOL TANK PUMP OUT	2" NPT

SHIPPING WEIGHTS		UNIT DIMENSIONS	
C-1	COMPRESSOR/ARIEL RG357M 4091 kg	MAIN SKID w/ALL EQUIP MOUNTED	
CE-1	ENGINE/CATERPILLAR 3512 TALE AFRC 6705 kg	LENGTH	14366 mm 47'-1 1/2"
E-2	COOLER: AIR-X 132EH 8432 kg	WIDTH	7010 mm 23'-0"
E-1	OIL COOLER: VIEX 1394 kg	HEIGHT	6913 mm 22'-8 1/4"
		WEIGHT	66852 kg
F-2	FUEL GAS FILTER: EFX 700 kg		
V-1	INLET SEP. 48" ID, 120" S/S 2480 kg	SHIPPING DIMENSIONS	
V-2	OIL SEP. 48" OD, 102" S/S 1840 kg	LENGTH	14366 mm 47'-1 1/2"
		WIDTH	7010 mm 23'-0"
		HEIGHT	6913 mm 22'-8 1/4"
GG	CONTROL PANEL: ALLEN-BRADLEY 75 kg	WEIGHT 66852 kg	
KK	BATTERY BOX PANEL		
LL	BATTERY BOX		
SKID	23500 kg	COOLER DIMENSIONS	
BUILDING	3500 kg	LENGTH	6636 mm 21'-9 1/4"
CRANE	3950 kg	WIDTH	3048 mm 10'
MISC.	10185 kg	HEIGHT	4254 mm 13'-11 1/2"
		WEIGHT	8432 kg
TOTAL WEIGHT: APPR. 67327 kg		BUILDING DIMENSIONS	
SHIPPED LOOSE:		LENGTH	10770 mm 35'-4"
EE	EXHAUST: EXHDP5 1099 kg	WIDTH	7010 mm 23'-0"
MUFFLER STAND	1200 kg	HEIGHT(EAVE)	4775 mm 15'-8"
		WEIGHT	3500 kg

- GENERAL NOTES**
- ALL TAIL DIMENSIONS FROM REFERENCE POINT.
 - ALL DIMENSIONS ARE IN MILLIMETERS.
 - DO NOT SCALE THIS DRAWING.
 - THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION UNLESS STAMPED "RELEASED FOR MANUFACTURE".
 - FOR DESIGN PARAMETERS AND PAINT SPECIFICATION REFER TO PROJECT SCOPE SUMMARY DRAWING NO. PF-060433-50(SHEET 2 OF 2).
 - ALL PIPING MUST BE SELF SUPPORTING BEYOND UNIT CONNECTIONS.
 - LOCATIONS OF CUSTOMER CONNECTIONS ARE NOT GUARANTEED AS THESE DIMENSIONS MAY BE SUBJECT TO AN ACCUMULATION OF TOLERANCES ON SEVERAL COMPONENTS. MINOR CHANGES MAY ALSO BE MADE ON SCREWED SERVICE PIPING IN ORDER TO FACILITATE INSTALLATION AND MAINTENANCE. UPON COMPLETION A FINAL DRAWING WILL BE ISSUED WITH FIELD CONNECTIONS CORRECTED TO 5 mm.
 - IT IS EFX'S RECOMMENDATION THAT ANY PRE-SPOOLING TO THIS COMPRESSOR PACKAGE CONTAIN FIELD WELDS AT ALL CUSTOMER CONNECTIONS.

REV	DESCRIPTION	DATE	DRAWN BY	CHECKED BY
2	AS BUILT	07/10/01	MGN	JB
1	FOR CONSTRUCTION	07/05/17	MGN	JB
0	FOR APPROVAL	07/05/17	MGN	JB

EFX Compression
ENERFLEX
 4700 47 Street SE Calgary AB Canada T2B 3R1 Canada Tel: +1.403.236.6800 Fax: +1.403.279.0367
 www.enerflex.com

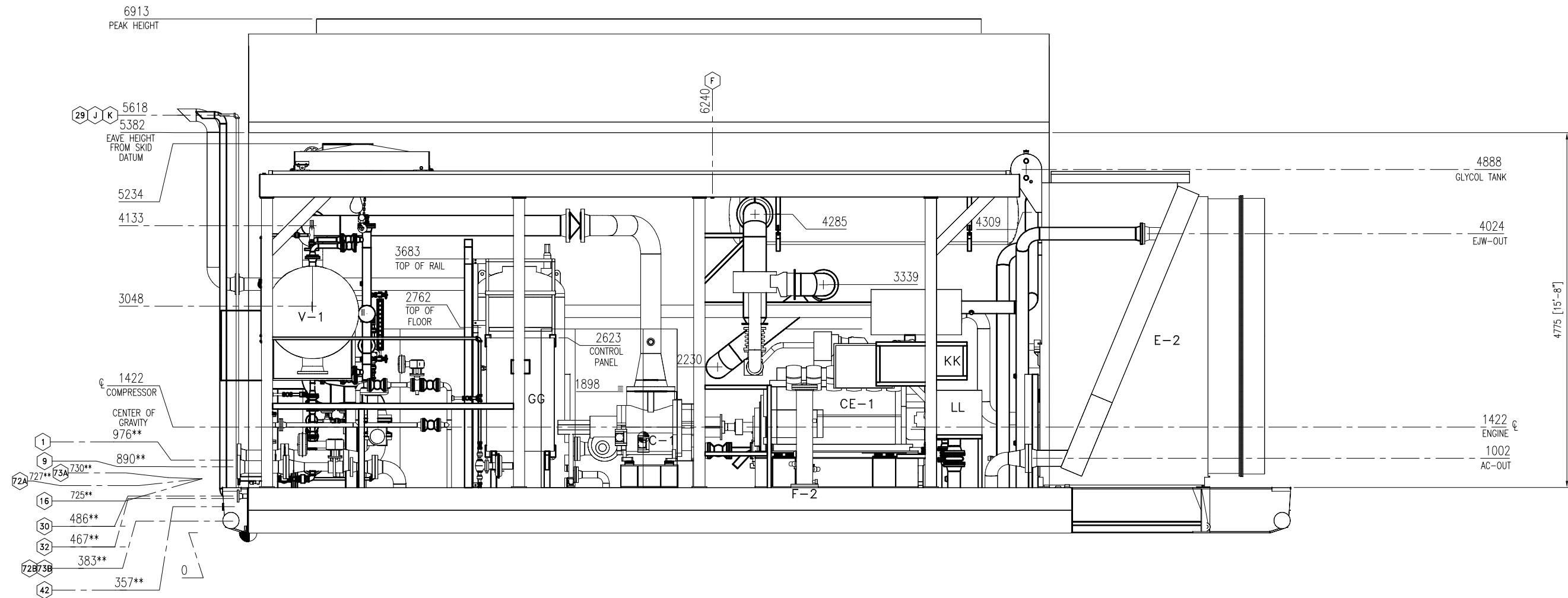
TITLE: **GENERAL ARRANGEMENT**
ARIEL RG357M, CATERPILLAR 3512, ADEM III AIR-X 132EH
1005HP SCREW COMPRESSOR PACKAGE

FOR: **ENCANA OIL & GAS PARTNERSHIP (CHINOOK)**

CONSULTANT: **DPH/FOCUS CORPORATION** LSD: **06-28-23-25 W4M**
 P.O.: **9066-k005** JOB No.: **060433**

DRWN BY: SN/MGM	DESIGN BY: SN	DATE: 06/03/02	DWG. No.:	OP#
DATE: 07/05/17	CHKD BY:	DATE:	GA-060433	10
SCALE: NTS	APPVD BY:	DATE:		

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ELEVATION 'A-A'

REV	DESCRIPTION	DATE	DRAWN BY	CHECKED BY
2	AS BUILT	07/10/02	MGN	JB
1	FOR CONSTRUCTION	07/05/17	MGN	JB
0	FOR APPROVAL	07/05/17	MGN	JB

EFX Compression
ENERFLEX INC.
 4700 47 Street SE Calgary AB Canada T2B 3R1 Canada Tel: +1.403.236.6800 Fax: +1.403.279.0367
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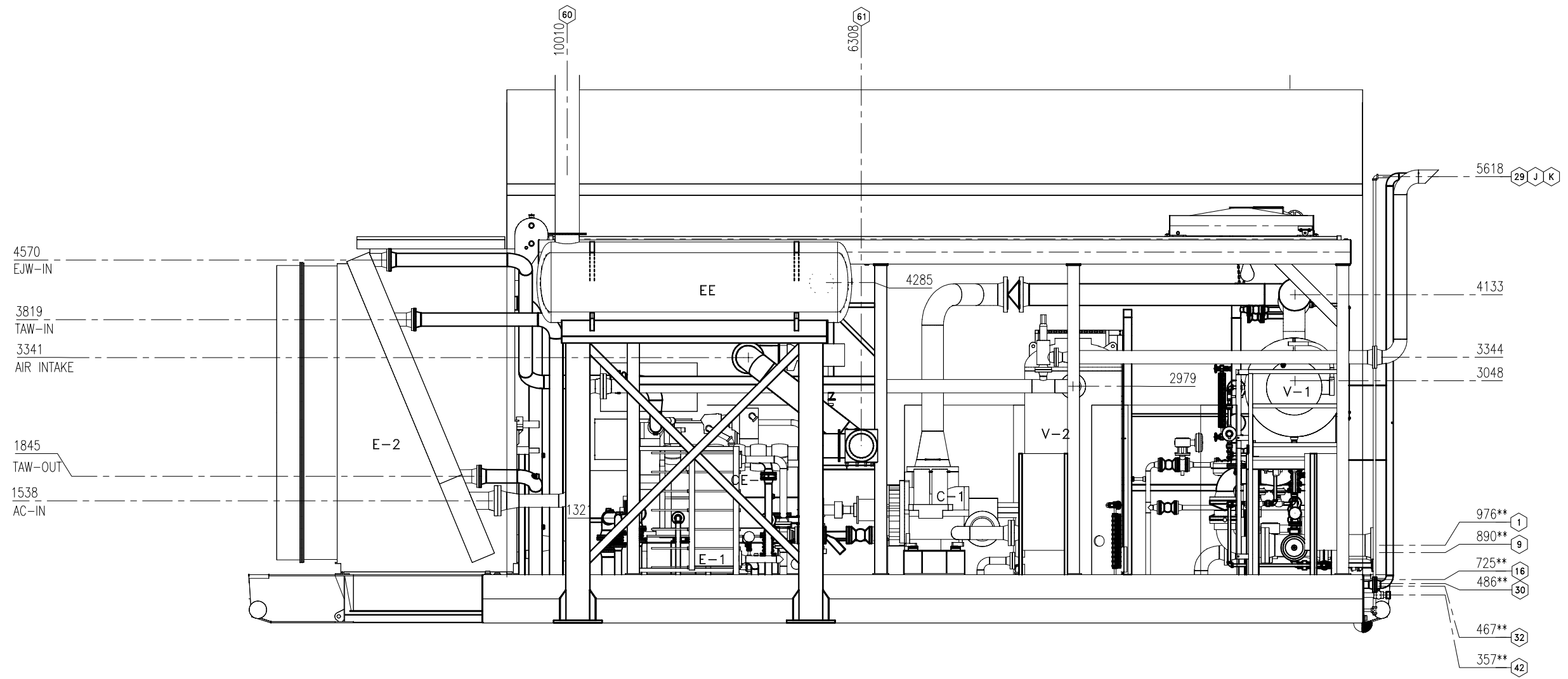
TITLE:
ELEVATION 'A-A'
ARIEL RG357M, CATERPILLAR 3512, ADEM III AIR-X 132EH
 1005HP SCREW COMPRESSOR PACKAGE

FOR:
ENCANA OIL & GAS PARTNERSHIP (CHINOOK)

CONSULTANT: **DPH/FOCUS CORPORATION** LSD: **06-28-23-25 W4M**
 P.O.: **9066-K005** JOB No.: **060433**

DRWN BY: MGN	DESIGN BY: SM	DATE: 06/03/02	DWG. No.:	OP#
DATE: 07/05/17	CHKD BY:	DATE:	GA-060433	10
SCALE: NTS	APPVD BY:	DATE:		

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ELEVATION 'B-B'

REV	DESCRIPTION	DATE	DRAWN BY	CHECKED BY
2	AS BUILT	07/10/02	MGN	JB
1	FOR CONSTRUCTION	07/05/17	MGN	JB
0	FOR APPROVAL	07/05/17	MGN	JB

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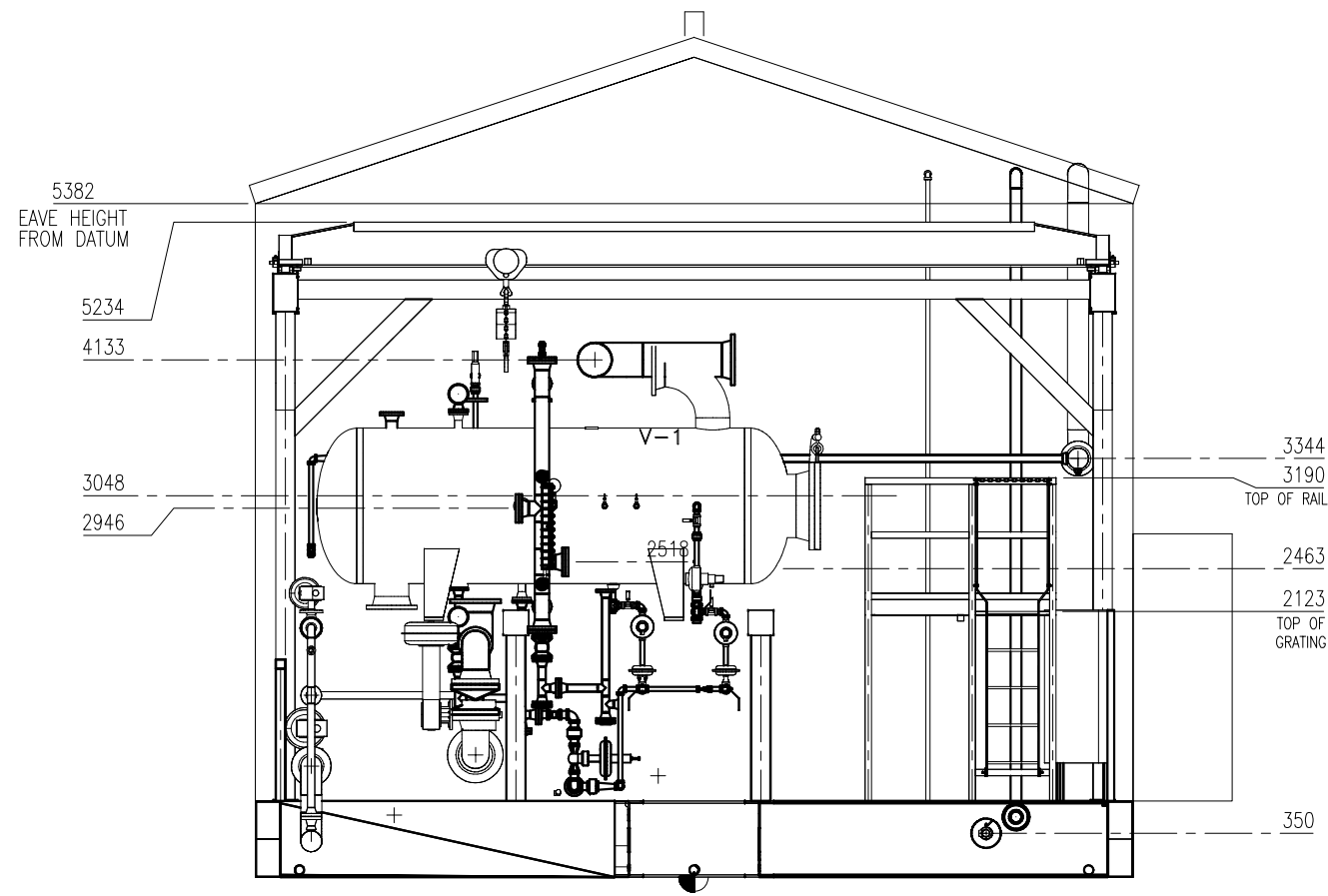
TITLE: **ELEVATION 'B-B'**
ARIEL RG357M, CATERPILLAR 3512, ADEM III AIR-X 132EH
 1005HP SCREW COMPRESSOR PACKAGE

FOR: **ENCANA OIL & GAS PARTNERSHIP (CHINOOK)**

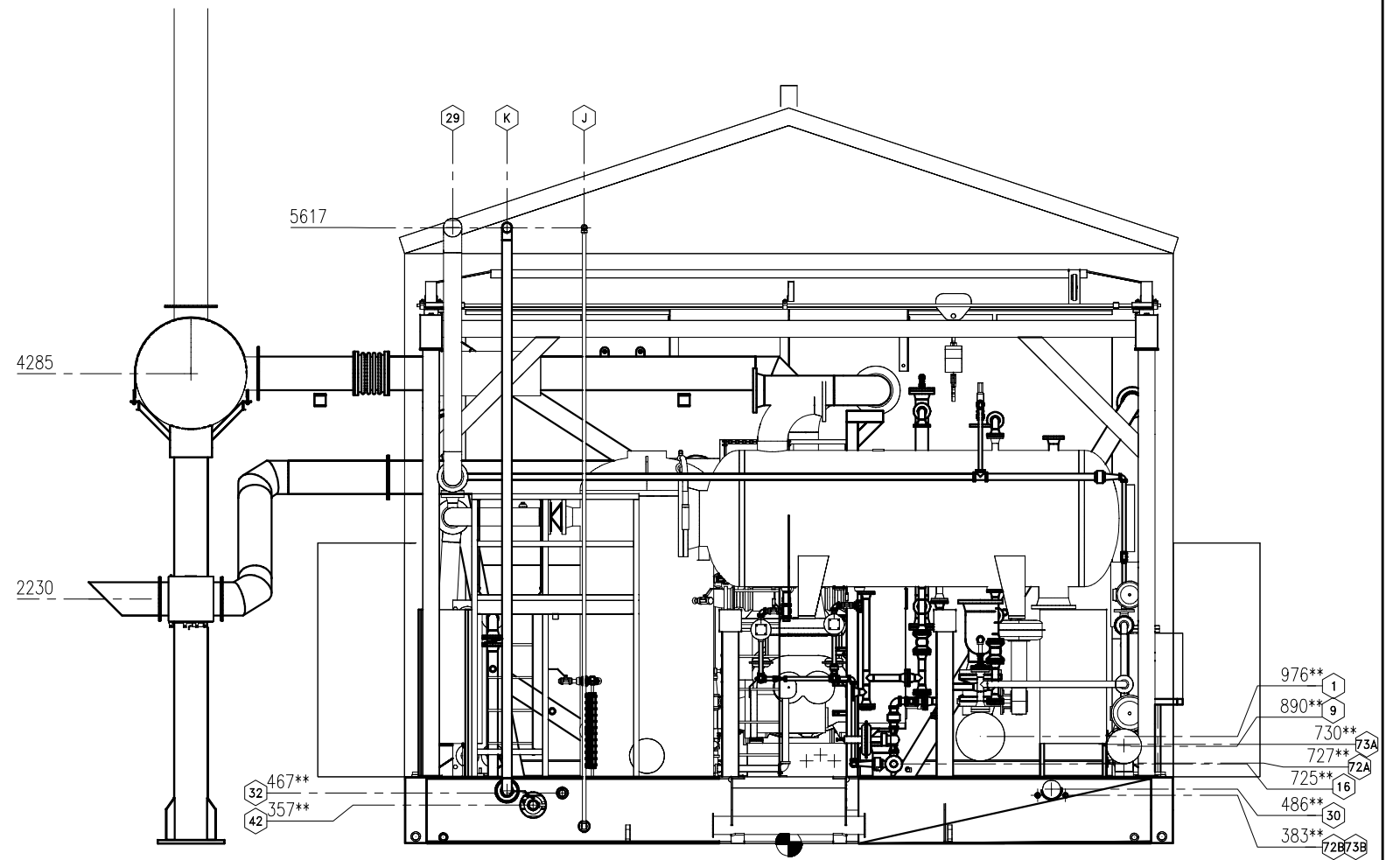
CONSULTANT: **DPH/FOCUS CORPORATION** LSD: **06-28-23-25 W4M**
 P.O.: **9066-K005** JOB No.: **060433**

DRWN BY: MGN	DESIGN BY: SM	DATE: 06/03/02	DWG. No.:	OP#
DATE: 07/05/17	CHKD BY:	DATE:	GA-060433	10
SCALE: NTS	APPVD BY:	DATE:		

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SECTION D-D



END VIEW C-C

REV	DESCRIPTION	DATE	DRAWN BY	CHECKED BY
2	AS BUILT	07/10/02	MGN	JB
1	FOR CONSTRUCTION	07/05/17	MGN	JB
0	FOR APPROVAL	07/05/17	MGN	JB

EFX Compression
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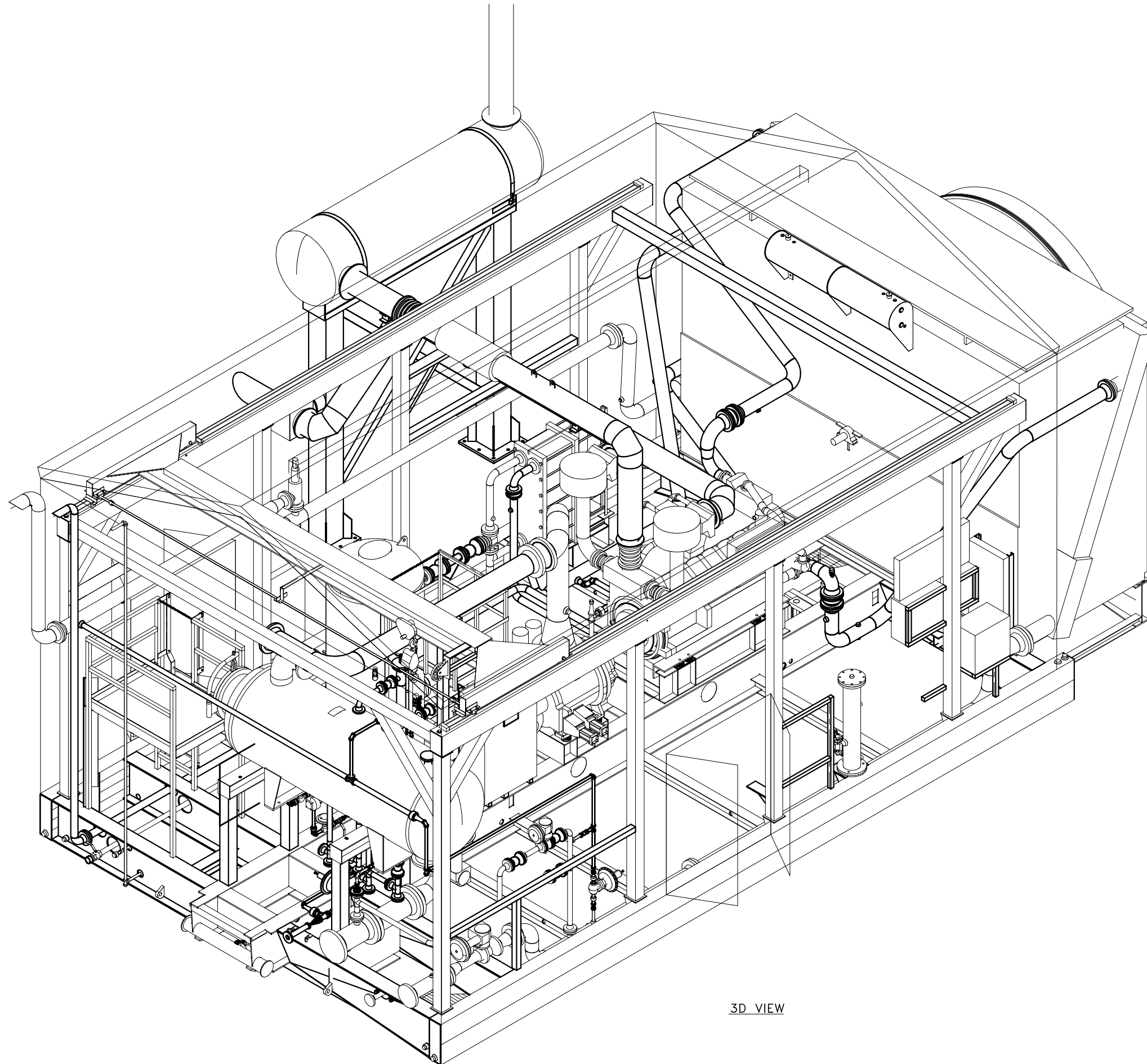
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ARIEL RG357M, CATERPILLAR 3512, ADEM III AIR-X 132EH
 1005HP SCREW COMPRESSOR PACKAGE

FOR: **ENCANA OIL & GAS PARTNERSHIP (CHINOOK)**

CONSULTANT: **DPH/FOCUS CORPORATION** LSD: **06-28-23-25 W4M**
 P.O.: **9066-K005** JOB No.: **060433**

DRWN BY: MGN	DESIGN BY:	DATE:	DWG. No.:	OP#
DATE: 07/05/17	CHKD BY:	DATE:	GA-060433	10
SCALE: NTS	APPVD BY:	DATE:		

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3D VIEW

REV	DESCRIPTION	DATE	DRAWN BY	CHECKED BY
2	AS BUILT	07/10/02	MGN	JB
1	FOR CONSTRUCTION	07/05/17	MGN	JB
0	FOR APPROVAL	07/05/17	MGN	JB

EFX Compression

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TITLE:		3D VIEW		
		ARIEL RG357M, CATERPILLAR 3512, ADEM III AIR-X 132EH		
		1005HP SCREW COMPRESSOR PACKAGE		
FOR:		ENCANA OIL & GAS PARTNERSHIP (CHINOOK)		
CONSULTANT:		DPH/FOCUS CORPORATION		LSD: 06-28-25 W4M
P.O.:		9066-K005		JOB No.: 060433
DRWN BY:	MGN	DESIGN BY:	DATE:	DWG. No.
DATE:	07/05/17	CHKD BY:	DATE:	OP#
SCALE:	NTS	APPVD BY:	DATE:	GA-060433
				10

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C-1
SCREW COMPRESSOR
 MODEL: RG357M
 MAKE: ARIEL
 MAX. RUNNING PRESSURE: 1586 kPag @ 149°C
 MAX. CASING PRESSURE: 2068 kPag @ 149°C
 GEAR RATIO: 1.375
 S/N: R10378

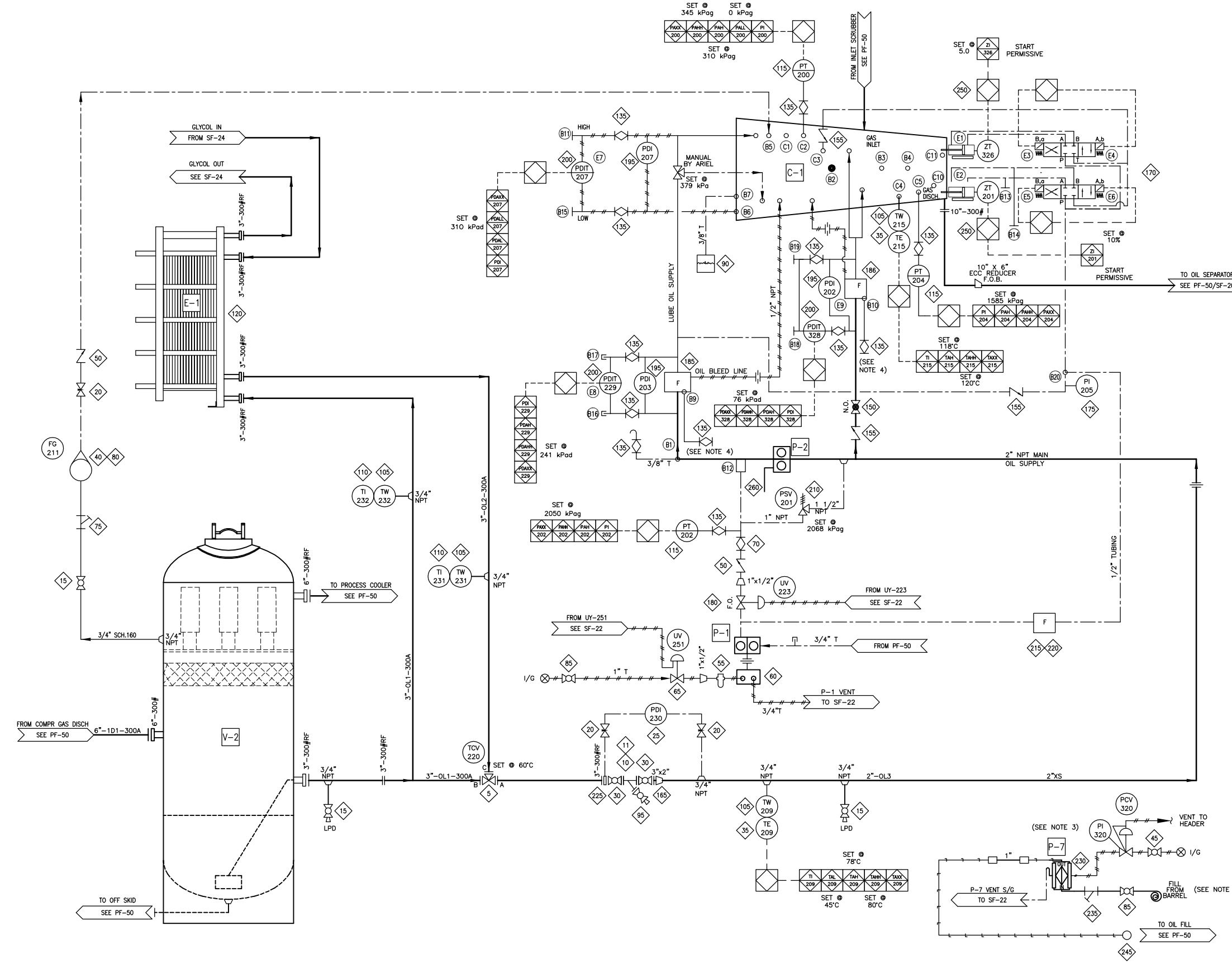
E-1
LUBE OIL COOLER
 MODEL: VXN-46-SS-FS-1-150MAX
 MAKE: VIEX
 DESIGN PRESS./TEMP.: 2758 kPag @ 121°C

P-1
PRELUBE PUMP
 SIZE: 1/2" NPT
 MAKE: VIKING
 MODEL: SG40570-GOV

P-2
INTEGRAL OIL PUMP
 DRIVEN BY FEMALE ROTOR
 MODEL: P76T-2.0x2.0

V-2
OIL SEPARATOR
 SIZE: 1219mm OD x 2591mm S/S
 MAWP: 2758 kPag @ 149°C
 ELEMENTS: (5) KELTEC-KR1360-006P
 CRN: T6489.213

P-7
COMPRESSOR LUBE OIL FILL PUMP
 MAKE: WARREN RUPP
 MODEL: G1FB1ATTXNSX00
 MAWP: 689 kPag
 CAPACITY: 112 L @ 138 kPag, 1.5 m HEAD



ITEM	CONNECTION	SIZE
B1	MAIN OIL (IN)	2" NPTF
B2	DISCHARGE HOUSING DRAIN	1-1/2" NPTF
B3	CAPACITY VALVE CAVITY DRAIN	3/4" NPTF
B4	ROTOR HOUSING DRAIN & STRAINER PLUG	2" NPTF
B5	SEPARATOR SCAVENGE OIL RETURN	1" NPTF
B6	GEARBOX OIL DRAIN	2" NPTF
B7	MECHANICAL SEAL DRAIN	1/2" NPTF
B9	LUBE OIL FILTER DRAIN	1/2" TUBE
B10	ROTOR INJECTION FILTER DRAIN	1/2" TUBE
B11	LUBE OIL PRESSURE	1/4" TUBE
B12	PRE-LUBE CONNECTION	1-1/4" NPTF
B13	CONNECTION FOR MANUAL OR PUMP UNLOADING	1/4" MJIC
B14	DRAIN (CAPACITY UNLOAD)	1/2" TUBE
B15	LUBE OIL PRESSURE DRAIN, (LOW) PRESSURE CONNECTION	1/4" TUBE
B16	OIL FILTER, LUBE (HIGH) PRESSURE CONNECTION	1/4" TUBE
B17	OIL FILTER, LUBE (LOW) PRESSURE CONNECTION	1/4" TUBE
B18	OIL FILTER, ROTOR (HIGH) PRESSURE CONNECTION	1/4" TUBE
B19	OIL FILTER, ROTOR (LOW) PRESSURE CONNECTION	1/4" TUBE
B20	CONNECTION FOR VALVE/CYLINDER ACTUATION	1/2" TUBE
C1	SUCTION FLANGE TAP - TEMPERATURE	3/4" NPTF
C2	SUCTION FLANGE TAP - PRESSURE	3/4" NPTF
C3	SUCTION FLANGE TAP - SPARE	3/4" NPTF
C4	DISCHARGE FLANGE TAP - TEMPERATURE	3/4" NPTF
C5	DISCHARGE FLANGE TAP - PRESSURE	3/4" NPTF
C10	VI STEM SEAL VENT	1/4" NPTF
C11	CAPACITY STEM SEAL VENT	1/4" NPTF
E1	Vi CONTROL POSITION INDICATOR	ELEC. CONN.
E2	CAPACITY CONTROL POSITION INDICATOR	ELEC. CONN.
E3	Vi POSITION SIGNAL INPUT (DECREASE Vi)	1/2" NPTF
E4	Vi POSITION SIGNAL INPUT (INCREASE Vi)	1/2" NPTF
E5	CAPACITY SIGNAL INPUT (INCREASE LOAD)	1/2" NPTF
E6	CAPACITY SIGNAL INPUT (UNLOAD)	1/2" NPTF
E7	OIL SUPPLY PRESSURE DIFFERENTIAL TRANSMITTER	1/2" NPTF
E8	LUBE OIL FILTER PRESSURE DIFFERENTIAL TRANSMITTER	1/2" NPTF
E9	ROTOR INJECTION FILTER PRESSURE DIF. TRANSMITTER	1/2" NPTF

- GENERAL NOTES:**
- USE LOCTITE 7649 (N) PRIMER & 545 SEALANT FOR ALL THREADED OIL CONNECTIONS.
 - ALL INSTRUMENTS USING GAS TO BE VENTED TO 1/2" VENT HEADER.
 - PUMP MOUNTED UNDER PLATFORM FOR V-1 AND PIPED NEAR V-2 WITH HOSE FOR OIL FILL CONNECTION ON V-2. DO NOT FILL WHILE UNIT OPERATING OR PRESSURIZED
 - ROTOR AND BEARING FILTER DRAINS TO BE TUBED TOGETHER AND PIPED TO MECHANICAL SEAL DRAIN POT LOCATION.
 - USE 1" CONDUIT FOR STINGER; NO PAINT.

REV	DESCRIPTION	DATE	DRAWN BY	CHECKED BY
2	AS BUILT	08/01/02	SHW	JB
1	CUSTOMER REQUESTED CHANGES	07/10/18	SHW	ATE
0	FOR CONSTRUCTION	07/05/25	ATE	ATE

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TITLE: SERVICE FLOW DIAGRAM
ARIEL RG357M, CAT G3512LE ADEM III AFRC, AIR-X 132EH
1005HP SCREW COMPRESSOR PACKAGE

FOR: **ENCANA OIL & GAS PARTNERSHIP**
(CHINOOK)

CONSULTANT: DPH FOCUS CORPORATION
 P.O.: 9066-K005
 LSD: 06-28-23-25 W4M
 JOB No.: 060433

DRWN BY: SN	DESIGN BY: SN	DATE: 06/03/08	DWG. No.	OP #
DATE: 06/03/08	CHKD BY: SHW	DATE: 06/03/08	SF-060433-20	20
SCALE: NTS	APPVD BY: -	DATE: -		

NOTES:

1. THE DISTANCE FROM THE ROTOR HOUSING MOUNTING PADS TO THE SHAFT CENTERLINE WILL GROW 0.25 mm (0.010") WITH A 38°C (100°F) TEMPERATURE INCREASE OF THE ROTOR HOUSING.
2. THE COMPRESSOR MUST BE SUPPORTED BY ALL FOUR (4) FEET.
3. THE AREA BELOW THE COMPRESSOR BETWEEN THE FEET AND AN AREA EXTENDING 457mm (18") BEYOND THE FEET TO THE Vi AND CAPACITY CONTROL SIDE OF THE COMPRESSOR IS REQUIRED TO REMOVE THE CAPACITY VALVE.

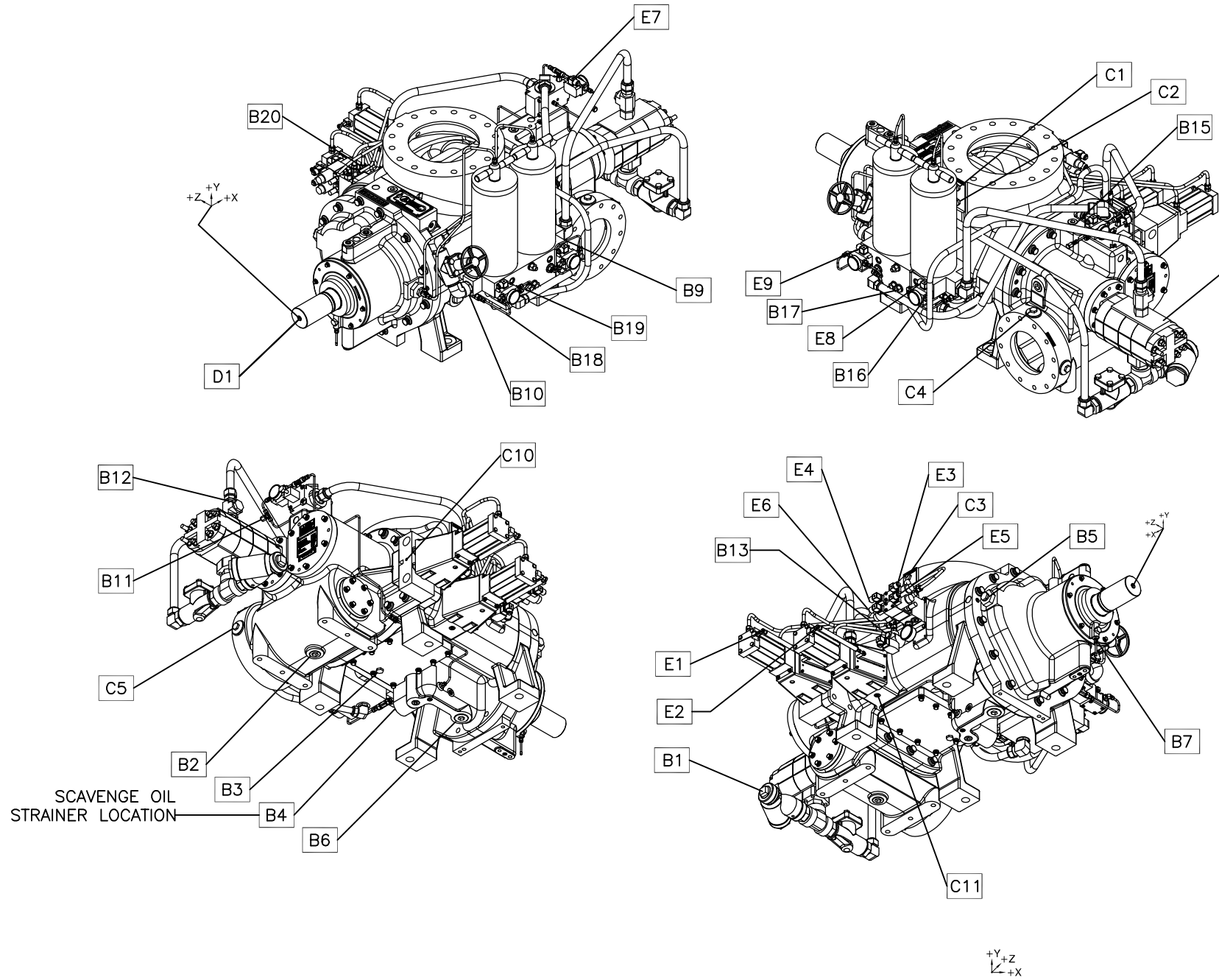
ITEM	CONNECTION	SIZE
B1	MAIN OIL (IN)	2" NPTF
B2	DISCHARGE HOUSING DRAIN	1-1/2" NPTF
B3	CAPACITY VALVE CAVITY DRAIN	3/4" NPTF
B4	ROTOR HOUSING DRAIN & STRAINER PLUG	2" NPTF
B5	SEPARATOR SCAVENGE OIL RETURN	1" NPTF
B6	GEARBOX OIL DRAIN	2" NPTF
B7	MECHANICAL SEAL DRAIN	1/2" NPTF
B9	LUBE OIL FILTER DRAIN	1/2" TUBE
B10	ROTOR INJECTION FILTER DRAIN	1/2" TUBE
B11	LUBE OIL PRESSURE	1/4" TUBE
B12	PRE-LUBE CONNECTION	1-1/4" NPTF
B13	CONNECTION FOR MANUAL OR PUMP UNLOADING	1/4" MJIC
B14	DRAIN (CAPACITY UNLOAD)	1/2" TUBE
B15	LUBE OIL PRESSURE DRAIN	1/4" TUBE
B16	OIL FILTER, LUBE (HIGH)	1/4" TUBE
B17	OIL FILTER, LUBE (LOW)	1/4" TUBE
B18	OIL FILTER, ROTOR, (HIGH)	1/4" TUBE
B19	OIL FILTER, ROTOR, (LOW)	1/4" TUBE
B20	CONNECTION FOR VALVE/CYLINDER ACTUATION	1/2" TUBE

ITEM	CONNECTION	SIZE
C1	SUCTION FLANGE TAP - TEMPERATURE	3/4" NPTF
C2	SUCTION FLANGE TAP - PRESSURE	3/4" NPTF
C3	SUCTION FLANGE TAP - SPARE	3/4" NPTF
C4	DISCHARGE FLANGE TAP - TEMPERATURE	3/4" NPTF
C5	DISCHARGE FLANGE TAP - PRESSURE	3/4" NPTF
C10	Vi STEM SEAL VENT	1/4" NPTF
C11	CAPACITY STEM SEAL VENT	1/4" NPTF

ITEM	CONNECTION	SIZE
E1	Vi CONTROL POSITION INDICATOR	ELEC. CONN.
E2	CAPACITY CONTROL POSITION INDICATOR	ELEC. CONN.
E3	Vi POSITION SIGNAL INPUT (DECREASE Vi)	1/2" NPTF
E4	Vi POSITION SIGNAL INPUT (INCREASE Vi)	1/2" NPTF
E5	CAPACITY SIGNAL INPUT (INCREASE LOAD)	1/2" NPTF
E6	CAPACITY SIGNAL INPUT (UNLOAD)	1/2" NPTF
E7	OIL SUPPLY PRESSURE DIFFERENTIAL	1/2" NPTF
E8	LUBE OIL FILTER PRESSURE DIFFERENTIAL	1/2" NPTF
E9	ROTOR INJECTION FILTER PRESSURE DIFFERENTIAL	1/2" NPTF

BILL OF MATERIAL			
ITEM	QTY	EFX CODE	DESCRIPTION
5	1	103933	VALVE, THERMOSTATIC, 3-WAY, 3" 300# RF @ 140 DEG.F, CAST STEEL [FPE, S3010X-140]
10	1	124565	STRAINER, Y, 3" 300# RF, 740 PSIG MAWP, CS, 1/8" SS SCREEN [ALTA, NYF300]
11	1	127701	SCREEN, INSERT, 1/8" PERF, 40 MESH, FOR Y-STRAINER, 3" 300# RF YF300 [ALTA]
15	3	119102	VALVE, BALL, 3/4" NPT, 3000# WOG, RP, CS C/W LOCKING HANDLE [NUTRON, T3-R07S30S]
20	3	124564	VALVE, NEEDLE, 3/4" MNPT X 1/2" FNPT, CS, VITON [CENTURY, CM23-M64T-BV]
25	1	127611	GAUGE, PRESSURE, DIFF., 2-1/2" DIAL, 0-15 PSID, LF [MIDWEST, 12AA0000015]
30	2	102964	VALVE, BALL, 3" 300# RF, RP, CS C/W HANDLE [NUTRON, T3-R30R03B]
35	2	127949	SENSOR, RTD, 100 OHM, 316SS, FLEX ARMOUR 8" [WIKA, OXXATO1XS314J96307.50UTPAG]
40	2	123081	INDICATOR, SIGHT GLASS WINDOW, 3/4" NPT, 500 PSIG MAWP, CS [HENRY, SG-1006]
45	1	102949	VALVE, BALL, 1/2" NPT, 2000# WOG, RP, 316SS, NACE C/W [NAVCO, C1-R05S20A]
50	2	110386	VALVE, CHECK, 1/2" TUBE, 1/3 PSI, 316SS C/W VITON SEALS [SWAGelok, SS-CH58-1/3]
55	1	121696	LUBRICATOR [PARKER, 07L32BE]
60	1	124377	PUMP, GEAR, 1/2" NPT C/W RELIEF VALVE, SET @ 55 PSID, [VIKING, SG40570-GOV]
65	1	120270	VALVE, CONTROL, 1" NPT, WCB, 9/16" OR, 5-35 PSI, ON/OFF [FISHER, 119-N12]
70	1	127789	VALVE, PLUG, 1/2" TUBE, 316SS, NUPRO [SWAGelok, SS-8P6T]
75	1	102832	STRAINER, Y, 3/4" NPT, 2000 PSIG MAWP, CS, NACE, 1/32" SS SCREEN [ALTA, YS-800]
80	1	105295	CROSS, SCRD, 3/4" 3000# SA105N
85	2	102937	VALVE, BALL, 1" NPT, 2000# WOG, RP, 316SS, NACE C/W LOCKING [NAVCO, C1-R10S20A]
90	1	NPN-REQ	Mechanical Seal Drain Pot
95	1	112801	VALVE, BALL, 1" NPT, 3000# WOG, RP, CS C/W LOCKING HANDLE [NUTRON, T3-R10S30B]
105	4	107977	THERMOWELL, 304SS, 1/2" X 3/4" NPTM X 4" LONG, U=2.5", .260" BORE, STEPPED
110	2	107943	GAUGE, TEMP, 3" DIAL LF, 4" STEM, 0-250 DEG.F DUAL, 1/2" NPT [TRENDO, SF30040]
115	3	127320	TRANSMITTER, GAUGE PRESSURE, -101.325 TO 2000 KPA [ROSEMOUNT, 3051TG3A2B21AC6]
120	1	127251	PHE, 400 PSIG @ 250 DEG.F [VIEXPLATE, VXN-46-SS-FS-1-150]
135	12	102801	VALVE, PLUG, 3/8" TUBE, 316SS, NUPRO [SWAGelok, SS-6P4T]
150	1	NPN-REQ	>> TEMPERATURE CONTROL VALVE, NORMALLY OPEN, BY ARIEL
155	3	NPN-REQ	>> CHECK VALVE, BY ARIEL
165	1	106424	FLANGE, RF RED HUB, 3" 300# X 2" NPT SA105N
170	1	127753	ASSEMBLY, MOUNTING KIT, Vi/CAPACITY CYLINDER FOR ARIEL RG357M, SCREW
175	1	NPN	>> PRESSURE INDICATOR, BY ARIEL
180	1	118070	VALVE, CONTROL, 1" NPT, LCC, FLOW ADJ, FO, NACE, 0-35# [FISHER/FLOPRO, D2-X2]
185	1	127868	FILTER, ELEMENT, INJECTION, BEARING, 6-MICRON, VT, FOR RG357M/RG282M [ARIEL, 002110]
186	1	127867	FILTER, ELEMENT, INJECTION, ROTOR, 16-MICRON, VT, FOR RG357M/RG282M [ARIEL, 001661]
195	3	NPN-REQ	>> PRESSURE INDICATOR BY ARIEL
200	3	127337	TRANSMITTER, PRESSURE, DIFF., -300-300 PSI, CSA, XP [ROSEMOUNT, 3051CD4A22A1AM5B4C6]
210	1	120764	VALVE, PSV, 1" MNPT X 1-1/2" FNPT, .233 OR, NACE I [FARRIS, 27EA34-M20/00]
215	1	127648	FILTER ASSEMBLY, 1-1/4" NPT, 350 PSIG MAWP, C/W VISUAL INDICATOR [ARIEL, 001486]
220	1	127647	ELEMENT, FILTER, LUBE OIL, SPIN-ON TYPE [ARIEL, 001601]
225	1	113133	BLEED RING, 3" 300# RF, 1-1/2" THK, 3/4" NPT SA516-70N
230	1	119927	PUMP, DIAPHRAGM, 1" NPT, ALUM, GAS, CSA, REG/PI [WARREN RUPP, G1FB1ATTXNSX00]
235	1	102828	STRAINER, Y, 1" NPT, 2000 PSIG MAWP, CS, NACE, 1/32" SS SCREEN [ALTA, YS-3000]
245	1	127423	COUPLER, QUICK DISCONNECT, 1" NPT MALE [AEROQUIP, 5602-16-16S]
250	2	127613	SENSOR, INDUCTIVE PROXIMITY [COMPACT, MADIX-05]
260	1	NPN-REQ	ASSEMBLY, SUPPORT, FOR P76T OIL PUMP ONLY
505	5	123230	OIL SYNTHETIC, COMPRESSOR LUBE, (208L DRUM) [SUMMIT, NGP 150]
515	5	116073	SPECIALTY DRUM DEPOSIT

BILL OF MATERIAL:		W 060433 : Encana 1005 hp Stock Screw Compressor Package	
DATE-TIME EXPORTED:		2007-05-11-09.48	



REV	DESCRIPTION	DATE	DRAWN BY	CHECKED BY
2	AS BUILT	08/01/02	SHW	JB
1	CUSTOMER REQUESTED CHANGES	07/10/18	SHW	ATE
0	FOR CONSTRUCTION	07/05/25	ATE	ATE

EFX Compression
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TITLE: SERVICE FLOW DIAGRAM
ARIEL RG357M, CAT G3512LE ADEM III AFRC, AIR-X 132EH
1005HP SCREW COMPRESSOR PACKAGE

FOR: ENCANA OIL & GAS PARTNERSHIP (CHINOOK)

CONSULTANT: DPH FOCUS CORPORATION
P.O.: 9066-K005
LSD: 06-28-23-25 W4M
JOB No.: 060433

DRWN BY: SN	DESIGN BY: SN	DATE: 06/03/08	DWG. No.	OP #
DATE: 06/03/08	CHKD BY: SHW	DATE: 06/03/08	SF-060433-20	20
SCALE: NTS	APPVD BY:	DATE: -		

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**F-2
FUEL GAS SCRUBBER**

SIZE: 219mm OD x 1270mm S/S
MAWP: 1965 kPag @ 38°C
FILTER: POROUS MEDIA, GCR3424K01BM
CRN: K-6363.2135

**CE-1
DRIVER**

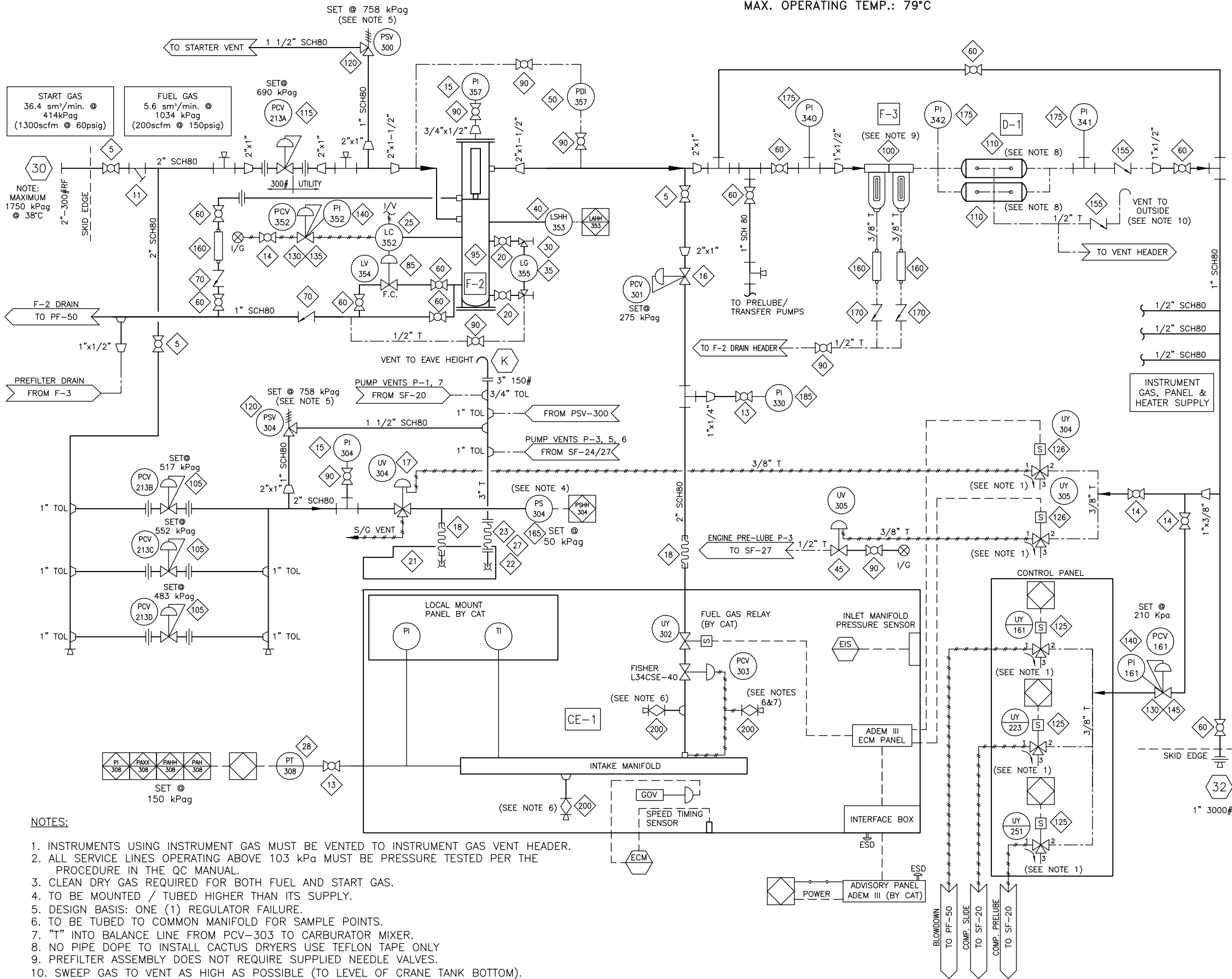
MAKE: CATERPILLAR
MODEL: G3512 TALE
RATING: 1005 HP @ 1400 RPM
S/N: WPR00174

**F-3
DUAL PREFILTER**

MAKE: CACTUS
MODEL: PPC-210G-FP
SIZE: 219mm x 1270mm S/S
FILTER ELEMENTS: 2C10-025
MAX. OPERATING PRESS.: 3447 kPag
MAX. OPERATING TEMP.: 79°C

**D-1
INSTRUMENT GAS DRYER**

MAKE: CACTUS
MODEL: PC3020-D2-4A-20
MAX. OPERATING PRESS.: 2068 kPag
MAX. OPERATING TEMP.: 65°C



- NOTES:**
1. INSTRUMENTS USING INSTRUMENT GAS MUST BE VENTED TO INSTRUMENT GAS VENT HEADER.
 2. ALL SERVICE LINES OPERATING ABOVE 103 kPa MUST BE PRESSURE TESTED PER THE PROCEDURE IN THE QC MANUAL.
 3. CLEAN DRY GAS REQUIRED FOR BOTH FUEL AND START GAS.
 4. TO BE MOUNTED / TUBED HIGHER THAN ITS SUPPLY.
 5. DESIGN BASIS: ONE (1) REGULATOR FAILURE.
 6. TO BE TUBED TO COMMON MANIFOLD FOR SAMPLE POINTS.
 7. "T" INTO BALANCE LINE FROM PCV-303 TO CARBURATOR MIXER.
 8. NO PIPE DOPE TO INSTALL CACTUS DRYERS USE TEFLON TAPE ONLY
 9. PREFILTER ASSEMBLY DOES NOT REQUIRE SUPPLIED NEEDLE VALVES.
 10. SWEEP GAS TO VENT AS HIGH AS POSSIBLE (TO LEVEL OF CRANE TANK BOTTOM).

BILL OF MATERIAL

ITEM	QTY	EFX CODE	DESCRIPTION
5	1	102951	VALVE, BALL, 2" NPT, 2000# WOG, RP, 316SS, NACE C/W LOCKING [NAVCO, C1-R20S20A]
15	1	107910	GAUGE, PRESSURE, BM, 4" LF, 0-300 PSI DUAL, 1/2" NPT [WIKA, 233.54]
17	1	104091	VALVE, GAS, 3-WAY, 2" NPT, 316SS BODY & TRIM, NACE [AMOT, 4418F6A6X000]
18	1	127994	HOSE, BRAIDED STEEL, SINGLE, 2" MNPT X MNPT UNION X 12" LONG, CGA, CSA & CRN
21	1	103760	STARTER, AIR/GAS, LOW 90-30 PSIG, INERTIA, DUAL [TDI TURBOSTART, T121-60001-B1R]
22	1	103741	ELBOW, STARTER EXHAUST, 90 DEG, SR, 3" NPTM, CS [TDI, T100-27900]
23	1	128014	HOSE, BRAIDED STEEL, SINGLE, 3" 150# RF X 3" 150# RF X 10" LONG, CGA, CSA & CRN
27	1	106700	FLANGE, RF WN, 3" 150# SCH STD SA105N
90	1	102949	VALVE, BALL, 1/2" NPT, 2000# WOG, RP, 316SS, NACE C/W [NAVCO, C1-R05S20A]
105	3	115599	REGULATOR, 1" NPT, DI, 1/2" OR, 35-80# SPR RNG, [FISHER, 627-498]
120	1	127453	VALVE, PSV, 1" NPT X 1-1/2" NPT, .357 OR. (F), STD TRIM [TAYLOR, 8200]
126	1	128125	VALVE, GP-SOLENOID, PRELUBRICATION/STARTER, C/W WIRING & [Caterpillar, 2519396]
165	1	105102	SWITCH, PRESSURE, 500 MWP, 3-20R, 1-18F, XP, SS, NACE [CCS, 6900GZE12]

Start Gas (B15)			
5	2	102951	VALVE, BALL, 2" NPT, 2000# WOG, RP, 316SS, NACE C/W LOCKING [NAVCO, C1-R20S20A]
11	1	102831	STRAINER, Y, 2" NPT, 1480 PSIG MAWP, CS, 1/32" SS SCREEN [ALTA, YS-600]
13	2	102950	VALVE, BALL, 1/4" NPT, 2000# WOG, RP, 316SS, NACE C/W [NAVCO, C1-R02S20A]
14	3	120928	VALVE, BALL, 3/8" NPT, 2000# WOG, RP, 316SS, NACE, 2 PIECE [NAVCO, C1-R03S20A]
15	1	107910	GAUGE, PRESSURE, BM, 4" LF, 0-300 PSI DUAL, 1/2" NPT [WIKA, 233.54]
16	1	115599	REGULATOR, 1" NPT, DI, 1/2" OR, 35-80# SPR RNG, [FISHER, 627-498]
18	1	127994	HOSE, BRAIDED STEEL, SINGLE, 2" MNPT X MNPT UNION X 12" LONG, CGA, CSA & CRN
20	2	102973	VALVE, BALL, 3/4" NPT, 2000# WOG, RP, 316SS, NACE C/W [NAVCO, C1-R07S20A]
25	1	101213	SWITCH, LEVEL, 2" NPT, 303SS BODY, PNEUM. C/W FLOAT [SOL, 1530B-G2A-C-J0-PS-CV]
28	1	127343	TRANSMITTER, GAUGE PRESSURE, -100 TO 200 KPAG, CSA, XP [ROSEMOUNT, 3051TG1A2B21AC6]
30	1	112629	VALVE, SET GAUGE, SWEET, 1/2" FNPT X 3/4" MNPT, CS, 3815# [PENBERTHY, 330J 3/4"]
35	1	104433	GAUGE, LEVEL, CS WITH REFLEX FLAT GLASS, 2240# [PENBERTHY, 1R1.1]
40	1	127319	SWITCH, LEVEL, 2" NPT, 316SS BODY, ELECTRIC, XP [KIMRAY, 2200-SLS-SS6]
45	1	120270	VALVE, CONTROL, 1" NPT, WCB, 9/16" OR, 5-35 PSI, ON/OFF [FISHER, 119-N12]
50	1	127611	GAUGE, PRESSURE, DIFF., 2-1/2" DIAL, 0-15 PSID, LF [MIDWEST, 12AA0000015]
60	10	102937	VALVE, BALL, 1" NPT, 2000# WOG, RP, 316SS, NACE C/W LOCKING [NAVCO, C1-R10S20A]
70	2	127407	VALVE, CHECK, SWING, 1" NPT, 800# WOG, CS, NACE [NAVCO, CS-R10S08A8]
85	1	104854	VALVE, CONTROL, 1" NPT, LCC, FLOW ADJ, FC, NACE, 0-35# [FISHER/FLOPRO, D2-X1]
90	6	102949	VALVE, BALL, 1/2" NPT, 2000# WOG, RP, 316SS, NACE C/W [NAVCO, C1-R05S20A]
95	1	127314B	VESSEL, FUEL GAS, 8-5/8" OD, 285 PSIG MAWP, 100 DEG.F WAUK VHP C/W GCR3424K01BM ELEMENT
100	1	127609	ASSEMBLY, INLET PRE-FILTER FOR CACTUS PPC-410-G DRYER [CACTUS, PPC-210G-FP]
110	2	127608	DRYER, GAS MEMBRANE [CACTUS, PPC-410-G]
115	1	115800	REGULATOR, 1" NPT, DI, 1/2" OR, 70-150# SPR, SET @ 90 PSIG [FISHER, 627-499]
120	1	127453	VALVE, PSV, 1" NPT X 1-1/2" NPT, .357 OR. (F), STD TRIM [TAYLOR, 8200]
125	3	104789	VALVE, SOLENOID, 3-WAY, 24VDC, CSA, XP, EPNC 115PSI, NC SS [ASCO, EF8320G202-24]
126	1	128125	VALVE, GP-SOLENOID, PRELUBRICATION/STARTER, C/W WIRING & [Caterpillar, 2519396]
130	2	104872	REGULATOR, 1/4" NPT, ALUM., 0-125#, TAPPED (W/O PI) [FISHER, 67CFR-601/SC]
135	1	122624	BRACKET, MOUNTING, FISHER 67AFR, LONG
140	2	107925	GAUGE, PRESSURE, CBM, 2" DRY, 0-60 PSI DUAL, 1/4" NPT [WIKA, 111.10]
145	1	122625	BRACKET, MOUNTING, FISHER 67AFR, SHORT
155	2	110386	VALVE, CHECK, 1/2" TUBE, 1/3 PSI, 316SS C/W VITON SEALS [SWAGelok, SS-CHS8-1/3]
160	3	127336	DRAIN, LIQUID, 3/4" INLET X 1/2" OUTLET [WATSON MCDANIEL, WLD1811]
170	2	102816	VALVE, CHECK, 3/8" TUBE, 1 PSI, 316SS, NUPRO [SWAGelok, SS-6C-1]
175	3	107895	GAUGE, PRESSURE, BM, 2-1/2" LF, 0-200 PSI DUAL, 1/4" NPT [WIKA, 233.53]
185	1	107926	GAUGE, PRESSURE, BM, 2-1/2" LF, 0-60 PSI DUAL, 1/4" NPT [WIKA, 233.53]
200	3	102802	VALVE, PLUG, 1/4" TUBE, 316SS, NUPRO [SWAGelok, SS-4P4T]

Fuel Gas (B35)			

REV	DESCRIPTION	DATE	DRAWN BY	CHECKED BY
2	AS BUILT	08/01/02	SHW	JB
1	CUSTOMER REQUESTED CHANGES	07/10/18	SHW	ATE
0	FOR CONSTRUCTION	07/05/25	ATE	ATE

ENERFLEX
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TITLE: FUEL AND START GAS SYSTEM
ARIEL RG357M, CAT G3512LE ADEM III AFRC, AIR-X 132EH
1005HP SCREW COMPRESSOR PACKAGE

FOR: ENCANA OIL & GAS PARTNERSHIP (CHINOOK)
CONSULTANT: DPH FOCUS CORPORATION
P.O.: 9066-K005
LSD: 06-28-23-25 W4M
JOB No.: 060433

DRWN BY: SN	DESIGN BY: SN	DATE: 06/03/08	DWG. No.	OP #
DATE: 06/03/08	CHKD BY: SHW	DATE: 06/03/08	SF-060433-22	22
SCALE: NTS	APPVD BY: -	DATE: -		

P:\Projects\Custom\060433\Fuel_SF-060433-22.dwg, Jan 02, 2008 - 1:29pm

CE-1 DRIVER
 MAKE: CATERPILLAR
 MODEL: G3512 TALE
 RATING: 1005 HP @ 1400 RPM
 GLYCOL CHARGE: 148 L
 S/N: WPRO0174

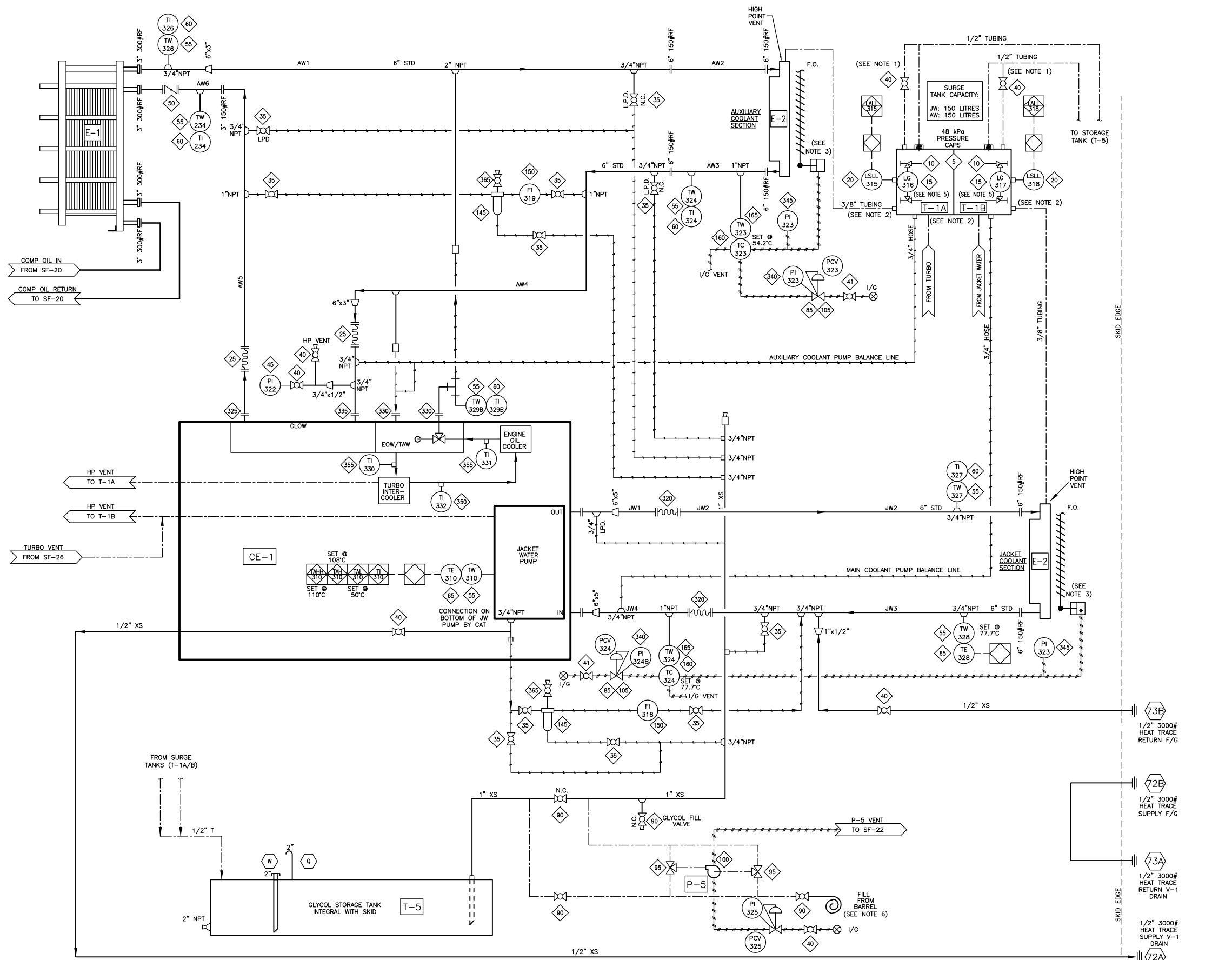
E-1 LUBE OIL COOLER
 MAKE: VIEX PLATE & FRAME
 MODEL: VXN-46-SS-FS-1-150MAX
 MAWP: 2758 kPag @ 121°C
 CRN: R5688.213

E-2 AERIAL COOLER
 MAKE: AIR-X-CHANGERS
 MODEL: 132EH
 WEIGHT: 8432 kg
 S/N: 065074

P-5 GLYCOL TRANSFER PUMP
 MAKE: WARREN RUPP
 MODEL: G1FB1ABTXNSX00
 MAWP: 689 kPag

T-1A/B ENGINE GLYCOL SURGE TANK
 TOTAL CAPACITY: 300 L

T-5 USED GLYCOL STORAGE TANK
 CAPACITY: 1236 L



ITEM	QTY	EFX CODE	DESCRIPTION
5	1	126512	TANK, SURGE, 2-COMPARTMENT, 150L/150L, WAUKESHA F3524GSI
10	2	103698	VALVE, SET GAUGE, SWEET, 5/8"OD TUBULARX1/2"MNPT CS 600# QUEST-TEC [DANIEL, 1TC]
15	2	101257	GAUGE, ACRYLIC SIGHT GLASS, 5/8" OD X 3/8" ID, 1/4" WALL THK
20	2	127318	SWITCH, LEVEL, 1-1/2" NPT, 316SS BODY, ELECTRIC, XP [KIMRAY, 1200-SLS-SS6]
25	2	119977	EXPANSION JOINT, RUBBER, 3" X 150# RF [HYDROFLEX, SERIES 240AV/EE]
35	11	102973	VALVE, BALL, 3/4" NPT, 2000# WOG, RP, 316SS, NACE C/W [NAVCO, C1-R07S20A]
40	7	102949	VALVE, BALL, 1/2" NPT, 2000# WOG, RP, 316SS, NACE C/W [NAVCO, C1-R05S20A]
41	2	120928	VALVE, BALL, 3/8" NPT, 2000# WOG, FP, 316SS, NACE, 2 PIECE [NAVCO, C1-R03S20A]
45	1	107903	GAUGE, PRESSURE, BM, 4" LF, 0-30 PSI DUAL, 1/2" NPT [WIKA, 233.54]
50	1	116798	VALVE, BUTTERFLY, 3" 150#, WAFER STYLE, CAST IRON BODY, [C&C BUTTERFLY]
55	7	107977	THERMOWELL, 304SS, 1/2" X 3/4" NPTM X 4" LONG, U=2.5", .260" BORE, STEPPED
60	5	107943	GAUGE, TEMP, 3" DIAL LF, 4" STEM, 0-250 DEG.F DUAL, 1/2" NPT [TREND, SF30040]
65	2	127950	SENSOR, RTD, 100 OHM, 316SS, FLEX ARMOUR 8' [WIKA, OXXATO1XS314J963060UTPAG]
85	2	104872	REGULATOR, 1/4" NPT, ALUM., 0-125#, TAPPED (W/O PI) [FISHER, 67CFR-601/SC]
90	4	102937	VALVE, BALL, 1" NPT, 2000# WOG, RP, 316SS, NACE C/W LOCKING [NAVCO, C1-R10S20A]
95	2	121379	VALVE, BALL, 3-WAY, 3/4" NPT, FULL SS, 800 PSI C/W LOCKING HANDLE [MAS, G4]
100	1	119927	PUMP, DIAPHRAGM, 1" NPT, ALUM, GAS, CSA, REG/PI [WARREN RUPP, G1FB1ATTXNSX00]
105	2	122624	BRACKET, MOUNTING, FISHER 67AFR, LONG
145	2	127239	FILTER, BAG, 1" NPT, 4" X 14" 150 PSIG MAWP
150	2	127467	INDICATOR, SIGHT GLASS WINDOW, 3/4" NPT, 150# ANSI SF SERIES [WEIR, SFB-3/4]
160	2	127624	CONTROLLER, TEMP, T12DA, 1" NPTM X 12" LG PROBE [KIMRAY, HAP]
165	2	104069	THERMOWELL, 316SS, 1" NPT X 12" LONG, SS-12-SS FOR HT12/T12DA [KIMRAY, HCE]
320	2	119976	EXPANSION JOINT, RUBBER, 6" X 150# RF [HYDROFLEX, SERIES 240AV/EE]
325	1	127594	FLANGE, SQ, ENGINE AW OULET, 3" NOM, 1" THK PLATE SA36 FOR CATERPILLAR G3512TALE
330	2	106487	FLANGE, RF SCRDR, 2" 150# SA105N
335	1	127593	FLANGE, ENGINE AW INLET, 3" NOM, 1" THK PLATE SA36 FOR CATERPILLAR G3512TALE
340	2	107881	GAUGE, PRESSURE, CBM, 2" DRY, 0-100 PSI DUAL, 1/4" NPT [WIKA, 111.10]
345	2	107878	GAUGE, PRESSURE, BM, 2-1/2" LF, 0-100 PSI DUAL, 1/4" NPT [WIKA, 233.53]
350	1	127924	GAUGE, TEMP, 3" DIAL LF, BM, 6" STEM, 0-250 DEG.F DUAL, 1/2" NPT [WIKA, 31060A006A4SF]
355	2	127923	GAUGE, TEMP, 3" DIAL LF, BM, 4" STEM, 0-250 DEG.F DUAL, 1/2" NPT [WIKA, 31040A006A4SF]
365	2	102950	VALVE, BALL, 1/4" NPT, 2000# WOG, RP, 316SS, NACE C/W [NAVCO, C1-R02S20A]

			BILL OF MATERIAL: W 060433 : Encana 1005 hp Stock Screw Compressor Package
			DATE-TIME EXPORTED: 2007-05-11-10.08

NOTES:

- VALVES TO BE MOUNTED AT 1.5 m ABOVE GRATING.
- DO NOT TRAP LINES; SLOPE COOLER HIGHPOINT VENT UP TOWARDS SURGE TANK.
- JW/AUX LOUVRES TO BE FAIL OPEN - TUBE CONTROLLER IN OPPOSITE DIRECTION.
- INSTRUMENTS USING INSTRUMENT GAS TO BE VENTED TO I/G VENT HEADER.
- ANGLE IRON TO BE USED FOR LEVEL GAUGE GUARDS.
- USE 1" CONDUIT FOR STINGER, NO PAINT.
- TOTAL ESTIMATED GLYCOL IN COOLING SYSTEM IS APPROX. 1150 L.

REV	DESCRIPTION	DATE	DRAWN BY	CHECKED BY
3	AS BUILT	08/01/02	SHW	JB
2	CUSTOMER REQUESTED CHANGES	07/08/10	SHW	SHW
1	CHANGED 1" VALVES FOR I/G SUPPLY TO 3/8"	07/08/10	SHW	SHW
0	FOR CONSTRUCTION	07/05/25	ATE	ATE

ENERFLEX

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TITLE: **ENGINE GLYCOL SYSTEM**
ARIEL RG357M, CAT G3512LE ADEM III AFRC, AIR-X 132EH
 1005HP SCREW COMPRESSOR PACKAGE

FOR: **ENCANA OIL & GAS PARTNERSHIP**
 (CHINOOK)

CONSULTANT: DPH FOCUS CORPORATION
 P.O.: 9066-K005
 LSD: 06-28-23-25 W4M
 JOB No.: 060433

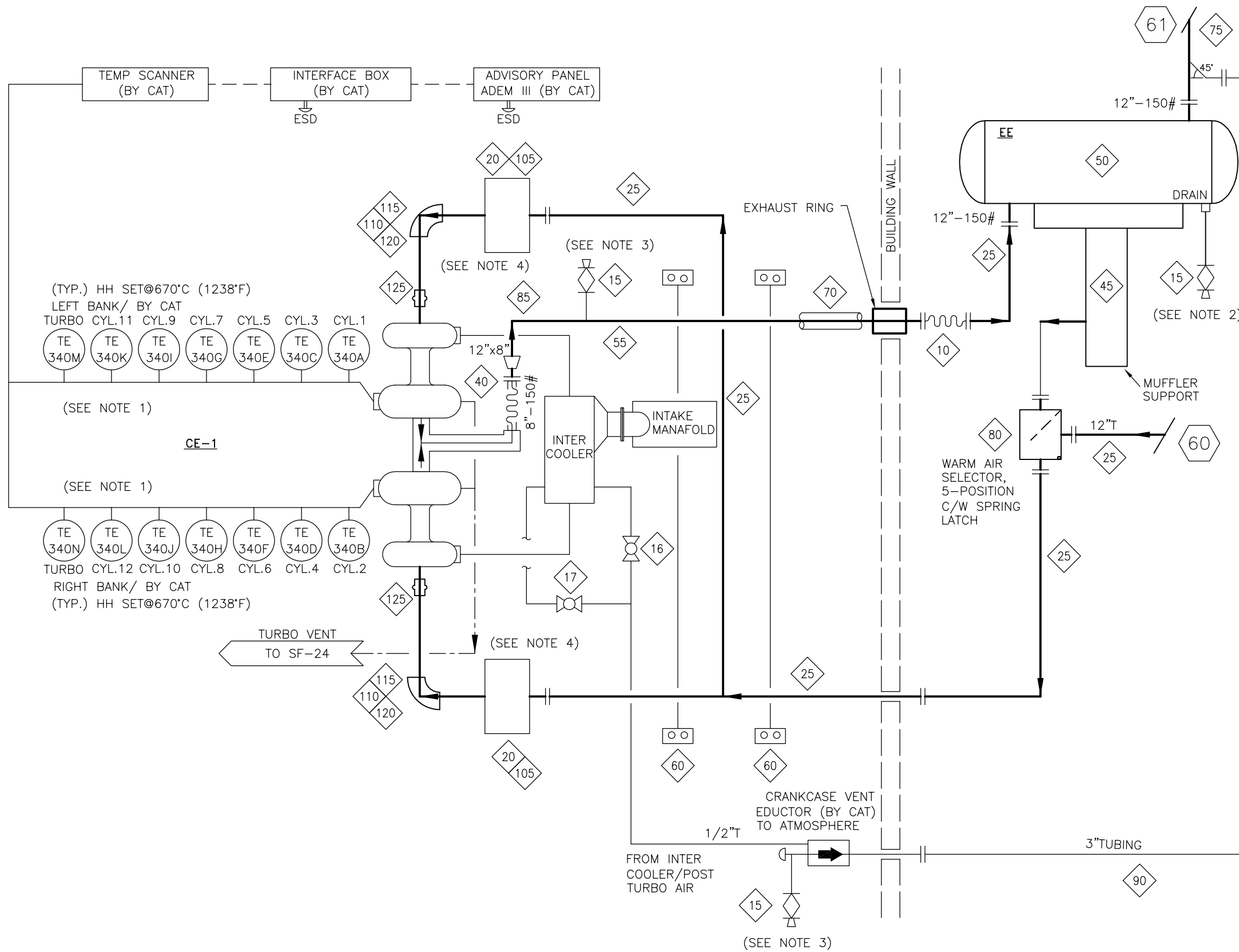
DRWN BY: SN	DESIGN BY: SN	DATE: 06/03/08	OP #
DATE: 06/03/08	CHKD BY: SHW	DATE: 06/03/08	
SCALE: NTS	APPVD BY: -	DATE: -	

DWG. No. **SF-060433-24** OP # **24**

CE-1
DRIVER
MAKE: CATERPILLAR
MODEL: G3512 TALE AFRC
RATING: 1005 HP @ 1400 RPM
S/N: WPR00174

EE
SUPER HOSPITAL PLUS MUFFLER
MAKE: EXCEL
MODEL: EXHDPS

HEIGHT IS 8.2 m:
1.2 x PEAK HEIGHT



BILL OF MATERIAL			
ITEM	QTY	EFX CODE	DESCRIPTION
20	2	NPN-REQ	>> AIR FILTER BOX, C/W FILTER, SUPPLIED BY CAT
25	30	104562	EXHAUST TUBING, MECHANICAL, 12" OD X 10 GAUGE (.134" WALL), ERW
80	1	127424	AIR INTAKE TWO-WAY DIVERTER, 12", 5 POSITION, SCREW
105	1	127615	GROMMET BUMPER, RUBBER, SRB BLACK, 60 DURO, FOR CAT 3500, PART# 315-311
110	10	117770	EXHAUST TUBING, MECHANICAL, 6" ID X 11 GAUGE (.125" WALL), 316LSS
115	8	102324	HOSE CLAMP, 5-1/8" - 7" OD [TRIDON, HS-104]
120	2	127464	ELBOW, RUBBER, 90 DEG, 6" [DONALDSON, P105535]
125	2	104039	HUMPHOSE, STRAIGHT, RUBBER, 6" [DONALDSON, P10-5612]

Air Intake (B20)			
10	1	104682	EXPANSION BELLOW, 12" 150# INTERNAL FLANGES C/W 2" COLLAR & SS LINER X 12" LONG
15	3	102802	VALVE, PLUG, 1/4" TUBE, 316SS, NUPRO [SWAGelok, SS-4P4T]
16	1	NPN-REQ	VALVE, PLUG, 1/2", SUPPLIED BY CAT
17	1	102949	VALVE, BALL, 1/2" NPT, 2000# WOG, RP, 316SS, NACE C/W [NAVCO, C1-RO5S20A]
25	5	104562	EXHAUST TUBING, MECHANICAL, 12" OD X 10 GAUGE (.134" WALL), ERW
40	1	119607	EXPANSION BELLOW, 8" "CAT" FLG X 8" 150# ANSI EXTERNAL FLANGE X 12" LONG
45	1	127752	MUFFLER STAND, SA1005-RG357M, SCREW
50	1	127221	MUFFLER, SUPER HOSPITAL PLUS, 12", ALUMINUM STEEL, 45-58 DBA, EXHDPS [EXCEL]
55	20	104561	EXHAUST TUBING, MECHANICAL, 12" ID X 11 GAUGE (.125" WALL), 316LSS
60	2	NPN-REQ	SUPPORT FRAME, AIR, JW AND EXHAUST
70	1	122061	***INSULATION, FOR 12" 150# SS EXHAUST LINE, NO AIR SPACE, CUSTOM
75	1	NPN-REQ	EXHAUST STACK, BUILT TO SUIT
85	1	103770	ELBOW, EXHAUST, 90 DEG, SR, 12" ID, 11 GAUGE (.125" WALL), 316LSS
90	40	107856	EXHAUST TUBING, MECHANICAL, 3" OD X 16 GAUGE (.065" WALL), ERW

Exhaust (B25)			

BILL OF MATERIAL: W 060433 : Encana 1005 hp Stock Screw Compressor Package			
DATE-TIME EXPORTED: 2007-05-11-10.53			

NOTES:

1. CYLINDER AND EXHAUST TEMPERATURE TO LOCAL-MOUNTED PANEL, SUPPLIED BY CAT.
2. RUN LINE TO 1.5 m ABOVE GRATING.
3. ALL TEST PORT CONNECTION TUBES TO COMMON MANIFOLD ON ENGINE.
4. CAT AIR FILTERS TO BE MOUNTED IN HORIZONTAL POSITION FOR ACCESS TO TURBOS.

REV	DESCRIPTION	DATE	DRAWN BY	CHECKED BY
2	AS BUILT	08/01/02	SHW	JB
1	CUSTOMER REQUESTED CHANGES	07/05/25	ATE	ATE
0	FOR CONSTRUCTION	07/05/25	ATE	ATE

ENERFLEX Compression

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TITLE: **AIR & EXHAUST SYSTEM**
ARIEL RG357M, CAT G3512LE ADEM III AFRC, AIR-X 132EH
1005HP SCREW COMPRESSOR PACKAGE

FOR: **ENCANA OIL & GAS PARTNERSHIP**
(CHINOOK)

CONSULTANT: DPH FOCUS CORPORATION
P.O.: 9066-K005

LSO: 06-28-23-25 W4M
JOB No.: 060433

DRWN BY: SN	DESIGN BY: SN	DATE: 06/03/08	DWG. No.	OP #
DATE: 06/03/08	CHKD BY: SHW	DATE: 06/03/08	SF-060433-26	26
SCALE: NTS	APPVD BY:	DATE:		

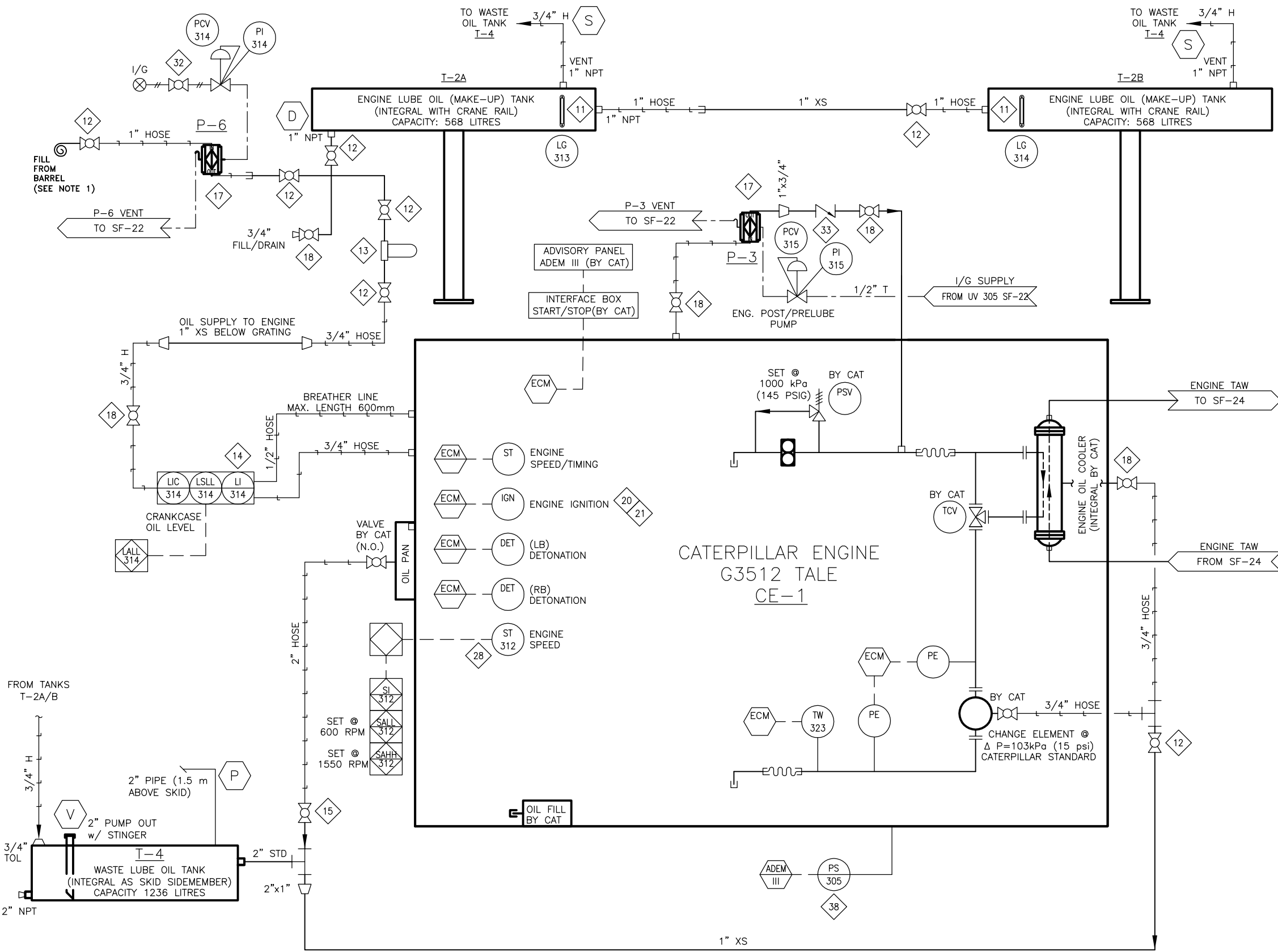
CE-1
DRIVER
 MAKE: CATERPILLAR
 MODEL: G3512 TALE AFRC
 RATING: 1005 HP @ 1400 RPM
 OIL CHARGE: 89.5 L
 S/N: WPR00174

P-3
ENGINE POST/PRELUBE PUMP
 MAKE: WARREN RUPP
 MODEL: G1FB1ATTXNSX00
 MAWP: 689 kPag
 CAPACITY: 112 L @139 kPag
 1.5m HEAD

P-6
OIL TRANSFER PUMP
 MAKE: WARREN RUPP
 MODEL: G1FB1ATTXNSX00
 MAWP: 689 kPag
 CAPACITY: 112 L @139 kPag
 1.5m HEAD

T-2A/B
ENGINE LUBE OIL TANK
 TOTAL CAPACITY: 1136 L

T-4
WASTE LUBE OIL TANK
 CAPACITY: 1236 L



BILL OF MATERIAL				
ITEM	QTY	EFX CODE	DESCRIPTION	
11	2	127616	INDICATOR,LEVEL,SIGHT GLASS WINDOW,8" BOLT CENTER [LUBE DEVICES, G605-08-A-1-RB]	
12	7	102937	VALVE, BALL, 1" NPT, 2000# WOG, RP, 316SS, NACE C/W LOCKING [NAVCO, C1-R10S20A]	
13	1	104295	FILTER, OIL, ASSEMBLY, 1" FNPT C/W BF915 ELEMENT & BASE FB1307 [BALDWIN, BF914]	
14	1	107969	CONTROLLER, OIL LEVEL C/W ELECTRIC SWITCH, XP, CSA C/W BRACKET [KENCO, KLCE-9]	
15	1	102951	VALVE, BALL, 2" NPT, 2000# WOG, RP, 316SS, NACE C/W LOCKING [NAVCO, C1-R20S20A]	
17	2	119927	PUMP, DIAPHRAGM, 1" NPT, ALUM, GAS, CSA, REG/PI [WARREN RUPP, G1FB1ATTXNSX00]	
18	5	102973	VALVE, BALL, 3/4" NPT, 2000# WOG, RP, 316SS, NACE C/W [NAVCO, C1-R07S20A]	
20	1	NPN-REQ	>> IGNITION SYSTEM BY CAT, CSA, CLASS 1, DIV 2	
21	1	NPN-REQ	>> HARNESS, IGNITION SYSTEM, CSA, CLASS 1, DIV 2, BY CAT	
28	1	104467	MAGNETIC PICK-UP, 5/8"-18 THREAD X 2-1/2" LONG, CSA, IS [DYNALCO, M204]	
32	1	102949	VALVE, BALL, 1/2" NPT, 2000# WOG, RP, 316SS, NACE C/W [NAVCO, C1-R05S20A]	
33	1	103075	VALVE, CHECK, PISTON, 3/4" NPT, 800# WOG, CS [NEWCO, 48T-FS2]	
38	1	128126	SWITCH, AS-PRESURE, ACTUATION, C/W WIRING & PIN CONNECTOR [Caterpillar, 1501240]	
300	340	104080	OIL, LUBE, BULK (1,600 LITRE CUBE) [PETRO CANADA, SENTRON 445]	

BILL OF MATERIAL: W 060433 : Encana 1005 hp Stock Screw Compressor Package				
DATE-TIME EXPORTED: 2007-05-11-10.59				

- NOTES**
- USE 1" CONDUIT FOR STINGER; NO PAINT.
 - SOLID RECTANGLE REPRESENTS ENGINE.
 - OVERSPEED SET @ 12.5% OVER RATED SPEED (1550)

REV	DESCRIPTION	DATE	DRAWN BY	CHECKED BY
2	AS BUILT	08/01/02	SHW	JB
1	CUSTOMER REQUESTED CHANGES	07/10/18	SHW	ATE
0	FOR CONSTRUCTION	07/05/25	ATE	ATE

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TITLE:
 ENGINE OIL SYSTEM
 ARIEL RG357M, CAT G3512LE ADEM III AFRC, AIR-X 132EH
 1005HP SCREW COMPRESSOR PACKAGE

FOR:
ENCANA OIL & GAS PARTNERSHIP
 (CHINOOK)

CONSULTANT: DPH FOCUS CORPORATION
 P.O.: 9066-K005
 LSD: 06-28-23-25 W4M
 JOB No.: 060433

DRWN BY: SN	DESIGN BY: SN	DATE: 06/03/08	OP #
DATE: 06/03/08	CHKD BY: SHW	DATE: 06/03/08	
SCALE: NTS	APPVD BY: -	DATE: -	

DWG. No. **SF-060433-27** OP # **27**

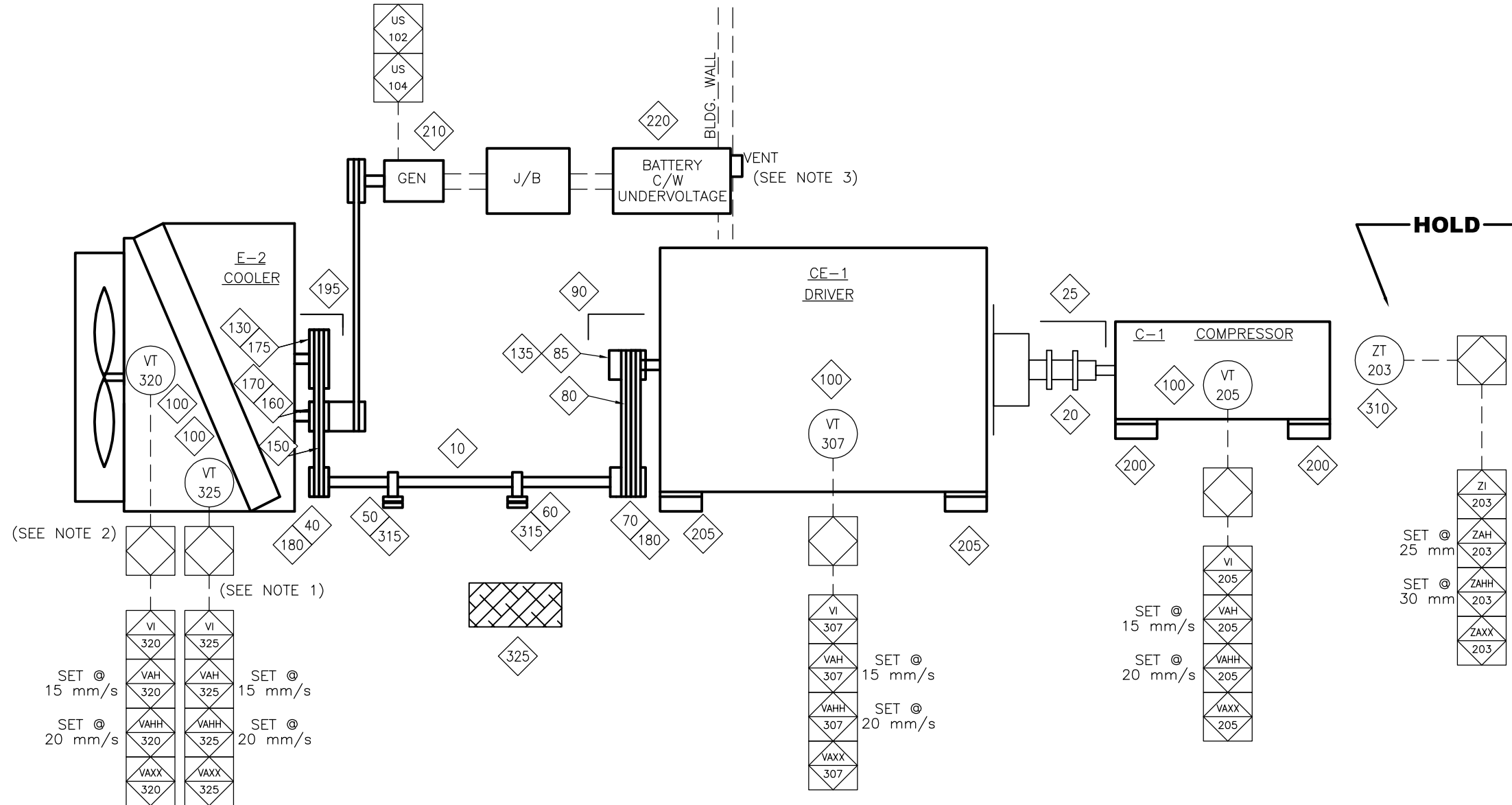
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DESCRIPTION	SHEAVE PITCH ϕ	RPM
ENGINE SHAFT	254 mm	1400
JACK SHAFT:		
ENGINE END	406 mm	875
COOLER END	279 mm	
IDLER		
COOLER END	279 mm	N/A
COOLER SHAFT	914 mm	267
GENERATOR	99 mm	2466

E-2
AERIAL COOLER
MAKE: AIR-X-CHANGERS
MODEL: 132EH
WEIGHT: 8432 kg
S/N: 065074

CE-1
DRIVER
MAKE: CATERPILLAR
MODEL: G3512LE AFRC
RATING: 1005 HP @ 1400 RPM
WEIGHT: 6705 kg
S/N: WPRO0174

C-1
SCREW COMPRESSOR
MAKE: ARIEL
MODEL: RG357M
MAX RUNNING PRESSURE: 1586 kPag
WEIGHT: 4090 kg
S/N: R10378



BILL OF MATERIAL				
ITEM	QTY	EFX CODE	DESCRIPTION	
10	1	103585	JACKSHAFT, 2-15/16" DIA C/W 3/4" X 3/8" X 8" KEYWAY @ BOTH ENDS (37"-60")	
20	1	127197	COUPLING, ARCUSAFLEX, 4171 SHRINK DISC, 3.74" BORE [RINGFEDER, 43-91.3327]	
25	1	NPN-REQ	COUPLING GUARD, ALUMINUM	
40	1	127452	SHEAVE, 5-GROOVE, USED WITH R1 BUSHING [BROWNING, 5C110R]	
50	1	107128	PILLOW BLOCK, 2-15/16", EXPANSION [BROWNING, PB970EX 2-15/16]	
60	1	107132	PILLOW BLOCK, 2-15/16", NON-EXPANSION [BROWNING, PB970EX 2-15/16]	
70	1	107204	SHEAVE, 5-GROOVE, USED WITH R1 BUSHING [BROWNING, 5C160R]	
80	5	107043	V-BELT, C-SECTION [GOODYEAR, C-122]	
85	1	107198	SHEAVE, 5-GROOVE, USED WITH R1 BUSHING [BROWNING, 5C100R]	
90	1	NPN-REQ	ASSEMBLY GUARD, STEEL	
100	4	118229	TRANSMITTER, VIBRATION, 4-20MA, 24VDC CSA, IS [METRIX, ST5484E-123-020-00]	
130	1	107209	SHEAVE, 5-GROOVE, USED WITH R2 BUSHING [BROWNING, 5C360R]	
135	1	113238	BUSHING, R1 2-1/2" [BROWNING, R1]	
150	5	107007	V-BELT, C-SECTION [GOODYEAR, C-255]	
160	1	107216	SHEAVE, 6-GROOVE, USED WITH R2 BUSHING [BROWNING, 6C96R]	
170	1	107087	BUSHING, R2 2-7/16" [BROWNING, R2]	
175	1	107105	BUSHING, R2 3-7/16" [BROWNING, R2]	
180	2	107079	BUSHING, R1 2-15/16" [BROWNING, R1]	
195	1	NPN-REQ	ASSEMBLY GUARD, STEEL, HINGED	
200	4	127649	MOUNT, CARBON STEEL, SM24 [VIBRACON, SM24CS-ID42]	
205	8	120462	MOUNT, CARBON STEEL, SM20CS [VIBRACON, SM20]	
210	1	128112	GENERATOR, ELECTRODYNE, 60AMP, CSA CL.1, DIV.II, 3.9" DATUM [HOLLEY, 10-080-678]	
220	1	120798	BATTERY BOX, SUITABLE FOR DIV.II C/W UNDERVOLTAGE [PIC, 10-080-678/BB2-DIV2UV]	
310	1	127895	TRANSMITTER ASS'Y, PROXIMITY, CSA, FOR MALE ROTOR POSITION C/W [METRIX, TX7300]	
315	2	123323C	ASSEMBLY, JACKSHAFT ADJUSTING PLATE, A1478	
325	AR	107440	PLATE, ALUMINUM, 1/8", GR 5052-H32	

BILL OF MATERIAL: W 060433 : Encana 1005 hp Stock Screw Compressor Package				
DATE-TIME EXPORTED: 2007-05-11-11.07				

NOTES:

- VT-325 TO BE MOUNTED BY FAN INPUT SHAFT SHEAVE INBOARD.
- VT-320 TO BE MOUNTED BY FAN INPUT SHAFT SHEAVE OUTBOARD.
- BATTERY BOX VENT SIDE TO OUTER SIDE OF BUILDING WALL.

REV	DESCRIPTION	DATE	DRAWN BY	CHECKED BY
2	AS BUILT	08/01/02	SHW	JB
1	CUSTOMER REQUESTED CHANGES	07/05/25	ATE	ATE
0	FOR CONSTRUCTION	07/05/25	ATE	ATE

EFX Compression
ENERFLEX

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TITLE: **DRIVE TRAIN EQUIPMENT**
ARIEL RG357M, CAT G3512LE ADEM III AFRC, AIR-X 132EH
1005HP SCREW COMPRESSOR PACKAGE

FOR: **ENCANA OIL & GAS PARTNERSHIP**
(CHINOOK)

CONSULTANT: DPH FOCUS CORPORATION
P.O.: 9066-K005

LSD: 06-28-23-25 W4M
JOB No.: 060433

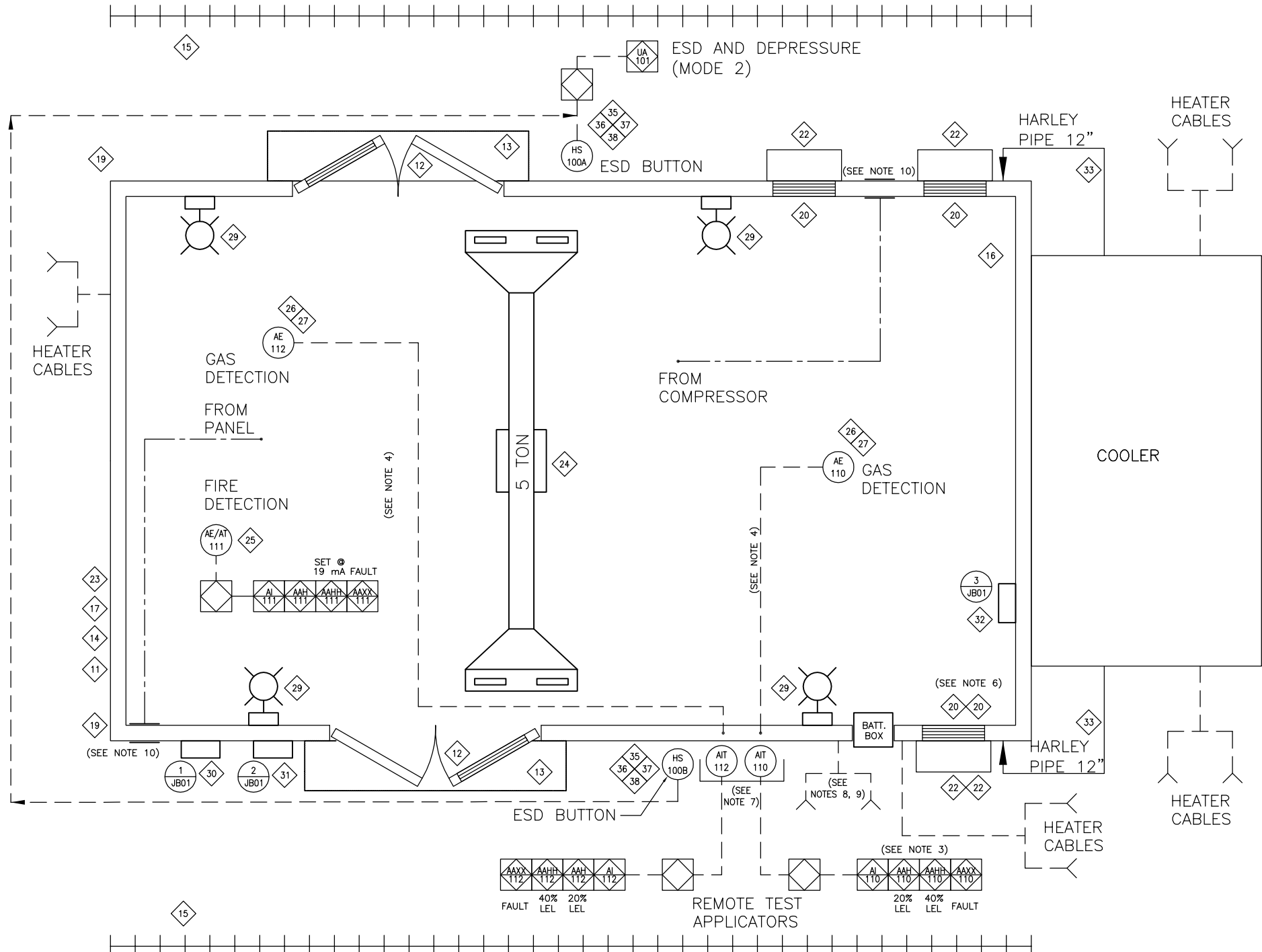
DRWN BY: SN	DESIGN BY: SN	DATE: 06/03/08	OP #
DATE: 06/03/08	CHKD BY: SHW	DATE: 06/03/08	
SCALE: NTS	APPVD BY: -	DATE: -	

DWG. No. **SF-060433-28** OP # **28**

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BILL OF MATERIAL				
ITEM	QTY	EFX CODE	DESCRIPTION	
11	1	127974	BUILDING, CUSTOM, 1005/860 HP, SCREW	
12	2	NPN-REQ	>> MAN DOOR, DOUBLE STEEL, 6' x 7', C/W LOCKING PANIC HARDWARE AND SOUND PACKS	
13	2	NPN-REQ	>>CANOPY, OVER DOOR TO MATCH BUILDING EXTERIOR	
14	1	NPN-REQ	>>ACTIVE RIDGE VENTILATOR C/W 9" THROAT AND ACOUSTICAL CAP	
15	2	NPN-REQ	>>FULL LENGTH ICE RAKES	
16	1	NPN-REQ	>>CUT AND FLASH AROUND COOLER OPENING	
17	1	NPN-REQ	>>33% WHITE, 20GA PERFORATED INTERIOR LINER	
19	2	NPN-REQ	>>EAVESTROUGHING C/W DOWNSPOUTS AND EXTENSIONS	
20	4	NPN-REQ	>>18" x 32" MANUALLY ADJUSTABLE WALL LOUVERS	
22	4	NPN-REQ	>>ACOUSTICAL STORM HOODS FOR THE 18" x 32" LOUVERS	
23	1	NPN-REQ	>>R12 ACOUSTICAL INSULATION IN WALLS AND R20 IN ROOF	
24	1	NPN-REQ	>>CRANE, 5-TON	
25	1	113989	DETECTOR, UV FIRE DETECTION C/W SWIVEL, ANALOG OUTPUT, [NET SAFETY, UVS-A]	
26	2	124495	DETECTOR, COMBUSTIBLE GAS DETECTION, MILLENNIUM [NET SAFETY, MLP-LP-A-SC1100-SEP]	
27	2	104309	ACCESSORY, CALIBRATION CUP, SPLASH GUARD & RAINSHIELD [NET SAFETY, CCS-1]	
29	4	NPN-REQ	INCANDESCENT FIXTURE, 200W, WALL MOUNT, 12VDC, CLASS I, ZONE 2 C/W CLOSE GUARD	
30	1	120702	JUNCTION BOX, 24" X 24" X 8" DEEP, FIBREGLASS, TYPE 4X [HOFFMAN, A24H2408GQRLP]	
31	1	114760	JUNCTION BOX, 16" X 14" X 8", FIBREGLASS [HOFFMAN, A-16148CHORFG]	
32	1	128367	JUNCTION BOX, 10" X 8" X 6", NEMA 3R, C/W BACK PAN [ACE, WPHH 1086]	
33	2	NPN-REQ	HARLEY PIPES 12"Ø GALVANIZED DUCTING	
35	2	128035	PUSH BUTTON, MUSHROOM HEAD, MOMENTARY CONTRACT, RED [ALLEN-BRADLEY, 800H-DR6]	
36	2	128036	PUSH BUTTON ENCLOSURE, ROSITE GLASS POLYESTER, TYPE [ALLEN-BRADLEY, 800H-1HZ4R]	
37	2	128044	SEALED SWITCH BLOCK, 1 N.C. [ALLEN-BRADLEY, 800T-XD2P]	
38	2	128045	LEGEND PLATE, STANDARD, "EMERG. STOP", RED [ALLEN-BRADLEY, 800H-W372]	

BILL OF MATERIAL: W 060433 : Encana 1005 hp Stock Screw Compressor Package				
DATE-TIME EXPORTED: 2007-05-11-12.51				



NOTES:

- THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION UNLESS STAMPED "RELEASED FOR MANUFACTURE".
- DO NOT SCALE THIS DRAWING.
- GAS DETECTION LEVEL INDICATORS TO BE MOUNTED OUTSIDE BUILDING.
- POLYETHYLENE TUBING LINES TO BE DIFFERENT COLOURS FOR REMOTE GAS TEST APPLICATIONS.
- TRIM INCLUDES DOORS, CANOPIES, WINDOW FRAMES, DOWNSPOUTS, STORM HOODS, ETC.
- LOUVERS ARE STACKED ON TOP OF EACH OTHER AT THIS LOCATION.
- SHROUD TO BE PROVIDED OVER LEL GAS DETECTION CONTROLLERS.
- CONNECT INTERIOR LIGHTS IN PARALLEL.
- USE 2C#8 WIRE.
- GROUND WIRES INSTALLED THROUGH STEEL PLATE ON BOTH SIDES OF BUILDING WALL.

REV	DESCRIPTION	DATE	DRAWN BY	CHECKED BY
2	AS BUILT	08/01/02	SHW	JB
1	CUSTOMER REQUESTED CHANGES	07/10/18	SHW	ATE
0	FOR CONSTRUCTION	07/05/25	ATE	ATE

COLOUR SCHEDULE	
WALL INTERIOR LINER:	WHITE
WALL EXTERIOR:	DOFASCO TAN 5M-QC-315
ROOF INTERIOR LINER:	WHITE
ROOF EXTERIOR:	BROWN 5M-QC-229
TRIM:	BROWN 5M-QC-229 (SEE NOTE 5)
COOLER:	ENCANA TAUPE
EQUIPMENT:	TAUPE
SKID PERIMETER:	TAUPE
GRATING:	BLACK
PIPING & VESSELS:	ENCANA STANDARD
DIMENSIONS	
WIDTH:	23'-0"
LENGTH:	35'-4"
EAVE HEIGHT:	15'-8" SLOPE 4:12

ENERFLEX Compression

4700 47 Street SE Calgary AB Canada T2B 3R1 Canada Tel. +1.403.236.6800 Fax +1.403.279.0367
www.enerflex.com

TITLE: BUILDING EQUIPMENT
ARIEL RG357M, CAT G3512LE ADEM III AFRC, AIR-X 132EH
1005HP SCREW COMPRESSOR PACKAGE

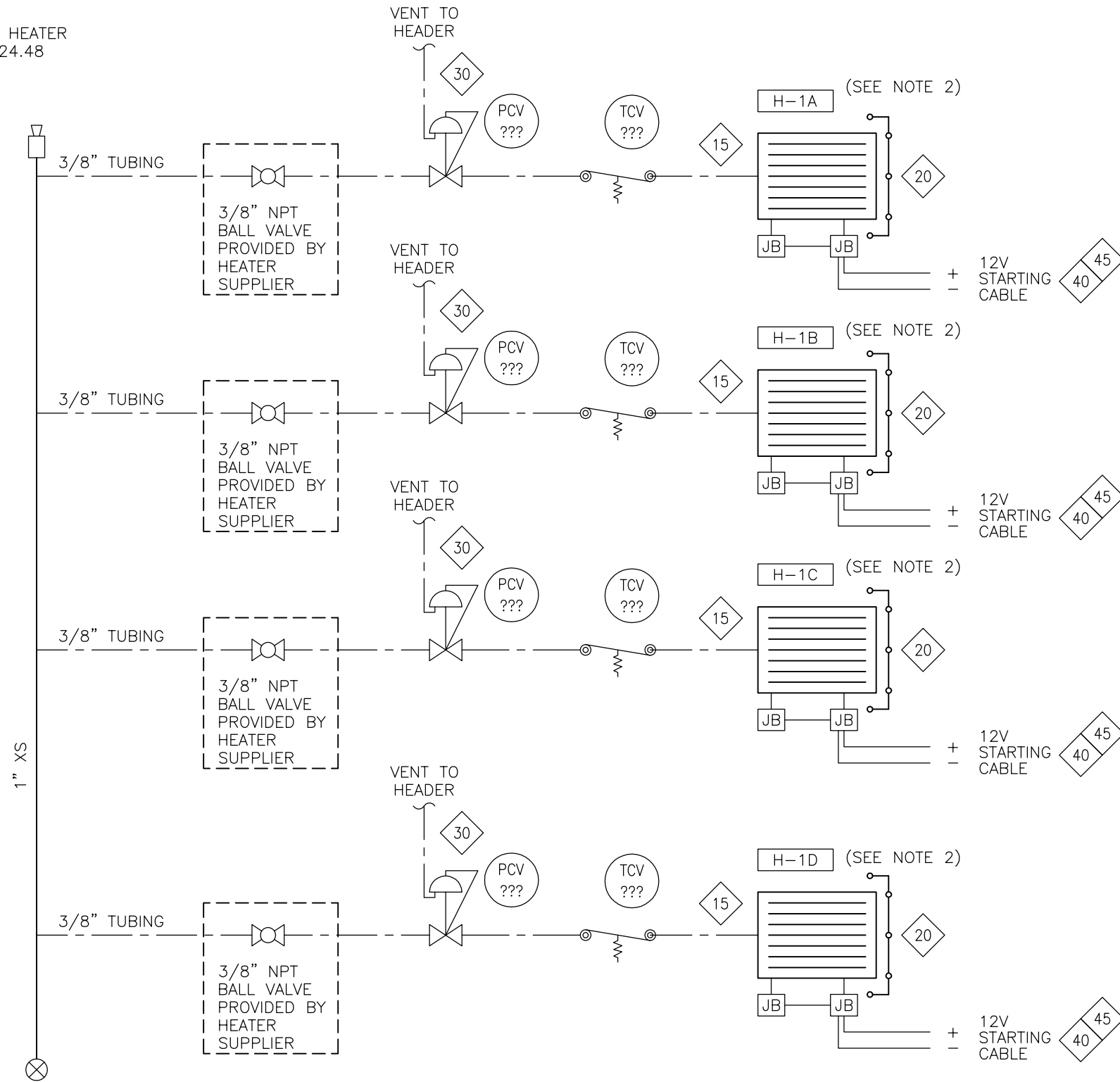
FOR: **ENCANA OIL & GAS PARTNERSHIP**
(CHINOOK)

CONSULTANT: DPH FOCUS CORPORATION
P.O.: 9066-K005
LSD: 06-28-23-25 W4M
JOB No.: 060433

DRWN BY: SN	DESIGN BY: SN	DATE: 06/03/08	DWG. No.	OP #
DATE: 06/03/08	CHKD BY: SHW	DATE: 06/03/08	SF-060433-70	70
SCALE: NTS	APPVD BY: -	DATE: -		

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H-1A/B/C/D
 THERMCAT 2000 BUILDING HEATER
 MODEL: COMBI-SAFE, HA 24.48
 RATING: 32 MBTU
 VOLTAGE: 12 VDC



GAS SUPPLY:
 896 kPag (130 PSIG) MAX.
 FROM FUEL GAS
 SEE DWG 'SF-22'

BILL OF MATERIAL

ITEM	QTY	EFX CODE	DESCRIPTION
15	4	127445	HEATER, 32 MBTU, 12/120 VOLT, COMBI-SAFE MODEL, CSA C/W [THERMCAT 2000, HA 24.48]
20	4	124349	HEATER, PROTECTION GRILL, 24" X 48" [THERMCAT, 1.17]
30	4	114721	HEATER, REGULATOR, 250 PSIG, 11" WC, 1/4" X 3/8" NPT [THERMCAT, 7.07]
40	4	127444	HEATER, STARTING CABLES, 35', 12V, FOR THERMCAT HEATERS [THERMCAT]
45	4	109152C	SUPPORT, HEATER CABLE

			BILL OF MATERIAL: W 060433 : Encana 1005 hp Stock Screw Compressor Package
			DATE-TIME EXPORTED: 2007-05-10-15.30

NOTES:

1. THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION UNLESS STAMPED "RELEASED FOR MANUFACTURE".
2. MOUNT SENSING BULB LOW & ON BUILDING WALL
3. DO NOT SCALE THIS DRAWING.

REV	DESCRIPTION	DATE	DRAWN BY	CHECKED BY
2	AS BUILT	08/01/02	SHW	JB
1	CUSTOMER REQUESTED CHANGES	07/10/18	SHW	ATE
0	FOR CONSTRUCTION	07/05/25	ATE	ATE

ENERFLEX

4700 47 Street SE Calgary AB Canada T2B 3R1 Canada Tel. +1.403.236.6800 Fax +1.403.279.0367
 www.enerflex.com

TITLE: **BUILDING HEATERS**
ARIEL RG357M, CAT G3512LE ADEM III AFRC, AIR-X 132EH
 1005HP SCREW COMPRESSOR PACKAGE

FOR: **ENCANA OIL & GAS PARTNERSHIP**
 (CHINOOK)

CONSULTANT: DPH FOCUS CORPORATION
 P.O.: 9066-K005
 LSD: 06-28-23-25 W4M
 JOB No.: 060433

DRWN BY: SN	DESIGN BY: SN	DATE: 06/03/08	DWG. No.	OP #
DATE: 06/03/08	CHKD BY: SHW	DATE: 06/03/08	SF-060433-72	72
SCALE: NTS	APPVD BY: -	DATE: -		

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MSDS Sheets



WHMIS (Pictograms)	WHMIS (Classification)	Protective Clothing	TDG (pictograms)
	Not controlled		

Section 1. Chemical Product and Company Identification			
Product Name	SENTRON 445	Code	460-110, STL445
Synonym	Not available	Validated on	6/29/2006.
Manufacturer	PETRO-CANADA P.O. Box 2844 Calgary, Alberta T2P 3E3	In case of Emergency	Petro-Canada: 403-296-3000 Canutec Transportation: 613-996-6666 Poison Control Centre: Consult local telephone directory for emergency number(s).
Material Uses	Sentron oils are designed for use in stationary, spark-ignition, natural gas fuelled engines.		

Section 2. Composition and Information on Ingredients						
				<i>Exposure Limits (ACGIH)</i>		
Name	CAS #	% (V/V)	TLV-TWA(8 h)	STEL	CEILING	
Mixture of severely hydrotreated and hydrocracked base oil (petroleum) and other proprietary, non-hazardous additives.	Mixture	100	5 mg/m ³ (oil mist)	10 mg/m ³ (oil mist)	Not established	
Manufacturer Recommendation	Not applicable					
Other Exposure Limits	Consult local, state, provincial or territory authorities for acceptable exposure limits.					

Section 3. Hazards Identification.	
Potential Health Effects	Prolonged or repeated contact may cause skin irritation, defatting, drying and dermatitis. Not expected to cause more than slight skin or eye irritation. With its relatively low vapour pressure, this product is not expected to be inhaled in any appreciable quantity at ambient conditions. If heated to high temperatures or subjected to mechanical actions which produce vapours or mists, inhalation may cause respiratory tract irritation. Ingestion may produce a laxative effect. For more information refer to Section 11 of this MSDS.

Section 4. First Aid Measures	
Eye Contact	No effects expected. If irritation does occur, flush contaminated eye(s) with lukewarm, gently flowing water for 5 minutes or until the chemical is removed. If irritation persists, obtain medical advice.
Skin Contact	Quickly and gently, blot or brush away excess chemical. Wash gently and thoroughly with water and non-abrasive soap for 5 minutes or until chemical is removed. Remove contaminated clothing, shoes and leather goods (e.g., watchbands, belts, etc.). If irritation persists, repeat flushing. Obtain medical advice immediately. Completely decontaminate clothing, shoes and leather goods before reuse or discard.
Inhalation	Remove source of contamination or move victim to fresh air. If irritation persists, obtain medical advice.
Ingestion	NEVER give anything by mouth if victim is rapidly losing consciousness, or is unconscious or convulsing. DO NOT INDUCE VOMITING. Have victim drink 240 to 300 mL (8 to 10 oz) of water to dilute material in stomach. If vomiting occurs naturally, rinse mouth and repeat administration of water. Obtain medical attention.
Note to Physician	Not available

Section 5. Fire-fighting Measures			
Flammability	May be combustible at high temperature.	Flammable Limits	Not available
Flash Points	Open cup: 230°C (446°F) (Cleveland.).	Auto-Ignition Temperature	Fire Point: 278°C (532.4°F)
Fire Hazards in Presence of Various Substances	Low fire hazard. This material must be heated before ignition will occur.	Explosion Hazards in Presence of Various Substances	Do not cut, weld, heat, drill or pressurize empty container. Containers may explode in heat of fire.

Products of Combustion	Carbon oxides (CO, CO ₂), nitrogen oxides (NO _x), sulphur oxides (SO _x), phosphorus compounds (PO _x), zinc oxides (ZnO _x), calcium oxides (CaO _x), smoke and irritating vapours as products of incomplete combustion.
Fire Fighting Media and Instructions	NAERG2004, GUIDE 171, Substances (low to moderate hazard). If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (0.5 mile) in all directions; also, consider initial evacuation for 800 meters (0.5 mile) in all directions. Shut off fuel to fire if it is possible to do so without hazard. If this is impossible, withdraw from area and let fire burn out under controlled conditions. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire. Cool containing vessels with water spray in order to prevent pressure build-up, autoignition or explosion. SMALL FIRE: use DRY chemicals, foam, water spray or CO ₂ . LARGE FIRE: use water spray, fog or foam. For small outdoor fires, portable fire extinguishers may be used, and self contained breathing apparatus (SCBA) may not be required. For all indoor fires and any significant outdoor fires, SCBA is required. Respiratory and eye protection are required for fire fighting personnel.

Section 6. Accidental Release Measures

Material Release or Spill	Consult current National Emergency Response Guide Book (NAERG) for appropriate spill measures if necessary. Ensure clean-up personnel wear appropriate personal protective equipment. Extinguish all ignition sources. Stop leak if safe to do so. Dike spilled material. Use appropriate inert absorbent material to absorb spilled product. Collect used absorbent for later disposal. Avoid contact with spilled material. Avoid contaminating sewers, streams, rivers and other water courses with spilled material. Notify appropriate authorities immediately.
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Section 7. Handling and Storage

Handling	Avoid contact with any sources of ignition, flames, heat, and sparks. Avoid skin contact. Avoid eye contact. Avoid inhalation of product vapours or mists. Wear proper personal protective equipment (See Section 8). Empty containers may contain product residue. Do not pressurize, cut, heat, or weld empty containers. Do not reuse containers without commercial cleaning and/or reconditioning. Personnel who handle this material should practice good personal hygiene during and after handling to help prevent accidental ingestion of this product. Properly dispose of contaminated leather articles including shoes that cannot be decontaminated.
Storage	Store in dry, cool, well-ventilated area. Keep container tightly closed. Store away from incompatible and reactive materials (See section 5 and 10).

Section 8. Exposure Controls/Personal Protection

Engineering Controls	For normal application, special ventilation is not necessary. If user's operations generate vapours or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit. Make-up air should always be supplied to balance air removed by exhaust ventilation. Ensure that eyewash station and safety shower are close to work-station.
Personal Protection - <i>The selection of personal protective equipment varies, depending upon conditions of use.</i>	
Eyes	As a minimum, safety glasses with side shields should be worn when handling this material.
Body	If this material may come in contact with the body during handling and use, we recommend wearing appropriate protective clothing to prevent contact with the skin. (Contact your PPE provider for more information.)
Respiratory	A NIOSH-approved air-purifying respirator with an organic vapour cartridge or canister with a dust, fume or mist filter (R, or P series) may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air-purifying respirators is limited. A NIOSH-approved positive-pressure, air-supplied respirator or self-contained breathing apparatus may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits.
Hands	If this material may come in contact with the hands during handling and use, we recommend wearing gloves of the following material(s): neoprene, nitrile, polyvinyl alcohol (PVA), fluoro-elastomer. Consult your PPE provider for breakthrough times and the specific glove that is best for you based on your use patterns. It should be realized that eventually any material regardless of their imperviousness, will get permeated by chemicals. Therefore, protective gloves should be regularly checked for wear and tear. At the first signs of hardening and cracks, they should be changed.
Feet	Wear appropriate footwear to prevent product from coming in contact with feet and skin.

Section 9. Physical and Chemical Properties

Physical State and Appearance	Viscous liquid.	Viscosity	125.5 cSt @ 40°C (104°F), 13.3 cSt @ 100°C (212°F), VI=101
Colour	Light amber or yellow.	Pour Point	-24°C (-11°F)
Odour	Mild petroleum oil like.	Softening Point	Not applicable
Odour Threshold	Not available	Dropping Point	Not applicable
Boiling Point	Not available	Penetration	Not applicable
Density	0.8775 kg/L @ 15°C (59°F).	Oil / Water Dist. Coefficient	Not available

Vapour Density	Not available	Ionicity (in water)	Not available
Vapour Pressure	Negligible at ambient temperature and pressure.	Dispersion Properties	Not available
Volatility	Not available	Solubility	Insoluble in water.

Section 10. Stability and Reactivity

Corrosivity	Not available		
Stability	The product is stable under normal handling and storage conditions.	Hazardous Polymerization	Will not occur under normal working conditions.
Incompatible Substances / Conditions to Avoid	Reactive with oxidizing agents and acids.	Decomposition Products	May release CO _x , H ₂ S, SiO _x , methacrylate monomers, aldehydes, smoke and irritating vapours when heated to decomposition.

Section 11. Toxicological Information

Routes of Entry	Skin contact, eye contact, inhalation and ingestion.
Acute Lethality	Acute toxicity information is not available for the product as a whole, therefore, data for the base oils are provided below: Acute Oral toxicity (LD50): >5000 mg/kg (rat) Acute Dermal toxicity (LD50): >2000 mg/kg (rabbit)
Chronic or Other Toxic Effects	
Dermal Route:	Prolonged or repeated contact may defat and dry skin, and cause dermatitis. Short-term exposure is expected to cause only slight irritation, if any.
Inhalation Route:	With its relatively low vapour pressure, this product is not expected to be inhaled in any appreciable quantity at ambient conditions. If heated to high temperatures or subjected to mechanical actions which produce vapours or mists, inhalation may cause respiratory tract irritation.
Oral Route:	Ingestion of this product may lead to aspiration of the liquid, especially if vomiting occurs. This may result in chemical pneumonitis (inflammation of the lungs) and/or pulmonary edema (an accumulation of fluid in the lungs). May produce a laxative effect.
Eye Irritation/Inflammation:	Short-term exposure is expected to cause only slight irritation, if any.
Immunotoxicity:	Not available
Skin Sensitization:	Contact with this product is not expected to cause skin sensitization, based upon the available data and the known hazards of the components.
Respiratory Tract Sensitization:	Contact with this product is not expected to cause respiratory tract sensitization, based upon the available data and the known hazards of the components.
Mutagenic:	This product is not known to contain any components at $\geq 0.1\%$ that have been shown to cause mutagenicity. Therefore, based upon the available data and the known hazards of the components, this product is not expected to be a mutagen.
Reproductive Toxicity:	This product is not known to contain any components at $\geq 0.1\%$ that have been shown to cause reproductive toxicity. Therefore, based upon the available data and the known hazards of the components, this product is not expected to be a reproductive toxin.
Teratogenicity/Embryotoxicity:	This product is not known to contain any components at $\geq 0.1\%$ that have been shown to cause teratogenicity and/or embryotoxicity. Therefore, based upon the available data and the known hazards of the components, this product is not expected to be a teratogen/embryotoxin.
Carcinogenicity (ACGIH):	This product is not known to contain any chemicals at reportable quantities that are listed as Group A1 or A2 carcinogens by ACGIH.
Carcinogenicity (IARC):	This product is not known to contain any chemicals at reportable quantities that are listed as Group 1, 2A, or 2B carcinogens by IARC.
Carcinogenicity (NTP):	This product is not known to contain any chemicals at reportable quantities that are listed as carcinogens by NTP.
Carcinogenicity (IRIS):	This product is not known to contain any chemicals at reportable quantities that are listed as carcinogens by IRIS.
Carcinogenicity (OSHA):	This product is not known to contain any chemicals at reportable quantities that are listed as carcinogens by OSHA.
Other Considerations	No additional remark.

Section 12. Ecological Information

Environmental Fate	Not available	Persistence/Bioaccumulation Potential	Not available
BOD5 and COD	Not available	Products of Biodegradation	Not available
Additional Remarks No additional remark.			

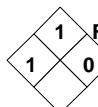
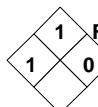
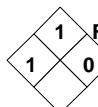
Section 13. Disposal Considerations

Waste Disposal	Spent/ used/ waste product may meet the requirements of a hazardous waste. Consult your local or regional authorities. Ensure that waste management processes are in compliance with government requirements and local disposal regulations.
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Section 14. Transport Information

TDG Classification	Not controlled under TDG (Canada).	Special Provisions for Transport	Not applicable.
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Section 15. Regulatory Information

Other Regulations	<p>This product is acceptable for use under the provisions of WHMIS-CPR. All components of this formulation are listed on the CEPA-DSL (Domestic Substances List).</p> <p>All components of this formulation are listed on the US EPA-TSCA Inventory.</p> <p>This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.</p> <p>Please contact Product Safety for more information.</p>																												
DSD/DPD (Europe)	For European classification and inventory information please see the European version of this MSDS.	HCS (U.S.A.)	Does not meet the definitions of a health or physical hazard according to the OSHA - Hazard Communication Standard. (United States)																										
ADR (Europe) (Pictograms)	NOT EVALUATED FOR EUROPEAN TRANSPORT NON ÉVALUÉ POUR LE TRANSPORT EUROPÉEN.	DOT (U.S.A) (Pictograms)	Not evaluated for transport Non évalué pour le transport																										
HMIS (U.S.A.)	<table border="1"> <tr> <td>Health Hazard</td> <td>1</td> </tr> <tr> <td>Fire Hazard</td> <td>1</td> </tr> <tr> <td>Reactivity</td> <td>0</td> </tr> <tr> <td>Personal Protection</td> <td>B</td> </tr> </table>	Health Hazard	1	Fire Hazard	1	Reactivity	0	Personal Protection	B	NFPA (U.S.A.)	<table border="1"> <tr> <td>Health</td> <td>1</td> <td>Fire Hazard</td> <td>0</td> <td>Reactivity</td> <td>0</td> </tr> <tr> <td colspan="6" style="text-align: center;">  </td> </tr> <tr> <td colspan="6" style="text-align: center;">Specific hazard</td> </tr> </table>	Health	1	Fire Hazard	0	Reactivity	0							Specific hazard					
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Reactivity	0																												
Personal Protection	B																												
Health	1	Fire Hazard	0	Reactivity	0																								
																													
Specific hazard																													
		Rating	0 Insignificant 1 Slight 2 Moderate 3 High 4 Extreme																										

Section 16. Other Information

References	Available upon request. * Marque de commerce de Petro-Canada - Trademark
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Glossary

ACGIH - American Conference of Governmental Industrial Hygienists	HCS - Hazardous Communication System
ADR - Agreement on Dangerous goods by Road (Europe)	HMIS - Hazardous Material Information System
ASTM - American Society for Testing and Materials	IARC - International Agency for Research on Cancer
BOD5 - Biological Oxygen Demand in 5 days	IRIS - Integrated Risk Information System
CAS - Chemical Abstract Services	LD50/LC50 - Lethal Dose/Concentration kill 50%
CEPA - Canadian Environmental Protection Act	LDLo/LCLo - Lowest Published Lethal Dose/Concentration
CERCLA - Comprehensive Environmental Response, Compensation and Liability Act	NFPA - National Fire Prevention Association
CFR - Code of Federal Regulations	NIOSH - National Institute for Occupational Safety & Health
CHIP - Chemical Hazard Information and Packaging Approved Supply List	NPRI - National Pollutant Release Inventory
COD - Chemical Oxygen Demand	NSNR - New Substances Notification Regulations (Canada)
CPR - Controlled Products Regulations	NTP - National Toxicology Program
DOT - Department of Transportation (U.S.A.)	OSHA - Occupational Safety & Health Administration
DSCL - Dangerous Substances Classification and Labeling (Europe)	PEL - Permissible Exposure Limit
DSD/DPD - Dangerous Substance or Dangerous Preparations Directives (Europe)	RCRA - Resource Conservation and Recovery Act
DSL - Domestic Substance List (Canada)	SARA - Superfund Amendments and Reorganization Act
EEC/EU - European Economic Community/European Union	STEL - Short Term Exposure Limit (15 minutes)
EINECS - European Inventory of Existing Commercial Chemical Substances	TDG - Transportation Dangerous Goods (Canada)
EPCRA - Emergency Planning And Community Right-To-Know Act	TDLo/TCLo - Lowest Published Toxic Dose/Concentration
FDA - Food and Drug Administration	TLV-TWA - Threshold Limit Value-Time Weighted Average
FIFRA - Federal Insecticide, Fungicide, and Rodenticide Act	TLm - Median Tolerance Limit
	TSCA - Toxic Substances Control Act
	USEPA - United States Environmental Protection Agency
	USP - United States Pharmacopoeia
	WHMIS - Workplace Hazardous Material Information System

For Copy of MSDS

The Canadian Controlled Products Regulations (CPR) (Under the Hazardous Products Act, part of the WHMIS legislation) only apply to WHMIS Controlled (i.e., hazardous) products. Therefore, the CPR and the 3-year update rule specified therein do not apply to WHMIS Non-Controlled products. Although this is true, customarily Petro-Canada reviews and updates Non-Controlled product MSDS if a customer requests such an update. These Non-Controlled product updates are given a lower priority than Controlled products but are handled as soon as practicable. If you would like to verify if the MSDS you have is the most current, or you require any further information, please contact:

Internet: www.petro-canada.ca/msds

Lubricants:

Western Canada, telephone: 1-800-661-1199; fax: (780) 464-9564

Ontario & Central Canada, telephone: 1-800-268-5850 and (905) 822-4222; fax: 1-800-201-6285

Quebec & Eastern Canada, telephone: 1-800-576-1686; fax: 1-800-201-6285

For Product Safety Information: (905) 804-4752

Prepared by Product Safety - JDW on 6/29/2006.

Data entry by Product Safety - DSR.

To the best of our knowledge, the information contained herein is accurate. However, neither the above named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

AUTO-IGNITION TEMPERATURE:

Not available

SENSITIVITY TO STATIC DISCHARGE: Yes

HAZARDOUS COMBUSTION PRODUCTS:

Carbon Monoxide, Carbon Dioxide and Oxides of Nitrogen.

===== SECTION V - REACTIVITY DATA =====

CHEMICAL STABILITY: STABLE

CONDITIONS TO AVOID:

Excessive heat, poor ventilation, corrosive atmospheres, excessive aging.

INCOMPATIBILITY (MATERIALS TO AVOID)

Alkaline materials, strong acids and oxidizing agents.

HAZARDOUS DECOMPOSITION OR BYPRODUCTS: NONE KNOWN

HAZARDOUS POLYMERIZATION:

Will not occur.

===== SECTION VI - TOXICOLOGICAL DATA =====

INHALATION HEALTH RISKS AND SYMPTOMS OF EXPOSURE

May cause respiratory irritation, dizziness, breathing difficulty, headaches and loss of co-ordination.

SKIN AND EYE CONTACT HEALTH RISKS AND SYMPTOMS OF EXPOSURE

Eye Contact: May cause severe irritation, tearing, redness and blurred vision.

Skin Contact: May cause irritation.

SKIN ABSORPTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE

May dry and defat skin causing cracks, irritation and dermatitis.

INGESTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE

May cause gastrointestinal irritation, vomiting, nausea and diarrhea.

HEALTH HAZARDS (ACUTE AND CHRONIC)

Acute health hazards are as listed above. No chronic health hazards.

SENSITIZING CAPABILITY: NONE KNOWN

CARCINOGENICITY: NTP CARCINOGEN:No IARC MONOGRAPHS:Yes OSHA REGULATED:No

Ethylbenzene has been classified by the IARC as a Group 2B substance on the basis of sufficient evidence for carcinogenicity in laboratory animals but inadequate evidence for cancer in humans.

TERATOGENICITY AND EMBRYOTOXICITY

High exposures to xylenes in some animal studies have been reported to cause health effects on the developing embryo/fetus. These effects were often at levels toxic to the mother. The significance of these findings to humans has not been determined.

REPRODUCTIVE TOXICITY

Not available.

MUTAGENICITY

Not available.

TOXICOLOGICALLY SYNERGISTIC PRODUCTS

None known.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

Anesthesia, respiratory tract irritation, dermatitis, nausea, vomiting.

===== SECTION VII - PREVENTIVE MEASURES =====

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Eliminate ignition sources. Provide good ventilation or wear appropriate breathing apparatus. Absorb small spills with non-flammable absorbent. Contain spills by diking with non-flammable

absorbent. Notify environmental agency.

WASTE DISPOSAL METHOD

Reclaim or dispose of through a licensed waste disposal company according to Federal, Provincial and local regulations.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Flammable. Store in a cool, dry, well ventilated area away from heat and ignition sources. Keep containers closed when not in use. Avoid breathing vapours or mist and prolonged or repeated contact with skin. Launder contaminated clothing prior to re-use. Use good personal hygiene. Product is a static accumulator. Transfer equipment should be grounded or bonded.

OTHER PRECAUTIONS: Smoking in the area where this material is used must be strictly prohibited.

RESPIRATORY PROTECTION

NIOSH approved for organic vapours and particulate matter.

VENTILATION

General mechanical ventilation or local exhaust should be suitable to keep vapour concentrations below TLV. Ventilation equipment must be explosion proof. Make up air should be supplied to balance air exhausted.

PROTECTIVE GLOVES

Solvent impervious e.g. Viton, Nitrile, PVC.

EYE PROTECTION

Chemical safety glasses, goggles or face shield.

OTHER PROTECTIVE CLOTHING OR EQUIPMENT

Use impermeable aprons and protective clothing whenever possible to prevent skin contact.

WORK/HYGIENIC PRACTICES

Eye washes and safety showers in the workplace are recommended.

===== SECTION VIII - FIRST AID MEASURES =====

INHALATION OVEREXPOSURE: Move person to fresh air. If breathing stops, apply artificial respiration and seek immediate medical attention.

EYE CONTACT: Flush with water for at least 15 minutes. Seek medical attention.

SKIN CONTACT: Wash thoroughly with mild soap and water.

INGESTION: Do not induce vomiting. Aspiration of solvents in this product can cause inflammation of the lungs.

===== SECTION IX - PREPARATION =====

PREPARED BY: TECHNICAL DEPARTMENT

===== SECTION X - DISCLAIMER =====

To the best of our knowledge, the information contained herein is accurate, obtained from sources believed by Cloverdale Paint Inc. to be accurate. No warranty concerning the accuracy of these sources is made and Cloverdale Paint Inc. will not be held liable for claims relating to use of this information or recommendations.

M A T E R I A L S A F E T Y D A T A S H E E T

Prod.ID: 78011

===== SECTION I - PRODUCT IDENTIFICATION =====

PRODUCT NAME: CLOVA THINNER #11
 PRODUCT IDENTIFIER: 78011
 PRODUCT USE : Paint thinner
 PRODUCT IDENTIFICATION NUMBER: UN1307
 WHMIS INFO.: B2,D2B

HMIS CODES: H F R P
 1 3 1 I

MANUFACTURER'S NAME: Cloverdale Paint Inc.
 ADDRESS : 6950 King George Highway
 Surrey, BC, Canada
 V3W 4Z1

EMERGENCY PHONE : (613) 996-6666 REVISION DATE: 03/05/01
 INFORMATION PHONE : (604) 596-6261
 ABBREVIATIONS: N/AP - NOT APPLICABLE N/AV - NOT AVAILABLE

===== SECTION II - HAZARDOUS INGREDIENTS =====

REPORTABLE COMPONENTS CAS NUMBERWEIGHT PERCENTOCCUPATIONAL EXPOSURE LIMITS

REPORTABLE COMPONENTS	CAS NUMBER	WEIGHT PERCENT	OCCUPATIONAL EXPOSURE LIMITS
* XYLENE	1330-20-7	60-100	ACGIH TLV: 100 PPM LD50: ORAL:4g/kg rat, LC50: 6500 ppm/4H(RAT)
ETHYLBENZENE	100-41-4	10-30	TWA: 100ppm LD50 (ORAL-RAT): 3500 mg/kg

* Indicates toxic chemical(s) subject to the reporting requirements of section 313 of Title III and of 40 CFR 372.

===== SECTION III - PHYSICAL/CHEMICAL CHARACTERISTICS =====

BOILING POINT: 136.2 C SPECIFIC GRAVITY (H2O=1): 0.87
 VAPOR DENSITY: Heavier than air.

PHYSICAL STATE: Liquid.
 EVAPORATION RATE: Slower than n-Butyl Acetate.

VAPOR PRESSURE: mm Hg @ TEMP (F)
 5 68
 7 20C

COATING V.O.C. : 867 g/l
 SOLUBILITY IN WATER: Insoluble.
 APPEARANCE AND ODOR: Clear, Thin liquid; Aromatic odor.
 FREEZING POINT: Not available. pH: N/AP
 COEFFICIENT OF WATER/OIL DIST: N/AV ODOR THRESHOLD: 1-30 ppm

===== SECTION IV - FIRE AND EXPLOSION HAZARD DATA =====

FLASH POINT: 15 C METHOD USED: CC
 FLAMMABLE LIMITS IN AIR BY VOLUME(%)- LOWER: 1% UPPER: 7

EXTINGUISHING MEDIA: Foam,CO2,Dry chemical, Water fog.

SPECIAL FIREFIGHTING PROCEDURES

Respiratory equipment should be worn to avoid inhalation of concentrated vapours. Water should not be used except as a fog to keep nearby containers cool.

UNUSUAL FIRE AND EXPLOSION HAZARDS

Handle as a flammable liquid. Vapours form an explosive mixture in air between the upper and lower explosive limits, which, can be ignited by many sources such as pilot lights, open flames, electrical boxes and switches. Vapour may travel

along the ground and flashback along vapour trail may occur.

FLAMMABILITY - T.D.G.R. CLASS
 3.3,9.2

SENSITIVITY TO IMPACT: NO

AUTO-IGNITION TEMPERATURE:
 Not available 527 deg C

SENSITIVITY TO STATIC DISCHARGE
 Yes

HAZARDOUS COMBUSTION PRODUCTS:

Carbon Monoxide, Carbon Dioxide and Oxides of Nitrogen.

===== SECTION V - REACTIVITY DATA =====

CHEMICAL STABILITY: STABLE

CONDITIONS TO AVOID

Excessive heat, Poor ventilation, Corrosive atmospheres, Excessive aging.

INCOMPATIBILITY (MATERIALS TO AVOID)

Alkaline materials, strong acids and oxidizing agents.

HAZARDOUS DECOMPOSITION OR BYPRODUCTS: NONE KNOWN

HAZARDOUS POLYMERIZATION: Will not occur.

===== SECTION VI - TOXICOLOGICAL DATA =====

INHALATION HEALTH RISKS AND SYMPTOMS OF EXPOSURE

May cause respiratory irritation, dizziness, breathing difficulty, headaches and loss of co-ordination.

SKIN AND EYE CONTACT HEALTH RISKS AND SYMPTOMS OF EXPOSURE

Eye Contact: May cause severe irritation, tearing, redness and blurred vision.

Skin Contact: May cause irritation.

SKIN ABSORPTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE

May dry and defat skin causing cracks, irritation and dermatitis.

INGESTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE

May cause gastrointestinal irritation, vomiting, nausea and diarrhea.

HEALTH HAZARDS (ACUTE AND CHRONIC)

Acute health hazards are as listed above.

No chronic health hazards.

SENSITIZING CAPABILITY: NONE KNOWN

CARCINOGENICITY: NTP CARCINOGEN: No IARC MONOGRAPHS: Yes OSHA REGULATED: No

Ethylbenzene has been classified by the IARC as a Group 2B substance on the basis of sufficient evidence for carcinogenicity in laboratory animals but inadequate evidence for cancer in humans.

TERATOGENICITY AND EMBRYOTOXICITY

High exposures to xylenes in some animal studies have been reported to cause health effects on the developing embryo/fetus. These effects were often at levels toxic to the mother. The significance of these findings to humans has not been determined.

REPRODUCTIVE TOXICITY

Not available.

MUTAGENICITY

Not available.

TOXICOLOGICALLY SYNERGISTIC PRODUCTS

None known.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

Anesthesia, respiratory tract irritation, dermatitis, nausea, vomiting.

===== SECTION VII - PREVENTIVE MEASURES =====

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Eliminate ignition sources. Provide good ventilation or wear appropriate breathing apparatus. Absorb small spills with non-flammable absorbent. Contain spills by diking with non-flammable absorbent. Notify environmental agency.

WASTE DISPOSAL METHOD

Reclaim or dispose of through a licensed waste disposal company according to Federal, Provincial and local regulations.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Flammable. Store in a cool, dry, well ventilated area away from heat and ignition sources. Keep containers closed when not in use. Avoid breathing vapours or mist and prolonged or repeated contact with skin. Launder contaminated clothing prior to re-use. Use good personal hygiene. Product is a static accumulator. Transfer equipment should be grounded or bonded.

OTHER PRECAUTIONS

Smoking in the area where this material is used must be strictly prohibited.

RESPIRATORY PROTECTION

NIOSH approved for organic vapours and particulate matter.

VENTILATION

General mechanical ventilation or local exhaust should be suitable to keep vapour concentrations below TLV. Ventilation equipment must be explosion proof. Make up air should be supplied to balance air exhausted.

PROTECTIVE GLOVES

Solvent impervious e.g. Viton, Nitrile, PVC.

EYE PROTECTION

Chemical safety glasses, goggles or face shield.

OTHER PROTECTIVE CLOTHING OR EQUIPMENT

Use impermeable aprons and protective clothing whenever possible to prevent skin contact.

WORK/HYGIENIC PRACTICES

Eye washes and safety showers in the workplace are recommended.

===== SECTION VIII - FIRST AID MEASURES =====

INHALATION OVEREXPOSURE: Move person to fresh air. If breathing stops, apply artificial respiration and seek immediate medical attention.

EYE CONTACT: Flush with water for at least 15 minutes. Seek medical attention.

SKIN CONTACT: Wash thoroughly with mild soap and water.

INGESTION: Do not induce vomiting. Aspiration of solvents in this product can cause inflammation of the lungs.

===== SECTION IX - PREPARATION =====

PREPARED BY: TECHNICAL DEPARTMENT

===== SECTION X - DISCLAIMER =====

To the best of our knowledge, the information contained herein is accurate, obtained from sources believed by Cloverdale Paint Inc. to be accurate. No warranty concerning the accuracy of these sources is made and Cloverdale Paint Inc. will not be held liable for claims relating to use of this information or recommendations.

SENSITIVITY TO STATIC DISCHARGE
Yes

HAZARDOUS COMBUSTION PRODUCTS:
Carbon Monoxide, Carbon Dioxide and Oxides of Nitrogen.

===== SECTION V - REACTIVITY DATA =====

CHEMICAL STABILITY: STABLE

CONDITIONS TO AVOID
Excessive heat, Poor ventilation, Corrosive atmospheres, Excessive aging.

INCOMPATIBILITY (MATERIALS TO AVOID)
Alkaline materials, strong acids and oxidizing agents.

HAZARDOUS DECOMPOSITION OR BYPRODUCTS: NONE KNOWN

HAZARDOUS POLYMERIZATION: Will not occur.

===== SECTION VI - TOXICOLOGICAL DATA =====

INHALATION HEALTH RISKS AND SYMPTOMS OF EXPOSURE
May cause respiratory irritation, dizziness, breathing difficulty, headaches and loss of co-ordination.

SKIN AND EYE CONTACT HEALTH RISKS AND SYMPTOMS OF EXPOSURE
Eye Contact: May cause severe irritation, tearing, redness and blurred vision.
Skin Contact: May cause irritation.

SKIN ABSORPTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE
May dry and defat skin causing cracks, irritation and dermatitis.

INGESTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE
May cause gastrointestinal irritation, vomiting, nausea and diarrhea.

HEALTH HAZARDS (ACUTE AND CHRONIC)
Acute health hazards are as listed above.
No chronic health hazards.

SENSITIZING CAPABILITY: NONE KNOWN

CARCINOGENICITY: NTP CARCINOGEN: No IARC MONOGRAPHS: Yes OSHA REGULATED: No
Ethylbenzene has been classified by the IARC as a Group 2B substance on the basis of sufficient evidence for carcinogenicity in laboratory animals but inadequate evidence for cancer in humans.

TERATOGENICITY AND EMBRYOTOXICITY
High exposures to xylenes in some animal studies have been reported to cause health effects on the developing embryo/fetus. These effects were often at levels toxic to the mother. The significance of these findings to humans has not been determined.

REPRODUCTIVE TOXICITY
Not available.

MUTAGENICITY
Not available.

TOXICOLOGICALLY SYNERGISTIC PRODUCTS
None known.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE
Anesthesia, respiratory tract irritation, dermatitis, nausea, vomiting.

===== SECTION VII - PREVENTIVE MEASURES =====

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Eliminate ignition sources. Provide good ventilation or wear appropriate breathing apparatus. Absorb small spills with non-flammable absorbent. Contain spills by diking with non-flammable absorbent. Notify environmental agency.

WASTE DISPOSAL METHOD
Reclaim or dispose of through a licensed waste disposal company according to Federal, Provincial and local regulations.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Flammable. Store in a cool, dry, well ventilated area away from heat and ignition sources. Keep containers closed when not in use. Avoid breathing vapours or mist and prolonged or repeated contact with skin. Launder contaminated clothing prior to re-use. Use good personal hygiene. Product is a static accumulator. Transfer equipment should be grounded or bonded.

OTHER PRECAUTIONS

Smoking in the area where this material is used must be strictly prohibited.

RESPIRATORY PROTECTION

NIOSH approved for organic vapours and particulate matter.

VENTILATION

General mechanical ventilation or local exhaust should be suitable to keep vapour concentrations below TLV. Ventilation equipment must be explosion proof. Make up air should be supplied to balance air exhausted.

PROTECTIVE GLOVES

Solvent impervious e.g. Viton, Nitrile, PVC.

EYE PROTECTION

Chemical safety glasses, goggles or face shield.

OTHER PROTECTIVE CLOTHING OR EQUIPMENT

Use impermeable aprons and protective clothing whenever possible to prevent skin contact.

WORK/HYGIENIC PRACTICES

Eye washes and safety showers in the workplace are recommended.

===== SECTION VIII - FIRST AID MEASURES =====

INHALATION OVEREXPOSURE: Move person to fresh air. If breathing stops, apply artificial respiration and seek immediate medical attention.

EYE CONTACT: Flush with water for at least 15 minutes. Seek medical attention.

SKIN CONTACT: Wash thoroughly with mild soap and water.

INGESTION: Do not induce vomiting. Aspiration of solvents in this product can cause inflammation of the lungs.

===== SECTION IX - PREPARATION =====

PREPARED BY: TECHNICAL DEPARTMENT

===== SECTION X - DISCLAIMER =====

To the best of our knowledge, the information contained herein is accurate, obtained from sources believed by Cloverdale Paint Inc. to be accurate. No warranty concerning the accuracy of these sources is made and Cloverdale Paint Inc. will not be held liable for claims relating to use of this information or recommendations.

M A T E R I A L S A F E T Y D A T A S H E E T

Prod.ID: 82069

===== SECTION I - PRODUCT IDENTIFICATION =====

PRODUCT NAME: S/P IND.EN.GLOSS BLACK

PRODUCT IDENTIFIER: 82069

HMIS CODES: H 1 F 3 R 1 P B

PRODUCT USE: General purpose coating.

PRODUCT IDENTIFICATION NUMBER: UN1263

WHMIS INFO: B2,D2B

MANUFACTURER'S NAME: Cloverdale Paint Inc

ADDRESS : 6950 King George Hwy

Surrey, BC,

EMERGENCY PHONE : 613-996-6666

REVISION DATE : 30-Mar-04

INFORMATION PHONE : 604-596-6261

ABBREVIATIONS : N/AP - NOT APPLICABLE N/AV - NOT AVAILABLE

===== SECTION II - HAZARDOUS INGREDIENTS =====

REPORTABLE COMPONENTS	CAS NUMBER	WEIGHT PERCENT	O.E.L.
*XYLENE	1330-20-	15-40	
	7		ACGIH TLV: 100 PPM LD50: ORAL:4g/kg rat, LC50: 6500 ppm/4H(RAT) LD50: SKIN:5000 mg/kg (RABBIT)
ETHYLBENZENE	100-41-	10-30	
	4		TWA: 100ppm LD50 (ORAL-RAT): 3500 mg/kg LD50: SKIN:17800 mg/kg (RABBIT)
STODDARD SOLVENT	8052-41-	5-10	
	3		ACGIH TLV: 100 ppm LD50: ORAL:>5g/kg (RAT), LC50:>5g/M3/4H (RAT)

* Indicates toxic chemical(s) subject to the reporting requirements of section 313 of Title III and of 40 CFR 372.

===== SECTION III - PHYSICAL/CHEMICAL CHARACTERISTICS =====

BOILING POINT: Not available. SPECIFIC GRAVITY (H2O=1): 0.94
VAPOR DENSITY: Heavier than air. PHYSICAL STATE: Liquid.
EVAPORATION RATE: Slower than n-Butyl Acetate.
COATING V.O.C.: 565 g/l
SOLUBILITY IN WATER: Insoluble.
APPEARANCE AND ODOR: Moderately thick liquid; Aromatic odor.
FREEZING POINT: Not available. pH: Not available.
COEFFICIENT OF WATER/OIL DIST: N/AV ODOR THRESHOLD:1-30 ppm

===== SECTION IV - FIRE AND EXPLOSION HAZARD DATA =====

FLASH POINT: 24 C METHOD USED: TCC
FLAMMABLE LIMITS IN AIR BY VOLUME- LOWER: 1.0 UPPER: 7.0

EXTINGUISHING MEDIA:
Foam,CO2,dry chemical, water fog.

SPECIAL FIREFIGHTING PROCEDURES
Respiratory equipment should be worn to avoid inhalation of concentrated vapours. Water should not be used except as a fog to keep nearby containers cool.

UNUSUAL FIRE AND EXPLOSION HAZARDS
Handle as a flammable liquid. Vapours form an explosive mixture in air between the upper and lower explosive limits, which, can be ignited by many sources such as pilot lights, open flames, electrical boxes and switches. Vapour may travel along the ground and flashback along vapour trail may occur.

FLAMMABILITY - T.D.G.R. CLASS:
TDG CLASS 3

SENSITIVITY TO IMPACT: NO

AUTO-IGNITION TEMPERATURE:

Not available

SENSITIVITY TO STATIC DISCHARGE: Yes

HAZARDOUS COMBUSTION PRODUCTS:

Carbon Monoxide, Carbon Dioxide and Oxides of Nitrogen.

===== SECTION V - REACTIVITY DATA =====

CHEMICAL STABILITY: STABLE

CONDITIONS TO AVOID:

Excessive heat, poor ventilation, corrosive atmospheres, excessive aging.

INCOMPATIBILITY (MATERIALS TO AVOID)

Alkaline materials, strong acids and oxidizing agents.

HAZARDOUS DECOMPOSITION OR BYPRODUCTS: NONE KNOWN

HAZARDOUS POLYMERIZATION:

Will not occur.

===== SECTION VI - TOXICOLOGICAL DATA =====

INHALATION HEALTH RISKS AND SYMPTOMS OF EXPOSURE

May cause respiratory irritation, dizziness, breathing difficulty, headaches and loss of co-ordination.

SKIN AND EYE CONTACT HEALTH RISKS AND SYMPTOMS OF EXPOSURE

Eye Contact: May cause severe irritation, tearing, redness and blurred vision.

Skin Contact: May cause irritation.

SKIN ABSORPTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE

May dry and defat skin causing cracks, irritation and dermatitis.

INGESTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE

May cause gastrointestinal irritation, vomiting, nausea and diarrhea.

HEALTH HAZARDS (ACUTE AND CHRONIC)

Acute health hazards are as listed above. No chronic health hazards.

SENSITIZING CAPABILITY: NONE KNOWN

CARCINOGENICITY: NTP CARCINOGEN:No IARC MONOGRAPHS:Yes OSHA REGULATED:No

Ethylbenzene has been classified by the IARC as a Group 2B substance on the basis of sufficient evidence for carcinogenicity in laboratory animals but inadequate evidence for cancer in humans.

TERATOGENICITY AND EMBRYOTOXICITY

High exposures to xylenes in some animal studies have been reported to cause health effects on the developing embryo/fetus. These effects were often at levels toxic to the mother. The significance of these findings to humans has not been determined.

REPRODUCTIVE TOXICITY

Not available.

MUTAGENICITY

Not available.

TOXICOLOGICALLY SYNERGISTIC PRODUCTS

None known.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

Anesthesia, respiratory tract irritation, dermatitis, nausea, vomiting.

===== SECTION VII - PREVENTIVE MEASURES =====

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Eliminate ignition sources. Provide good ventilation or wear appropriate breathing apparatus. Absorb small spills with non-flammable absorbent. Contain spills by diking with non-flammable

absorbent. Notify environmental agency.

WASTE DISPOSAL METHOD

Reclaim or dispose of through a licensed waste disposal company according to Federal, Provincial and local regulations.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Flammable. Store in a cool, dry, well ventilated area away from heat and ignition sources. Keep containers closed when not in use. Avoid breathing vapours or mist and prolonged or repeated contact with skin. Launder contaminated clothing prior to re-use. Use good personal hygiene. Product is a static accumulator. Transfer equipment should be grounded or bonded.

OTHER PRECAUTIONS: Smoking in the area where this material is used must be strictly prohibited.

RESPIRATORY PROTECTION

NIOSH approved for organic vapours and particulate matter.

VENTILATION

General mechanical ventilation or local exhaust should be suitable to keep vapour concentrations below TLV. Ventilation equipment must be explosion proof. Make up air should be supplied to balance air exhausted.

PROTECTIVE GLOVES

Solvent impervious e.g. Viton, Nitrile, PVC.

EYE PROTECTION

Chemical safety glasses, goggles or face shield.

OTHER PROTECTIVE CLOTHING OR EQUIPMENT

Use impermeable aprons and protective clothing whenever possible to prevent skin contact.

WORK/HYGIENIC PRACTICES

Eye washes and safety showers in the workplace are recommended.

==== SECTION VIII - FIRST AID MEASURES =====

INHALATION OVEREXPOSURE: Move person to fresh air. If breathing stops, apply artificial respiration and seek immediate medical attention.

EYE CONTACT: Flush with water for at least 15 minutes. Seek medical attention.

SKIN CONTACT: Wash thoroughly with mild soap and water.

INGESTION: Do not induce vomiting. Aspiration of solvents in this product can cause inflammation of the lungs.

==== SECTION IX - PREPARATION =====

PREPARED BY: TECHNICAL DEPARTMENT

==== SECTION X - DISCLAIMER =====

To the best of our knowledge, the information contained herein is accurate, obtained from sources believed by Cloverdale Paint Inc. to be accurate. No warranty concerning the accuracy of these sources is made and Cloverdale Paint Inc. will not be held liable for claims relating to use of this information or recommendations.

M A T E R I A L S A F E T Y D A T A S H E E T

Prod.ID: 83203

===== SECTION I - PRODUCT IDENTIFICATION =====

PRODUCT NAME: HI-HEAT ALUMINUM

PRODUCT IDENTIFIER: 83203

HMIS CODES: H 1 F 2 R 0 P H

PRODUCT USE: General purpose coating.

PRODUCT IDENTIFICATION NUMBER: UN1263

WHMIS INFO:

MANUFACTURER'S NAME: Cloverdale Paint Inc

ADDRESS : 6950 King George Hwy

Surrey, BC,

EMERGENCY PHONE : 613-996-6666

REVISION DATE : 31-Mar-04

INFORMATION PHONE : 604-596-6261

ABBREVIATIONS : N/AP - NOT APPLICABLE N/AV - NOT AVAILABLE

===== SECTION II - HAZARDOUS INGREDIENTS =====

REPORTABLE COMPONENTS	CAS NUMBER	WEIGHT PERCENT	O.E.L.
*XYLENE	1330-20-7	15-40	ACGIH TLV: 100 PPM LD50: ORAL:4g/kg rat, LC50: 6500 ppm/4H(RAT) LD50: SKIN:5000 mg/kg (RABBIT)
*TOLUENE	108-88-3	7-13	ACGIH TLV: 100 ppm LD50: >2g/kg ORAL RAT, LC50: 8000 ppm/4H(RAT)
ETHYLBENZENE	100-41-4	5-10	TWA: 100ppm LD50 (ORAL-RAT): 3500 mg/kg LD50: SKIN:17800 mg/kg(RABBIT)
*ALUMINUM POWDER	7429-90-5	5-10	TWA: 10 mg/m3
STODDARD SOLVENT	8052-41-3	1-5	ACGIH TLV: 100 ppm LD50: ORAL:>5g/kg(RAT), LC50:>5g/M3/4H(RAT)

* Indicates toxic chemical(s) subject to the reporting requirements of section 313 of Title III and of 40 CFR 372.

===== SECTION III - PHYSICAL/CHEMICAL CHARACTERISTICS =====

BOILING POINT: Not available. SPECIFIC GRAVITY (H2O=1): 1.00
 VAPOR DENSITY: Heavier than air. PHYSICAL STATE: Liquid.
 EVAPORATION RATE: Slower than n-Butyl Acetate.
 COATING V.O.C.: 634 g/l
 SOLUBILITY IN WATER: Insoluble.
 APPEARANCE AND ODOR: Moderately thick liquid; Aromatic odor.
 FREEZING POINT: Not available. pH: Not available.
 COEFFICIENT OF WATER/OIL DIST: N/AV ODOR THRESHOLD:1-30 ppm

===== SECTION IV - FIRE AND EXPLOSION HAZARD DATA =====

FLASH POINT: 6 C METHOD USED: Not available.
 FLAMMABLE LIMITS IN AIR BY VOLUME- LOWER: 1.0 UPPER: 7.1

EXTINGUISHING MEDIA:
 Foam,CO2,dry chemical, water fog.

SPECIAL FIREFIGHTING PROCEDURES
 Respiratory equipment should be worn to avoid inhalation of concentrated vapours. Water should not be used except as a fog to keep nearby containers cool.

UNUSUAL FIRE AND EXPLOSION HAZARDS
 Handle as a flammable liquid. Vapours form an explosive mixture in air between the upper and lower explosive limits, which, can be ignited by many sources such as pilot lights, open flames, electrical boxes and switches. Vapour may travel along the ground and flashback along vapour trail may occur.

FLAMMABILITY - T.D.G.R. CLASS:
 TDG CLASS 3

SENSITIVITY TO IMPACT: NO

AUTO-IGNITION TEMPERATURE:
 Not available

SENSITIVITY TO STATIC DISCHARGE: Yes

HAZARDOUS COMBUSTION PRODUCTS:
 Carbon Monoxide, Carbon Dioxide and Oxides of Nitrogen.

===== SECTION V - REACTIVITY DATA =====

CHEMICAL STABILITY: STABLE

CONDITIONS TO AVOID:

Excessive heat, poor ventilation, corrosive atmospheres, excessive aging.

INCOMPATIBILITY (MATERIALS TO AVOID)
Alkaline materials, strong acids and oxidizing agents.

HAZARDOUS DECOMPOSITION OR BYPRODUCTS: NONE KNOWN

HAZARDOUS POLYMERIZATION:
Will not occur.

===== SECTION VI - TOXICOLOGICAL DATA =====

INHALATION HEALTH RISKS AND SYMPTOMS OF EXPOSURE
May cause respiratory irritation, dizziness, breathing difficulty, headaches and loss of co-ordination.

SKIN AND EYE CONTACT HEALTH RISKS AND SYMPTOMS OF EXPOSURE
Eye Contact: May cause severe irritation, tearing, redness and blurred vision.
Skin Contact: May cause irritation.

SKIN ABSORPTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE
May dry and defat skin causing cracks, irritation and dermatitis.

INGESTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE
May cause gastrointestinal irritation, vomiting, nausea and diarrhea.

HEALTH HAZARDS (ACUTE AND CHRONIC)
Acute health hazards are as listed above. No chronic health hazards.

SENSITIZING CAPABILITY: NONE KNOWN

CARCINOGENICITY: NTP CARCINOGEN:No IARC MONOGRAPHS:Yes OSHA REGULATED:No
Ethylbenzene has been classified by the IARC as a Group 2B substance on the basis of sufficient evidence for carcinogenicity in laboratory animals but inadequate evidence for cancer in humans.

TERATOGENICITY AND EMBRYOTOXICITY
High exposures to xylenes in some animal studies have been reported to cause health effects on the developing embryo/fetus. These effects were often at levels toxic to the mother. The significance of these findings to humans has not been determined.

REPRODUCTIVE TOXICITY
Not available.

MUTAGENICITY
Not available.

TOXICOLOGICALLY SYNERGISTIC PRODUCTS
None known.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE
Anesthesia, respiratory tract irritation, dermatitis, nausea, vomiting.

===== SECTION VII - PREVENTIVE MEASURES =====

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Eliminate ignition sources. Provide good ventilation or wear appropriate breathing apparatus. Absorb small spills with non-flammable absorbent. Contain spills by diking with non-flammable absorbent. Notify environmental agency.

WASTE DISPOSAL METHOD
Reclaim or dispose of through a licensed waste disposal company according to Federal, Provincial and local regulations.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Flammable. Store in a cool, dry, well ventilated area away from heat and ignition sources. Keep containers closed when not in use. Avoid breathing vapours or mist and prolonged or repeated contact with skin. Launder contaminated clothing prior to re-use. Use good personal hygiene. Product is a static accumulator. Transfer equipment should be grounded or bonded.

OTHER PRECAUTIONS: Smoking in the area where this material is used must be strictly prohibited.

RESPIRATORY PROTECTION
NIOSH approved for organic vapours and particulate matter.

VENTILATION
General mechanical ventilation or local exhaust should be suitable to keep vapour concentrations below TLV. Ventilation equipment must be explosion proof. Make up air should be supplied to balance air exhausted.

PROTECTIVE GLOVES
Solvent impervious e.g. Viton, Nitrile, PVC.

EYE PROTECTION
Chemical safety glasses, goggles or face shield.

OTHER PROTECTIVE CLOTHING OR EQUIPMENT
Use impermeable aprons and protective clothing whenever possible to prevent skin contact.

WORK/HYGIENIC PRACTICES

Eye washes and safety showers in the workplace are recommended.

===== SECTION VIII - FIRST AID MEASURES =====

INHALATION OVEREXPOSURE: Move person to fresh air. If breathing stops, apply artificial respiration and seek immediate medical attention.

EYE CONTACT: Flush with water for at least 15 minutes. Seek medical attention.

SKIN CONTACT: Wash thoroughly with mild soap and water.

INGESTION: Do not induce vomiting. Aspiration of solvents in this product can cause inflammation of the lungs.

===== SECTION IX - PREPARATION =====

PREPARED BY: TECHNICAL DEPARTMENT

===== SECTION X - DISCLAIMER =====

To the best of our knowledge, the information contained herein is accurate, obtained from sources believed by Cloverdale Paint Inc. to be accurate. No warranty concerning the accuracy of these sources is made and Cloverdale Paint Inc. will not be held liable for claims relating to use of this information or recommendations.

M A T E R I A L S A F E T Y D A T A S H E E T

Prod.ID: T-240

PRODUCT NAME: IND. ENAMEL URETHANE/ACRYLIC - WHITE
 PRODUCT CODE: T-240
 PRODUCT USE : INDUSTRIAL COATING
 WHMIS INFO.:

HMIS CODES: H F R P
 1 2 1 H

===== SECTION I - MANUFACTURER IDENTIFICATION =====

MANUFACTURER'S NAME: TOWER PAINT DIVISION OF CLOVERDALE PAINT
 ADDRESS : 15846 - 111 AVENUE
 EDMONTON, ALBERTA, CANADA
 T5M 2R8
 EMERGENCY PHONE : (780) 451 - 3830 DATE PRINTED : 24/12/02
 INFORMATION PHONE : (780) 451 - 3830 NAME OF PREPARER : TECHNICAL DEPT.

===== SECTION II - HAZARDOUS INGREDIENTS/SARA III INFORMATION =====

REPORTABLE COMPONENTS	CAS NUMBER	VAPOR PRESSURE mm Hg @ TEMP	WEIGHT PERCENT
ALIPHATIC HYDROCARBON SOLVENT	64742-47-87	100 25	
ACGIH TLV: 100 PPM			
LD50: ORAL: >5000mg/kg (RAT), LC50: >2500 PPM/4HRS (RAT)			
* XYLENE (MIXED ISOMERS)	1330-20-7	>5 68 6	
ACGIH TLV: 100 PPM			
LD50: ORAL: 4300 mg/kg (RAT), LC50: 5000 ppm/4H (RAT)			
LD50: SKIN: 5000 mg/kg (RABBIT)			
AROMATIC HYDROCARBON SOLVENT	64742-94-50	0 0	
ACGIH TLV: 50 ppm			
LD50: ORAL: >10 ml/kg (RAT), LC50: >3800 mg/m3 /4H (RAT)			
ETHYL BENZENE (COMPONENT OF XYLENE)	100-41-4	7 20deg.C	1.04
LD50: ORAL: 3500 mg/kg (RAT)			
LD50: SKIN: 17800 mg/kg (RABBIT)			
TWA: 100ppm			
* ETHYLENE GLYCOL MONOBUTYL ETHER	111-76-2	0.6 68 deg.F	1
OSHA PEL: N/E, ACGIH TLV: 25 ppm, TWA: N/E			
LD50 ORAL: 1480 mg/kg (RAT), LC50: 450 ppm/4H (RAT)			
LD50 DERMAL : 490 mg/kg (RABBIT)			

* Indicates toxic chemical(s) subject to the reporting requirements of section 313 of Title III and of 40 CFR 372.
 N/A

===== SECTION III - PHYSICAL/CHEMICAL CHARACTERISTICS =====

BOILING RANGE: 136.2deg.C SPECIFIC GRAVITY (H2O=1): 1.12
 VAPOR DENSITY: HEAVIER THAN AIR
 EVAPORATION RATE: FASTER THAN n-BUTYL ACETATE
 COATING V.O.C. : 4.66 lb/gal
 SOLUBILITY IN WATER: INSOLUBLE
 APPEARANCE AND ODOR: LIQUID WITH SOLVENT ODOUR.
 FREEZING POINT: NOT AVAILABLE pH: N/AP
 COEFFICIENT OF WATER/OIL DIST: N/A ODOR THRESHOLD: N/A

===== SECTION IV - FIRE AND EXPLOSION HAZARD DATA =====

FLASH POINT: 24 C METHOD USED: TCC
 FLAMMABLE LIMITS IN AIR BY VOLUME- LOWER: 1 UPPER: 10.6

EXTINGUISHING MEDIA: FOAM, CO2, DRY CHEMICAL, WATER FOG

SPECIAL FIREFIGHTING PROCEDURES
 EXCLUDE AIR; DO NOT USE WATER EXCEPT AS A FOG. HANDLE AS A FLAMMABLE LIQUID. WEAR

ADEQUATE RESPIRATORY PROTECTION.

UNUSUAL FIRE AND EXPLOSION HAZARDS
 VAPOUR FORMS AN EXPLOSIVE MIXTURE BETWEEN UPPER AND LOWER FLAMMABLE LIMITS.

FLAMMABILITY - T.D.G.R. CLASS
 3 P.I.N.: 1263

SENSITIVITY TO IMPACT
 N/A

SENSITIVITY TO STATIC DISCHARGE
 YES

=====
SECTION V - REACTIVITY DATA
=====

STABILITY: STABLE
CONDITIONS TO AVOID
SPARKS, OPEN FLAMES AND OTHER SOURCES OF IGNITION.

INCOMPATIBILITY (MATERIALS TO AVOID)
STRONG OXIDIZING AGENTS.

HAZARDOUS DECOMPOSITION OR BYPRODUCTS
CARBON MONOXIDE, CARBON DIOXIDE, OXIDES OF NITROGEN, ALDEHYDES MAY BE GENERATED BY
THERMAL DECOMPOSITION.

HAZARDOUS POLYMERIZATION: WILL OCCUR

=====
SECTION VI - HEALTH HAZARD DATA
=====

INHALATION HEALTH RISKS AND SYMPTOMS OF EXPOSURE
MODERATELY IRRITATING TO RESPIRATORY PASSAGES. PROLONGED EXPOSURE TO HIGH VAPOUR
CONCENTRATIONS CAN CAUSE HEADACHES, NAUSEA, DIZZINESS, ANESTHESIA AND CENTRAL
NERVOUS SYSTEM DEPRESSION. IN RARE CASES MAY SENSITIZE HEART CAUSING ARRHYTHMIA.

SKIN AND EYE CONTACT HEALTH RISKS AND SYMPTOMS OF EXPOSURE
SKIN AND EYE IRRITATION WHICH MAY LEAD TO DERMATITIS WITH REPEATED
OVEREXPOSURES. OVEREXPOSURE MAY RESULT IN ALLERGIC SENSITIVITY.

SKIN ABSORPTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE
REPEAT OR PROLONGED CONTACT CAN CAUSE DERMATITIS.

INGESTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE
MAY CAUSE GASTROINTESTINAL IRRITATION, VOMITING, NAUSEA AND DIARRHEA.

HEALTH HAZARDS (ACUTE AND CHRONIC)
ACUTE HEALTH HAZARDS ARE AS LISTED ABOVE. NO CHRONIC HEALTH HAZARDS.

CARCINOGENICITY: NTP CARCINOGEN: No IARC MONOGRAPHS: Yes OSHA REGULATED: No
ETHYL BENZENE HAS BEEN CLASSIFIED AS A GROUP 2B SUBSTANCE ON THE BASIS OF
SUFFICIENT EVIDENCE FOR CARCINOGENICITY IN LABORATORY ANIMALS BUT INADEQUATE
EVIDENCE FOR CANCER IN HUMANS.

TERATOGENICITY
HIGH EXPOSURE TO XYLENE IN SOME ANIMAL STUDIES HAVE BEEN REPORTED TO CAUSE
HEALTH EFFECTS ON THE DEVELOPING EMBRYO/FETUS. THESE EFFECTS ARE OFTEN AT LEVELS
TOXIC TO THE MOTHER. THE SIGNIFICANCE OF THESE FINDING TO HUMANS HAS NOT BEEN
DETERMINED.

MUTAGENICITY
NOT AVAILABLE

TOXICOLOGICALLY SYNERGISTIC PRODUCTS
NOT AVAILABLE

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE
ANESTHESIA, RESPIRATORY TRACT IRRITATION, DERMATITIS, NAUSEA, VOMITING.

EMERGENCY AND FIRST AID PROCEDURES
INHALATION OVEREXPOSURE: MOVE PERSON TO FRESH AIR. IF BREATHING STOPS, APPLY
ARTIFICIAL RESPIRATION AND SEEK IMMEDIATE MEDICAL ATTENTION. EYE CONTACT: FLUSH
WITH WATER FOR AT LEAST 15 MINUTES, SEEK MEDICAL ATTENTION. SKIN CONTACT: WASH
THOROUGHLY WITH MILD SOAP AND WATER. INGESTION: DO NOT INDUCE
VOMITING, ASPIRATION OF THIS PRODUCT CAN CAUSE INFLAMMATION OF LUNGS.

=====
SECTION VII - PRECAUTIONS FOR SAFE HANDLING AND USE
=====

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
ELIMINATE IGNITION SOURCES, PROVIDE GOOD VENTILATION OR WEAR APPROPRIATE
BREATHING APPARATUS, ABSORB SMALL SPILLS WITH NON FLAMMABLE ABSORBENT, CONTAIN
SPILLS BY DIKING WITH NON-FLAMMABLE ABSORBENT. NOTIFY ENVIRONMENTAL AGENCY.

WASTE DISPOSAL METHOD
RECLAIM OR DISPOSE OF THROUGH A LICENSED WASTE DISPOSAL COMPANY ACCORDING TO
FEDERAL, PROVINCIAL AND LOCAL REGULATIONS.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
COMBUSTIBLE. STORE IN A COOL, DRY, WELL VENTILATED AREA AWAY FROM HEAT AND IGNITION
SOURCES. KEEP CONTAINERS CLOSED WHEN NOT IN USE. AVOID BREATHING VAPOURS OR MIST
AND PROLONGED OR REPEATED CONTACT WITH SKIN.

OTHER PRECAUTIONS

SMOKING IN AREA WHERE THIS MATERIAL IS USED SHOULD BE STRICTLY PROHIBITED. EMPTY CONTAINERS MAY CONTAIN HAZARDOUS RESIDUES AND CAN BE DANGEROUS. USE GOOD PERSONAL HYGIENE.

===== SECTION VIII - CONTROL MEASURES =====

RESPIRATORY PROTECTION

NIOSH APPROVED FOR SOLVENT VAPOURS AND PARTICULATE MATTER.

VENTILATION

GENERAL MECHANICAL VENTILATION OR LOCAL EXHAUST SHOULD BE SUITABLE TO KEEP VAPOUR CONCENTRATIONS BELOW TLV. VENTILATION EQUIPMENT MUST BE EXPLOSION PROOF.

PROTECTIVE GLOVES

SOLVENT IMPERVIOUS.

EYE PROTECTION

CHEMICAL SAFETY GLASSES, GOGGLES OR FACE SHIELD.

OTHER PROTECTIVE CLOTHING OR EQUIPMENT

USE IMPERMEABLE APRONS AND PROTECTIVE CLOTHING WHENEVER POSSIBLE TO PREVENT SKIN CONTACT.

WORK/HYGIENIC PRACTICES

EYE WASHES AND SAFETY SHOWERS IN THE WORKPLACE IS RECOMMENDED.

===== SECTION IX - DISCLAIMER =====

TO THE BEST OF OUR KNOWLEDGE, THE INFORMATION CONTAINED HEREIN IS ACCURATE, OBTAINED FROM SOURCES BELIEVED BY CLOVERDALE PAINT INC. TO BE ACCURATE. NO WARRANTY CONCERNING THE ACCURACY OF THESE SOURCES IS MADE AND

CLOVERDALE PAINT INC. WILL NOT BE HELD LIABLE FOR CLAIMS RELATING TO USE OF THIS INFORMATION OR RECOMMENDATIONS.

Material Safety Data Sheet

[Back](#)

Trade Name: UCARTHERM **Manufacturer:** Van Waters and Rogers
MSDS Code: **MSDS Date:** 7/13/2000 **Type of Chemical:** LIQUID

Notes:

-EMERGENCY ASSISTANCE-

FOR EMERGENCY ASSISTANCE INVOLVING CHEMICALS
CALL CHEMTREC (800) 424-9300

VW&R CODE: LA3887

Union Carbide urges each customer or recipient of this MSDS to study it carefully to become aware of and understand the hazards associated with the product. The reader should consider consulting reference works or individuals who are experts in ventilation, toxicology, and fire prevention, as necessary or appropriate to use and understand the data contained in this MSDS.

To promote safe handling, each customer or recipient should: 1) Notify its employees, agents, contractors and others whom it knows or believes will use this material of the information in this MSDS and any other information regarding hazards or safety; 2) Furnish this same information to each of its customers for the product; and 3) Request its customers to notify their employees, customers, and other users of the product of this information.

CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

1.1 IDENTIFICATION

Product Name UCARTHERM(R) PM-6195 Aqueous Dilution
Chemical Name Ethylene glycol (mixture)
Chemical Family Aqueous ethylene glycol
Common Name UCARTHERM(R) PM-6195 Aqueous Dilution
Formula Not applicable (mixture)
Synonym PM-6195

1.2 COMPANY IDENTIFICATION

Supplier: Union Carbide Canada Inc.
Suite 360
7400 Les Galeries d'Anjou Blvd.
Anjou, Quebec HIM 3M2

Manufacturer: Union Carbide Corporation
39 Old Ridgebury Road
Danbury, CT 06817-0001

Prepared By: Product Safety Department
Print Date: 2000 05 16

1.3 EMERGENCY TELEPHONE NUMBER

24 hours a day: (514) 640-6400
Number for non-emergency questions concerning MSDS: (514) 493 -2666

2. COMPOSITION INFORMATION

Component: Ethylene glycol
CAS # %: 107-21-1
W/W: >=40.
Hazard: <=70% Toxic

Component: Water and processing additives
CAS# %: Not available
W/W: >=30.
Hazard: <60% WHMIS: Not Hazardous

Component: Dipotassium hydrogen phosphate
CAS# %: 7758-11-4
W/W: >=0.5
Hazard: <=1.5% WHMIS: Not Hazardous

3. HAZARDS IDENTIFICATION

3.1 EMERGENCY OVERVIEW

Appearance: Transparent colorless

Physical State: Liquid

Odor: Mild

Hazards of product DANGER! HARMFUL OR FATAL IF SWALLOWED.

CAUSES EYE IRRITATION.
PROLONGED OR REPEATED BREATHING OF AEROSOL OR VAPOR IS HARMFUL.
MAY CAUSE KIDNEY AND NERVOUS SYSTEM DAMAGE. CONTAINS ETHYLENE GLYCOL - CAUSES BIRTH DEFECTS IN LABORATORY ANIMALS.

3.2 POTENTIAL HEALTH EFFECTS

Potential Effects of a Single Acute Exposure

Inhalation: May cause irritation of the nose and throat with headache, particularly from mist. High vapor concentrations caused, for example, by heating the material in an enclosed and poorly ventilated workplace, may produce nausea, vomiting, headache, dizziness, and irregular eye movements.

Eye Contact: Injury to the cornea is not expected. Liquid, vapor, or mist causes irritation, experienced as stinging, excess blinking and tear production, with excess redness of the conjunctiva.

Skin Contact No evidence of harmful effects from available information.

Skin Absorption information: No evidence of harmful effects from available

Swallowing: May cause abdominal discomfort or pain, nausea, vomiting, dizziness, drowsiness, malaise, blurring of vision, irritability, lumbar pain, oliguria, uremia, and central nervous system effects, including irregular eye movements, convulsions and coma. Cardiac failure and pulmonary edema may develop. Severe kidney damage follows the swallowing of large volumes of ethylene glycol. May be fatal. A few reports have been published describing the development of weakness of the facial muscles, diminished hearing, and difficulty with swallowing, during the late stages of severe poisoning.

Chronic, Prolonged or Repeated Exposure

Potential Effects of Repeated Exposure: Repeated inhalation of ethylene glycol mist may produce signs of central nervous system involvement, particularly dizziness and nystagmus.

Other Potential Effects of Exposure: Repeated skin contact with ethylene glycol may, in a very small of cases, cause sensitization with the development of allergic contact dermatitis. The incidence is significantly less than 1% with the undiluted material.

Medical Conditions Aggravated by Exposure

May aggravate an existing kidney disease

3.3 POTENTIAL ENVIRONMENTAL EFFECTS

See Section 12 for Ecological Information.

4. FIRST AID PROCEDURES

4.1 INHALATION Remove to fresh air. Obtain medical attention if symptoms persist

4.2 EYE CONTACT

Flush eyes thoroughly with water for several minutes. Remove contact lenses, if worn.

4.3 SKIN CONTACT

Remove contaminated clothing. Wash skin thoroughly with soap and water, Obtain immediate medical attention for thermal burns. Wash clothing before reuse.

4.4 SWALLOWING

If patient is fully conscious, give two glasses of water. Induce vomiting. This should be done only by medical or experienced first-aid personnel. Obtain medical attention without delay. If medical advice is delayed, and if the person has swallowed a moderate volume of material (a few ounces), then give three to four ounces of hard liquor, such as whiskey. For children, give proportionally less liquor, according to weight.

4.5 NOTES TO PHYSICIAN

It is estimated that the lethal oral dose of ethylene glycol to adults is of the order of 1.0 ml/kg. Ethylene glycol is metabolized by alcohol dehydrogenase to various metabolites including glycoaldehyde, glycolic acid, and oxalic acid, which cause an elevated anion-gap metabolic acidosis and renal tubular injury. The signs and symptoms in ethylene glycol poisoning are those of metabolic acidosis, CNS depression, and kidney injury. Urinalysis may show albuminuria, hematuria and oxaluria. Clinical chemistry may reveal anion-gap metabolic acidosis and uremia. The currently recommended medical management of ethylene glycol poisoning includes elimination of ethylene glycol and metabolites, correction of metabolic acidosis, and prevention of kidney injury.

It is essential to have immediate and follow-up urinalysis and clinical chemistry. There should be particular emphasis on acid-base balance and renal function tests. A continuous infusion of 5% sodium bicarbonate with frequent monitoring of electrolytes and fluid balance is used to achieve correction of metabolic acidosis and forced diuresis. As a competitive substrate for alcohol dehydrogenase, ethanol is antidotal. Given in the early stages of intoxication, it blocks the formation of nephrotoxic metabolites. A therapeutically effective blood concentration of ethanol is in the range 100-150 mg/dl, and should be achieved by a rapid loading dose and maintained by intravenous infusion. For severe and/or deteriorating cases, hemodialysis may be required. Dialysis should be considered for patients who are symptomatic, have severe

metabolic acidosis, a blood ethylene glycol concentrations greater than 25 mg/dl, or compromise of renal functions. 4-Methylpyrazole, a potent inhibitor of alcohol dehydrogenases, has been effectively used to decrease the metabolic consequences of ethylene glycol poisoning before metabolic acidosis, coma, seizures, and renal failure have occurred. Additional therapeutic measures may include the administration of cofactors involved in the metabolism of ethylene glycol. Thiamine (100 mg) and pyridoxine (50 mg) should be given every six hours.

Pulmonary edema with hypoxemia has been described in a number of patients following poisoning with ethylene glycol. The mechanism of production has not been elucidated, but it appears to be non-cardiogenic in

origin in several cases. Respiratory support with mechanical ventilation and positive end expiratory pressure may be required. There may be cranial nerve involvement in the late stages of toxicity from swallowed ethylene glycol. In particular, effects have been reported involving the seventh, eighth and ninth cranial nerves, presenting with bilateral facial paralysis, diminished hearing, and dysphagia.

5. FIRE FIGHTING MEASURES

5.1 FLAMMABLE PROPERTIES

Flash Point - Closed Cup: Pensky-Martens Closed Cup ASTM D 93 None.

Flash Point - Open Cup: Not currently available

Autoignition Temperature: Not currently available

Flammable Limits In Air: Lower Not determined. Upper Not determined.

5.2 EXTINGUISHING MEDIA

Non-flammable (aqueous solution): After water evaporates, remaining material will burn. Use alcohol-type or all-purpose-type foam, applied by manufacturer's recommended techniques for large fires. Use carbon dioxide or dry chemical media for small fires.

5.3 EXTINGUISHING MEDIA TO AVOID

No information currently available.

5.4 SPECIAL FIRE FIGHTING PROCEDURES

No information currently available

5.5 SPECIAL PROTECTIVE EQUIPMENT FOR FIREFIGHTERS

Use self-contained breathing apparatus and protective clothing.

5.6 UNUSUAL FIRE AND EXPLOSION HAZARDS

None known.

5.7 HAZARDOUS COMBUSTION PRODUCTS

Burning can produce the following combustion products: Carbon monoxide and/or carbon dioxide. Carbon monoxide is highly toxic if inhaled; carbon dioxide in sufficient concentrations can act as an asphyxiant.

6. ACCIDENTAL RELEASE MEASURES

Steps to be taken if Material is Released or Spilled:

Large spills should be contained and collected. Small spills can be collected or may be absorbed with appropriate liquid absorbing material. All spill response and disposal should be carried out in accordance with federal, provincial, and local regulations.

Personal Precautions: Wear suitable protective equipment. See Section

8.2 - Personal Protection.

7. HANDLING AND STORAGE

7.1 HANDLING

General Handling Do not swallow.
Avoid contact with eyes.
Avoid prolonged or repeated breathing of aerosol and vapor.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.

FOR INDUSTRY USE ONLY

Ventilation

General (mechanical) room ventilation may be adequate, if handled at ambient temperatures or in covered equipment. If ambient temperatures are exceeded or operations exist which may produce misting, local exhaust ventilation or other engineering controls may be required.

Other Precautions

The maximum recommended skin temperature on the heat transfer fluid side of a heat exchanger is 160°C. If the fluid is exposed to excessively high temperatures, thermal degradation can occur, organic acids and other irritating fumes could result. Respiratory protection, such as an air-supplied mask, may be needed until the fumes can be removed. UCARTHERM(R) PM-6195 is not suitable for use in any system where contamination of drinking water supply is possible.

7.2 STORAGE

No information currently available

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1 EXPOSURE LIMITS

Component: Ethylene glycol
Exposure Limits: 100 mg/m³ CEILING ACGIH
100 mg/m³ CEILING UCC
39.4 ppm CEILING UCC

Skin Form: Aerosol
Aerosol and Vapor
Aerosol and Vapor

Consult local authorities for recommended exposure limits

In the Exposure Limits Chart above, if there is no specific qualifier (i.e., Aerosol) listed in the Form Column for a particular limit, the listed limit includes all airborne forms of the substance that can be inhaled.

A "Yes" in the Skin Column indicates a potential significant contribution to overall exposure by the cutaneous (skin) route, including mucous membranes and the eyes, either by contact with vapors or by direct skin contact with the substance. A "Blank" in the Skin Column indicates that exposure by the cutaneous (skin) route is not potential significant contributor to overall exposure.

8.2 PERSONAL PROTECTION

Respiratory Protection

If personnel exposure exceeds exposure limits 39.4 ppm (100 mg/m³) (aerosol and vapor combined) at any time, select respiratory protection equipment. NIOSH-approved atmosphere-supplying respirator or a NIOSH-approved air-purifying respirator with organic vapor cartridge and dust/mist pre-filter is recommended.

Ventilation:

General (mechanical) room ventilation may be adequate, if handled at ambient temperatures or in covered

equipment. If ambient temperatures are exceeded or operations exist which may produce misting, local exhaust ventilation or other engineering controls may be required.

Eye Protection: Monagoggles or faceshield

Protective Gloves:

Natural Rubber

Neoprene Nitrile (NBR)

PVC-coated

Butyl

Other Protective Equipment: Eye Bath, Safety Shower

8.3 ENGINEERING CONTROLS

PROCESS HAZARD: Sudden release of hot organic chemical vapors or mists from process equipment operating at elevated temperature and pressure, or sudden ingress of air into vacuum equipment, may result in ignitions without the presence of obvious ignition sources. Published "autoignition" or "ignition" temperature values cannot be treated as safe operating temperatures in chemical processes without analysis of the actual process conditions. Any use of this product in elevated-temperature processes should be thoroughly evaluated to establish and maintain safe operating conditions. Further information is available in a technical bulletin entitled "Ignition Hazards of Organic Chemical Vapors."

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Liquid

Appearance: Transparent colorless

pH: Not currently available

Solubility in Water (by weight): 100 %

Odor: Mild

Percent Volatiles : - 97

Boiling Point 760 mmHg): 104 - 115/C 219.2 - 239 /F

Freezing Point: -260 - -25/C -43 6 - - 13

Specific Gravity (H2O = 1): ~ 1.064 - 1.10 20/C / 20/C

Vapor Pressure at 20C: 20C 10-15 mmHg 1. 3 - 1. 9 kPa

Vapor Density (air = 1): 1.2 - 9.9

Evaporation Rate (Butyl Acetate = 1):

0.7 - 0.8

Melting Point: Not applicable

10. STABILITY AND REACTIVITY

10.1 STABILITY/INSTABILITY Stable

Incompatible Materials: Explosive decomposition may occur if combined with strong acids or strong bases and subjected to elevated temperatures. Therefore, avoid strong acids and strong bases at elevated temperatures.

Avoid contamination with strong oxidizing agents and materials reactive with hydroxyl compounds.

10.2 HAZARDOUS POLYMERIZATION Will Not Occur

10.3 INHIBITORS/STABILIZERS

11. TOXICOLOGICAL INFORMATION

PEROPAL

Toxicology for the Component

Ethylene glycol

Rat LD50 4700 mg/kg

PERCUTANEOUS Toxicology for the Component

Ethylene glycol

Rabbit LD50 9530 =ul/kg

Incompatible Materials: Explosive decomposition may occur if combined with strong acids or strong bases and subjected to elevated temperatures. Therefore, avoid strong acids and strong bases at elevated temperatures. Avoid contamination with strong oxidizing agents and materials reactive with hydroxyl compounds.

Ethylene glycol has been shown to produce dose-related teratogenic effects in rats and mice when given by gavage or in drinking water at high concentrations or doses. The no-effect doses for developmental toxicity for ethylene glycol given by gavage over the period of organogenesis has been shown to be 150 mg/kg/day for the mouse and 500 mg/kg/day for the rat. Also, in a preliminary study to assess the effects of exposure of pregnant rats and mice to aerosols at concentrations of 150, 1000 and 2500 mg/m³ for 6 hours a day throughout the period of organogenesis, teratogenic effects were produced at the highest concentration, but only in mice. The conditions of these latter experiments did not allow a conclusion as to whether the developmental toxicity was mediated by inhalation of aerosol, percutaneous absorption of ethylene glycol from contaminated skin, or swallowing of ethylene glycol as a result of grooming the wetted coat. In a further study, comparing effects from high aerosol concentration by whole-body or nose-only exposure, it was shown that nose-only exposure resulted in maternal toxicity (1000 and 2500 mg/m³) and developmental toxicity with minimal evidence of teratogenicity (2500 mg/m³). The no-effects concentration (based on maternal toxicity) was 500 mg/m³. In a further study in mice, no teratogenic effects could be produced when ethylene glycol was applied to skin of pregnant mice over the period of organogenesis. The above observations suggest that ethylene glycol is to be regarded as an animal teratogen. There is currently no available information to suggest that ethylene glycol has caused birth defects in humans. Cutaneous application of ethylene glycol is ineffective in producing developmental toxicity. Exposure to high aerosol concentrations is only minimally effective in producing developmental toxicity. The major route for producing developmental toxicity is perorally. Two chronic feeding studies, using rats and mice, have not produced any evidence that ethylene glycol causes dose-related increases in tumor incidence, or a different pattern of tumors compared with untreated, controls. The absence of a carcinogenic potential for ethylene glycol has been supported by numerous in vitro genotoxicity studies showing that it does not produce mutagenic or clastogenic effects.

12. ECOLOGICAL INFORMATION

12.1 ENVIRONMENTAL FATE

Partial information may be available, call Union Carbide.

12.2 ECOTOXICITY

Partial information may be available, call Union Carbide.

12.3 FURTHER INFORMATION

None

13. DISPOSAL CONSIDERATIONS

13.1 WASTE DISPOSAL METHOD

Ethylene glycol from many applications is readily reclaimed; reclamation of ethylene glycol from spent fluids is encouraged where possible. At low concentrations in water this product is biodegradable in a biological wastewater treatment plant. Where ethylene glycol reclamation or sewerage are not viable, this product may be incinerated where permitted under appropriate federal, provincial, and local regulations. Dispose in accordance with all applicable federal, provincial, and local environmental regulations. Empty containers should be recycled or disposed of through an approved waste management facility.

13.2 DISPOSAL CONSIDERATIONS

Section 13.1

Disposal methods identified are for the product as sold. For proper disposal of used material, an assessment must be completed to determine the proper and permissible waste management options permissible under applicable rules, regulations and/or laws governing your location.

14. TRANSPORT INFORMATION

14.1 TDG - CANADA

SMALL CONTAINER

Proper Shipping Name: NOT REGULATED

LARGE CONTAINER

Proper Shipping Name: NOT REGULATED

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. REGULATORY INFORMATION

FEDERAL/PROVINCIAL

WHMIS CLASSIFICATION

D2A Very Toxic Materials Causing Other Effects

D2B Toxic Materials Causing Other Effects

ACCELERATED REDUCTION/ELIMINATION OF TOXICS

None of the components of this product are listed on the Accelerated Reduction/Elimination of Toxics (ARET) lists A-1, B-2, or B-3.

CEPA - NATIONAL POLLUTANTS RELEASE INVENTORY

At least one component of this product is on the National Pollutant Release Inventory (NPRI) at a concentration equal to or greater than 1%:

Component: Ethylene glycol

CAS #: 107-21-1

Amount
<= 70.0000 %

CEPA - TOXIC SUBSTANCES

None of the components of this product are on the CEPA lists of toxic substances (Schedule 1, Schedule 3-1, or Schedule 3-2).

CPR COMPLIANCE

This product has been classified with the hazard criteria of the CPR, and the MSDS contains all the information required by CPR.

TOXIC SUBSTANCES CONTROL ACT (TSCA)

All components of this product are on the TSCA Inventory or are exempt from TSCA Inventory requirements.

EUROPEAN INVENTORY OF EXISTING COMMERCIAL CHEMICAL SUBSTANCES (EINECS):

The components of this product are on the EINECS inventory.

CEPA - DOMESTIC SUBSTANCES LIST (DSL)

The components of this product are on the DSL

VOC : Vapor pressure 12.223 mmHg at 20 /C
29.28 g/l VOC

This section provides selected regulatory information on this product including its components. This is not intended to include all regulations. It is the responsibility of the user to know and comply with all applicable rules, regulations and laws relating to the product being used.

OTHER INFORMATION

16.1 AVAILABLE LITERATURE AND BROCHURES

ADDITIONAL INFORMATION: Additional product safety information on this product may be obtained by calling your Union Carbide Sales or Customer Service contact. Ask for the brochure:

16.2 SPECIFIC HAZARD RATING SYSTEM

HMIS ratings for this product are:

H - 1
F - 0
S - 0

NFPA ratings for this product are:

H - 1
F - 0
S - 0

These ratings are part of specific hazard communications program(s) and should be disregarded where individuals are not trained in the use of these hazard rating systems. You should be familiar with the hazard communication applicable to your workplace.

16.3 RECOMMENDED USES AND RESTRICTIONS

Heat transfer fluid

FOR INDUSTRY USE ONLY

16.4 REVISION

Version: 1.

Revision: 1999.09.15

Most recent revisions are noted by the bold, double bars in left-hand margin throughout this document.

16.5 LEGEND

TS Trade Secret

N/A Not available

W/W Weight/Weight

The opinions expressed herein are those of qualified experts within Union Carbide. We believe that the information contained herein is current as of the date of this material Safety Data Sheet. Since the use of this information and the conditions of the use of the product are not under the control of Union Carbide, it is the user's obligation to determine conditions of safe use of the product.

MATERIAL SAFETY DATA SHEET

Product Name: UCARTHERM(R) PM-6195 Aqueous Dilution

Effective Date: 1999.09.15

MSDS#: 26705

Page 13 of 13

UNION CARBIDE CANADA INC. MATERIAL SAFETY DATA SHEET

Product Name: UCARTHERM(R) PM-6195 Aqueous Dilution

Effective Date: 1999.09.15

MSDS#: 26705 Page

1 of 13

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Part B – Field Commissioning Documents

Unit # _____ Model: _____
 Customer: _____ Site Name: _____
 LSD: _____
 Office Contact: _____ Phone: _____ e-mail: _____
 Field Contact: _____ Phone: _____ e-mail: _____
 Start-up Date: _____ Branch Service Order: _____

COMMISSIONING (to be completed by the start-up technician)

Date Start-up _____ Notification received from: _____
 Notification received: _____
 Date Operating Manual received: _____ Customer on-site representative: _____
 Reviewed Compressor Performance:

 Spare fluids needed? Yes No
 Reviewed GA and Service Flows:

 Spare parts needed? Yes No
 Reviewed Scope Summary:

 Special tools needed? Yes No
 Reviewed P&ID:

 Fuel Gas Analysis current? Yes No

Quality Assessment #1:	Yes	No
Were the Unit Manuals delivered with adequate time before start-up?	<input type="checkbox"/>	<input type="checkbox"/>
Were the drawings in the Unit Manual and/or Commissioning Binder accurate?	<input type="checkbox"/>	<input type="checkbox"/>
Was the compressor performance runs accurate and adequate for the current conditions?	<input type="checkbox"/>	<input type="checkbox"/>
Was there any information missing from the manual? (Please note below)	<input type="checkbox"/>	<input type="checkbox"/>
As the start-up technician, did the project information by Enerflex adequately prepare you?	<input type="checkbox"/>	<input type="checkbox"/>
Was support available from EFX Compression when needed?	<input type="checkbox"/>	<input type="checkbox"/>
Quality Score - please rate from 0 (inadequate preparation) to 10 (fully prepared)		

Notes: (Please explain all NO answers)

SITE PREPARATIONS:

Did the customer adequately complete the following:

Foundation (check for structural integrity, correct alignment of anchor bolts or piles, check for gaps between pile caps and skid)

Pre-grout Alignment (was the skid properly leveled before securing to piles or grouted into foundation?)

Were the ship-loose items properly stored?

Was the process pipe work properly connected?

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

- Was the service piping (start gas, fuel gas) correct for the application?
- Was all service piping cleaned prior to being put into service?
- Was the instrument air/gas properly supplied to the panel?
- Was the electrical power supply adequate for the application (correct amperage, wire size, distance from UPS to panel)?
- Was the site prepared for the unit commissioning?
- Were all safety concerns addressed before commencement of work?

Yes	No

Notes:

PRE-START COMMISSIONING: (note that pre-commissioning activities are to be commenced only after proper lock-out procedures and unit depressurization is ensured)

P&ID Review:

- identify components and red-line any discrepancies
- Confirm "Witch's Hat" screens and orifice plates match locations and size on P&ID
- Confirm flow arrows on check valves and mufflers are correct
- Ensure PSV settings are correct and match P&ID's/MAWP of cylinder
- Ensure PI's and TI's match P&ID and are the correct range.

Identify all tagged components; ensure components are corrected and tags removed

Remove all shipping covers and plugs from vents

Review all ship-loose items; ensure components match ship-loose Bill of Material;

Review OEM Start-up Checklists;

Unit survey for completeness; note deficiencies on FCD-50647 Field Deficiency List

Ensure site has adequate engine/compressor lubrication and glycol

Confirm proper balance line and vent line connections to JW/Aux surge tanks

Ensure proper alignment and tightness of wing skid fasteners

- **Cold Alignment: (note that OEM alignment procedures are to be followed. Please review Ariel ER-10.4.0 for Ariel start-up procedures and alignment documentation. The PAMCO Start-up Compressor Report and Clearance Record may also be used as well as PAM-005A Engine Alignment Report)**

If required, check tightness of skid hold-down bolts (to foundation)

Loosen, shim and readjust all process pipe clamps;

Tighten all bottle supports

Install coupling (if necessary);

Check torque on coupling bolts

Yes	No	N/A

- Check and adjust pull-downs on compressor
- Check cylinder supports and cross-head supports
- Check engine pull-downs
- Adjust engine crankcase centre preload (Waukesha VHP only)
- Proceed with Rim and Face cold alignment; record readings on OEM documentation
- Check engine and compressor crankshaft end plays

Yes	No	N/A

➤ **Package Checks:**

- Check tightness of process flanges (mark tightened flanges with an X)
- Check tightness of gas fittings, plugs and unions
- Check tightness on all fuel gas and start gas connections
- Check orifice size in fuel gas regulator

Yes	No	N/A

- Clean inside of cooler of road debris
- Check fan tip clearance
- Check fan pitch to match Cooler Data Sheet
- Loosen and re-torque fan blades; tighten hub bolts and set screws
- Check pillow block bearings; tighten bolts, locks set-screws and grease bearings
- Check and adjust belt tensioning
- Complete cooler drive/jackshaft alignment. Install, level and verify sheave alignment
- Torque jackshaft bearing set-screws
- Check louver operation from fully open to fully closed
- Place reflective tape on fan shaft to measure fan speed when running
- Measure sheaves to ensure they match Service Flows;

- Ensure Inside/outside air diverter box working with no obstructions
- Check tightness on instrumentation connections, fittings and thermowells

- Install all engine sample ports
- Check engine air filters
- Confirm proper engine oil and glycol levels
- Check oil fill lines from day tanks to engine oil level controllers. Bleed air out from day tanks to controllers
- Blow out starter gas line; clean strainer if necessary
- Blow out fuel gas line;
- Check fuel gas filter for cleanliness and proper installation

- Check lubrication and grease in prelube motors, transfer pumps and starter
- Check compressor lubricator system primed to all points

Check oil fill lines from day tanks to compressor oil level controllers
 Ensure level settings of oil level controllers
 Remove compressor valves and yokes; re-install to proper compressor curve

Yes	No	N/A

Ensure proper 24VDC power supply to panel and engine controls
 Adjust instrument gas regulator; verify pressure setting with P&ID
 Review Panel Shutdown Key; confirm proper values for equipment
 Check program for proper tooth count on flywheel
 Ensure end devices calibrated
 Remove functioning of scrubber level switches; roll test and verify continuity change of state; Verify float extensions of level switches;
 Stroke Suction Valve; ensure controller properly set
 Stroke Bypass valve; ensure controller properly set
 Activate all dump valves
 Check proper action of Louver controls

Install the catalyst elements

(Note that it is Enerflex's policy to ensure that all emissions equipment is operating at the time of commissioning. Activation/installation of emissions equipment is **not** to be left to the 500 hour service unless specified by the customer.)

Notes:

Quality Assessment #2:	Yes	No
Was the unit free of noticeable defects?		
Were the ship-loose items and packing slips present and accurate?		
Was the equipment alignment as delivered acceptable?		
Were the flanges, fittings and unions tight and secure?		
Were all fill and sample points correct?		
Were start-up screens properly fitted and in the right locations?		
Was the shutdown key accurate?		
Quality Score - please rate from 0 (significant defects) to 10 (defect-free)		

Notes: (Please explain all NO answers)

UNIT COMMISSIONING:

	Yes	No	N/A
Confirm Fluid levels			
Engine Crankcase			
Compressor Crankcase			
Oil day tanks			
Surge tanks			
Lubricator system (if separate)			
Bar unit over – ensure freedom of rotation			
Introduce Start Gas; check pressure and inspect for leaks			
Introduce Fuel Gas; check pressure and inspect for leaks			
Test Starter cranking and oil pressure build-up			
Introduce process gas; pressurize process and check for leaks			
Purge compressor			

Start Unit; bring to Low idle;			
Confirm lubricator rate is set for break in (as per Ariel Lube Sheet)			
Check packing vent leakage			

Bring Unit to load			
Check operation of suction and bypass controllers			
Check auto-louver controls			
Set vibration switches (engine, compressor, cooler)			
Confirm proper process temperatures, pressures and shutdowns			
Take fan shaft speed readings Fan rpm: _____ @ Engine rpm: _____			

Complete engine OEM start-up checks including hot alignment			
Complete compressor OEM start-up checks			
Review all engine controls for proper tuning			
Activate and program air-fuel controls			

(Note that it is Enerflex's policy to ensure that all emissions equipment is operating at the time of commissioning. Activation/installation of emissions equipment is **not** to be left to the 500 hour service unless specified by the customer.)

Final inspection of unit for leaks, vibration, defects			
--	--	--	--

Notes:

Quality Assessment #3:	Yes	No
Was the unit free of noticeable defects when started?		
Did all instrumentation appear calibrated when checked?		
Did all scrubber dumps and level switches work properly?		
Were the start gas and fuel gas systems properly assembled and leak free?		
Was the process connections properly assembled and leak free?		
Did the unit start and load properly?		
Did the suction and bypass operate properly?		
Was there any identifiable vibration concerns?		
Did the unit meet the compressor performance requirements (flows)?		
Quality Score - please rate from 0 (significant defects) to 10 (defect-free)		
Customer Satisfaction: (to be filled out by the Commissioning Technician in conjunction with the customer)	Yes	No
Was the customer satisfied with the state of the equipment when it first arrived?		
Was the customer satisfied with the documentation, manuals and drawings?		
Was the customer satisfied with the coordination of the commissioning?		
Did the customer express concerns over any defects found?		
Was the duration of the commissioning acceptable to the customer?		
Did the customer feel satisfied with the performance of the commissioning branch?		
Did the customer feel satisfied with any training or hand-on orientation with the package?		
Was the customer satisfied with the overall package performance?		
Quality Score - please rate from 0 (extremely dissatisfied) to 10 (extremely satisfied)		

Notes: (Please explain all NO answers)

Signature of commissioning Technician

Date

Phone: _____

e-mail: _____

Please complete FCD-50647 Field Deficiency List

Overall Quality Assessment: _____ (out of a maximum of 40 points)

Field Commissioning Equipment and Deficiency List

General Information	
Job#/Unit#:	Date (M/D/Y):
	PAMCO-Jiro mechanic : Syntech Technician:

Item #	Deficiency Description (Include pictures when applicable)	Suggested Corrective Action	Action to be taken by	Severity 1, 3 or 5	Initials	Date Complete (M/D/Y)
1						
2						
3						
4						
5						
6						
7						
			Total Severity Rating			
			Overall Package Rating (100-Severity Rating)			

Field Commissioning Equipment and Deficiency List

Item #	Customer Feedback and Preference (not deficiencies)	Suggested Corrective Action	Action to be taken by	Severity 1, 3 or 5	Initials	Date Complete (M/D/Y)
8						
9						
10						
11						
Item #	Positive Feedback		Acknowledgment	Severity 1, 3 or 5	Initials	Date Complete (M/D/Y)
14						
15						
16						
17						
By:				Date (M/D/Y):		

Field Commissioning Equipment and Deficiency List
P&ID Deficiency List**Severity Rating**

The severity rating is an indication of the magnitude of each of the defects found. Each defect is scored with the following Severity from one of the three severity levels. The Total Severity Rating is the sum of all defects found.

Severity 1: Minor – This is a defect that does not affect package performance but does not comply with Enerflex QC or packaging standards. Examples would include:

- crooked/bend tubing;
- grating not cut properly;
- missing TI's or PI's
- pipe clamps not tightened;

Severity 3: Significant – This is a defect that may affect unit performance, could result in a component failure and/or will create future problems if not corrected. Examples would include:

- Incorrect venting on process valve
- Improper service piping (aux water, J/W, fuel gas, start gas, prelube)
- incorrectly wired instrumentation
- incorrect ranged transmitters
- Improperly sized bypass valves, fuel gas regulators

Severity 5: Major – This is a defect of extensive magnitude that could compromise the safety of personnel or result in damage to the package if not corrected immediately. Examples would include:

- Improper vent connections (sour)
- Incorrect packing vent and drain installation
- Improper power supply wiring or grounding
- Loose fittings or connections on pressure vessels;

Overall Package Quality Rating

The Overall Package Quality Rating is a score based on the total of all severity ratings on the package. Each package has an initial assessment of 100, and each Severity score is subtracted from this number (100 – Total Severity Rating).

For example, if all defects on a package sum to 20 (Total Severity Rating), then the Overall Package Quality Rating would be 80%.

START UP CHECK LIST - RG ROTARY COMPRESSORS



Compressor Model RG _____ Serial/No. R- _____ Gear Ratio _____
 Control Actuation - Hydraulic _____ Handwheel _____
 Driver Manufacturer _____ Model _____ Rated Speed _____ RPM
 Packager _____ Packager Unit No. _____
 Date Packager Shipped _____ Serviceman _____
 Customer _____ Start Up Date _____
 Location _____ Field Contact _____
 Field Telephone No. _____ Unit Location _____
 Gas Service _____
 Compressor Oil - Make/Grade _____

YES NO

Check List - Prior To Starting:

1. Are the correct Ariel parts book, technical manual, special tools, and spares available? _____
2. Have the design limitations for the compressor model such as maximum suction & discharge pressures, maximum and minimum speed, discharge temperature been checked? _____
3. Have the Packager's design operating conditions been reviewed?
 Pressure, psig (bar_g): Suction _____ Discharge _____
 Temperature, °F (°C): Suction _____ Discharge _____
 Maximum RPM _____ Minimum RPM _____
 Type of Gas _____ SG _____
 If start-up conditions are different check with Packager or Ariel.
4. Soft Foot Check [max. allowable 0.002" (0.05 mm)]: Have the compressor feet supports been shimmed so the machine is not twisted or bent? _____
5. Have compressor anchor and/or bell-housing flange bolts been re-torqued? _____
6. Have the piping and supports been checked to be sure they do not bend or stress compressor? _____

4	Page 4, 40 was min. now max.; 1 & 2, deleted phrases, old 7. deleted; page 5, new 20 added, renumbered as required.	4	013793	8-22-06			
		3	013576	4-6-06			
		2	013527	3-15-06			
		1	013029	3-3-06			
		0	010774	8-14-02			
REV	DESCRIPTION	REV	EC	DATE	REV	EC	DATE

START UP CHECK LIST - RG ROTARY COMPRESSORS



Compressor Model RG _____ Serial/No. R- _____

- | | YES | NO |
|--|-------|-------|
| 7. Have coupling bolt torque values been rechecked? | _____ | _____ |
| 8. Has the compressor to driver alignment been field checked?
See compressor outline drawing for shaft thermal growth value. | _____ | _____ |
| 9. Record coupling dial indicator field verification readings in inches (mm) at the 3, 6, 9 and 12 o'clock positions on lines provided: (not applicable to bell-house mountings) | | |



Maximum allowable face misalignment 0.005 in. (0.13 mm) TIR
Maximum allowable radial misalignment 0.003 in. (0.08 mm) TIR

- | | | |
|--|-------|-------|
| 10. Does the compressor input shaft turn freely? | _____ | _____ |
| 11. Have coupling elements been installed and has coupling been inspected for proper assembly, including axial engagement? | _____ | _____ |
| 12. Has any preservation oil been drained from rotor housing? | _____ | _____ |
| 13. Have oil & gas systems been pressurized & leak tested? | _____ | _____ |
| 14. Has proper oil been installed that matches operating conditions, with a viscosity adequate for current gas analysis? | _____ | _____ |
| 15. Has oil supplier provided gas dilution versus pure oil viscosity information? | _____ | _____ |
| 16. Has the compressor oil system been filled with oil to the proper level without over filling? | _____ | _____ |
| 17. Is the compressor oil supply isolation valve open? | _____ | _____ |

NOTE: CLEARLY LABEL UNIT WITH THE COMPRESSOR OIL MAKE/GRADE CURRENTLY IN USE.

- | | | |
|--|-------|-------|
| 18. Does the compressor oil system low level shutdown work? | _____ | _____ |
| 19. Have the properly rated elements been installed in the gas inlet separator, oil filters and strainers, and gas/oil separator? | _____ | _____ |
| 20. Are the oil filter elements and all oil piping primed with oil? | _____ | _____ |
| 21. Is the low oil differential pressure shutdown installed & tubed correctly to the bearing oil supply and scavenged oil gallery? | _____ | _____ |
| 22. Is the low oil differential pressure shutdown set per Ariel's recommendations & does it work on falling pressure? | _____ | _____ |

START UP CHECK LIST - RG ROTARY COMPRESSORS



Compressor Model RG _____ Serial/No. R- _____

	YES	NO
23. Is there an oil cooler? Note: Recommended minimum compressor inlet oil temperature is 150°F (66°C); maximum 170°F (77°C).	_____	_____
24. Is the rotor injection's oil temperature control (trim) valve setting appropriate for cold start-up applications?	_____	_____
25. Is the oil temperature control valve piped for a "mixing" condition?	_____	_____
26. If so equipped, is there a working vibration shutdown mounted on the compressor or drive train?	_____	_____
27. Is there suction pressure control upstream of the compressor? Refer to Ariel's performance prediction program to verify acceptable P ₁ , P ₂ combination.	_____	_____
28. Are the suction and discharge pressure shutdowns set & working?	_____	_____
29. Are the safety relief valves installed & working to protect compressor gas and oil piping?	_____	_____
30. Is the gas high discharge temperature shutdown installed, set at 10% above anticipated temperature & working? 248°F, max. (120°C)	_____	_____
31. Is the mechanical seal leakage tubing installed, unplugged and visible to determine if leakage occurs?	_____	_____
32. Have the gas suction lines been thoroughly cleaned to be sure that no dirt, slag or other debris enters the compressor?	_____	_____
33. Has strainer screen been installed upstream of compressor suction?	_____	_____
34. Have the oil system components been primed and the compressor prelubed prior to starting?	_____	_____
35. Does the driver rotation match the compressor rotation arrow?	_____	_____
36. For engine driven units, has the machine been rolled to make sure it is free?	_____	_____
37. For other drivers, has the machine been barred over by hand to be sure it is rolling free?	_____	_____
38. For combustible gas applications, has the piping and compressor been purged to remove all air?	_____	_____
39. Have start-up instructions for other package equipment been followed?	_____	_____

START UP CHECK LIST - RG ROTARY COMPRESSORS



Compressor Model RG _____ Serial/No. R- _____

	YES	NO
40. Has compressor variable Vi been moved to the maximum Vi position, 5.0? (Vi range 2.5 to 5.0)	_____	_____
41. Has compressor capacity control plate been moved to minimum load position, to reduce compressor start-up torque?	_____	_____
42. Have minimum compressor oil pressure alarm and shutdown settings been tested?	_____	_____
43. Has the Packager's representative reviewed the Packager's Start-Up & Operating Instructions for the unit with the unit operator?	_____	_____
44. Has the separator scavenge line been connected to the gearbox and is the scavenge control valve fully open?	_____	_____

Check List - After Starting:

1. When idle speed is achieved, did the compressor bearing oil pressure come up immediately after loading the compressor?	_____	_____
2. Did the discharge pressure raise immediately to facilitate oil scavenging and lube flow?	_____	_____
3. Was required differential pressure in the separator, above suction achieved immediately & maintainable until normal operating pressures are reached?	_____	_____
4. Are the oil filters, bearing & oil system, & hydraulic-valve-stack pressure gauges working?	_____	_____
5. Are the oil filter differential pressures less than 35 psid (2.4 bar _d) at operating temperature, unless otherwise specified?	_____	_____
6. Did the compressor develop discharge pressure when capacity control plate moved to loaded position?	_____	_____
7. Any strange noises or shaking in the compressor or piping?	_____	_____
8. Is the compressor system oil level within acceptable limits?	_____	_____
9. Is bearing oil differential pressure above minimum specified?	_____	_____
10. Is the high discharge temperature shutdown working?	_____	_____
11. Is the high discharge gas temperature shutdown set at approx. 10% above normal discharge temperature? 248°F (120°C) maximum.	_____	_____
12. Is the mechanical seal weep hole leaking? Drops/minute _____	_____	_____
13. Are there any other oil leaks? If so, where?	_____	_____

START UP CHECK LIST - RG ROTARY COMPRESSORS



Compressor Model RG _____ Serial/No. R- _____

	YES	NO
14. Are the scrubber dumps and high level shutdowns working?	_____	_____
15. Are the scrubber dumps removing all liquids from the gas without obvious carryover?	_____	_____
16. Do you hear solid contaminants in the suction piping?	_____	_____
17. Is overspeed shutdown set?	_____	_____
18. Is the mechanical seal properly sealing gas and oil at the shaft?	_____	_____
19. Have all Package safety functions been tested to be sure of unit shutdown upon malfunction?	_____	_____
20. After compressor and driver are warmed up, was Vi and capacity control set to load available driver horsepower?	_____	_____
21. After the compressor reaches normal operating conditions, has the separator scavenge control been set to show mostly gas flow at the sight glass?	_____	_____
22. After running compressor for 24 hours, are oil filter and separator differential pressures less than maximum allowable?	_____	_____
23. Upon shutdown verify that compressor reverse rotation is less than 2 seconds to be sure of check valve operation.	_____	_____
24. Has initial compressor operating data been recorded?	_____	_____
25. Complete Ariel's "Compressor Warranty Notification and Installation List Data", copy this completed "Start-up Checklist" and mail both to Ariel Corporation, 35 Blackjack Road, Mount Vernon, OH 43050, USA, Attention: Administrative Assistant - Sales or fax to Ariel at 740-397-3856, Attention: Administrative Assistant - Sales.		

START UP CHECK LIST - RG ROTARY COMPRESSORS



DAILY LOG SHEET

COMPANY/LOCATION _____ UNIT _____
 COMPRESSOR MODEL RG _____ SERIAL No. R- _____ GEAR RATIO _____

Date/Time							
Operator							
Driver Load, HP (kW)							
Driver Speed, RPM							
Compressor Speed, RPM							
Gas flow Rate MMSCFD (m ³ /s _n)							
Variable Vi Position (Vi or # of turns)							
Capacity Control Position (% or # of turns)							
Suction Pressure, psig (bar _g)							
Suction Temperature, °F (°C)							
Discharge Pressure, psig (bar _g)							
Discharge Temperature, °F (°C)							
Compr. Bearing Oil Supply Temp., °F (°C)							
Bearing Oil Differential Pressure, psid (bar _d)							
Bearing Oil Filter Differential, psid (bar _d)							
Rotor Injection Oil Filter Differential, psid (bar _d)							
Hydraulic Oil Supply Pressure, psig (bar _g)							
Separator Coalescing Filter Differential, psid (bar _d)							
Compressor Oil Supply Pressure, psig (bar _g)							
Coalescing Scavenged Oil Line Valve Adjusted & Flow Observed							
Mechanical Seal Weep Rate, drops/min.							
System Oil Level							
Compressor Oil added, gal (L)							

Remarks:

START UP CHECK LIST - RECIPROCATING COMPRESSORS



Compressor Model _____ Serial/No. F- _____
 Cylinder S/N C- _____ C- _____ C- _____ C- _____ C- _____ C- _____
 Driver _____ Rated Speed _____
 Packager _____ Packager Unit No. _____
 Date Packager Shipped _____ Start Up Date _____
 Serviceman _____ Customer _____
 Location _____ Field Contact _____
 Field Telephone No. _____ Unit Location _____
 Frame Oil - Make/Grade _____
 Cylinder Oil - Make/Grade _____

YES NO

Check List - Prior To Starting:

1. Are the correct Ariel parts book, technical manual, special tools, and spares available? _____
2. Have the design limitations for the compressor model such as rod load, maximum and minimum speed, discharge temperature been checked? _____
3. Have the design operating conditions been determined?
 Pressure, psig (bar_g): Suction _____ Discharge _____
 Temperature, °F (°C): Suction _____ Discharge _____
 Maximum RPM _____ Minimum RPM _____
4. Soft Foot Check: Have the compressor feet and crosshead guide supports been shimmed so the machine is not twisted or bent? More than 0.002 inches (0.05 mm) pull-down requires correction. Record compressor feet pull-down readings:
 Drive-End _____

8	Add new footnote #1 to remove piston end clearances check on mechanically complete compressors.	7	12515	11-22-04			
		6	011766	2-6-04			
		5	8236	---			
		4	6887	---			
REV	DESCRIPTION	3	6633	---	8	012216	7-12-06
		REV	EC	DATE	REV	EC	DATE

START UP CHECK LIST - RECIPROCATING COMPRESSORS



Compressor Model _____ Serial/No. F- _____

YES NO

5. Have crosshead feeler gage clearances been checked with cylinders mounted? Top is checked by inserting 0.5 inch (12.7 mm) wide feelers from one side edge across to the opposite side, at both ends. See Technical Manual, Section 1, Clearances for limits. Bottom is checked with a 0.0015 inches (0.038 mm) feeler at the (4) corners. Feeler insertion is 0.50 inches (13 mm) maximum at each corner. Record feeler values below:

Throw Number	Record Crosshead to Guide Feeler Gage Clearances		
	Top minimum	Top maximum	Bottom max. Corner Insertion
1	_____	_____	_____
2	_____	_____	_____
3	_____	_____	_____
4	_____	_____	_____
5	_____	_____	_____
6	_____	_____	_____

6. Have the piping and supports been checked to be sure they do not bend or stress compressor? _____

7. Has the compressor to driver alignment been checked at site? Maximum allowable 0.005 inches (0.13 mm) TIR. _____

8. Have coupling dial indicator readings been taken? Record in inches (mm) at the 3, 6, 9 and 12 o'clock positions on lines provided below: _____



9. Has the compressor crankshaft thrust clearance been checked? See Technical Manual, Section 1, Clearances. _____

Record compressor crankshaft thrust clearance here: _____ inches (mm)

10. Have piston end clearances been checked with feeler gages¹? See Technical Manual, Section 1, Clearances. Record below: _____

Throw No.	1	2	3	4	5	6
Head End	_____	_____	_____	_____	_____	_____
Crank End	_____	_____	_____	_____	_____	_____

START UP CHECK LIST - RECIPROCATING COMPRESSORS



Compressor Model _____ Serial/No. F- _____

					YES	NO
11. Has piston rod runout been checked? See Technical Manual, Section 5 for maximum acceptable readings. Record Below:					_____	_____
Throw No.	1	2	3	4	5	6
	Vertical:					
Piston @ CE	_____	_____	_____	_____	_____	_____
Mid-Stroke	_____	_____	_____	_____	_____	_____
Piston @ HE	_____	_____	_____	_____	_____	_____
	Horizontal:					
Piston @ CE	_____	_____	_____	_____	_____	_____
Mid-Stroke	_____	_____	_____	_____	_____	_____
Piston @ HE	_____	_____	_____	_____	_____	_____
12. Has the compressor crankcase been filled with oil to the proper level? Approximately 7/8 full in site glass, prior to starting.					_____	_____
13. Has proper oil been installed if extreme ambient conditions exist or special gases are compressed?					_____	_____
14. Is the compressor crankcase oil level control working and set at the proper level and properly vented?					_____	_____
15. Is the crankcase oil supply isolation valve open?					_____	_____
16. Does the crankcase low level shutdown work?					_____	_____
17. Has the recommended oil filter element been installed?					_____	_____
18. Are the oil filter element and all lube oil piping primed with oil?					_____	_____
19. Is the low oil pressure shutdown installed and tubed correctly to the downstream side of the oil filter?					_____	_____
20. Does the low oil pressure shutdown work?					_____	_____
21. Oil cooler? Compressor inlet oil temp. is 190°F (88°C) maximum.					_____	_____
22. Is the crankcase oil temperature shutdown installed, set and working?					_____	_____
23. If oil is cooled, is there a temperature control valve?					_____	_____
24. Is the crankcase breather element clean?					_____	_____
25. Is the force feed lubricator box filled with oil?					_____	_____
26. Is the force feed lubrication system primed?					_____	_____
27. Is the force feed lubrication system no flow shutdown installed and working?					_____	_____

START UP CHECK LIST - RECIPROCATING COMPRESSORS



Compressor Model _____ Serial/No. F- _____

	YES	NO
28. Is the force feed blow out assembly installed? Check rupture disc for color? See Lubrication section of the Technical Manual for disc color vs. rating table.	_____	_____
29. Has the lubricator instruction plate or "Parts Book" Cylinder Lubrication Sheet been checked for proper lube feed rate?	_____	_____
30. Is there a working vibration shutdown mounted on the compressor and adjusted properly?	_____	_____
31. Are the primary and secondary packing-case, and the cross-head-distance-piece vents and drains open, and when necessary, tubed off of the skid or out of the building?	_____	_____
32. Is there some method of suction pressure control?	_____	_____
33. Are the suction pressure, inter-stage pressure and discharge pressure shutdowns set and working?	_____	_____
34. Are the safety relief valves installed and working to protect cylinders and piping for each stage of compression?	_____	_____
35. Are the gas discharge temperature shutdowns installed, set and working?	_____	_____
36. Have the gas suction lines been blown out to remove water, slag, dirt, etc.?	_____	_____
37. Have temporary screens been installed at cylinder suction?	_____	_____
38. Has compressor been prelubed prior to starting? If motor driven, unattended or large frame models prelube at 10 psig (0.7 bar _g) & 30 seconds minimum?	_____	_____
39. For engine driven units, has the machine been rolled with the starter to make sure it is free? The oil pressure should come up noticeably while rolling on the starter.	_____	_____
40. For other drivers, has the machine been barred over by hand to ensure it is rolling free?	_____	_____
41. Does the driver rotation match the compressor rotation arrow?	_____	_____
42. Have torque values been checked on all critical fasteners where loosening could result in a safety hazard or equipment failure, and including: gas nozzle flange, valve cap, cylinder head, compressor rod packing, hold down, crosshead guide support and coupling bolting?	_____	_____
43. For machines compressing a combustible gas, have the piping and compressor been purged to remove all air?	_____	_____

START UP CHECK LIST - RECIPROCATING COMPRESSORS



Compressor Model _____ Serial/No. F- _____

	YES	NO
44. Have start-up instructions for other package equipment been followed?	_____	_____
45. Is the compressor skid properly grounded to a suitable earth ground?	_____	_____
46. Has the Packager's representative done the required review of the Packager's Start-Up and Operating Instructions for the unit with the unit operator?	_____	_____

Check List - After Starting:

1. Did the oil pressure come up immediately?	_____	_____
2. Are the oil filter pressure gauges working?	_____	_____
3. Is oil filter differential pressure less than filter change value? Reference value listed on filter information plate on compressor top cover.	_____	_____
4. Any strange noises or shaking in the compressor or piping?	_____	_____
5. Is low oil pressure shutdown set at 35 psig (2.4 bar _g)?	_____	_____
6. Is oil pressure set at 50 to 60 psig (3.5 to 4.2 bar) at operating speed and temperature? Reference Technical Manual, Section 4.	_____	_____
7. Are the high discharge gas temperature shutdowns set at approx. 10% above normal discharge temperature? To 350°F (177°C) maximum.	_____	_____
8. Is the distribution block indicator working and lubricator set for proper break-in flow rate?	_____	_____
9. Are there any oil leaks? If so, where?	_____	_____
10. Are the scrubber dumps and high level shutdowns working?	_____	_____
11. Are the scrubbers removing all liquids from the gas? How often do they dump? (_____ minutes)	_____	_____
12. Are there sands or oxides in the gas?	_____	_____
13. Is the overspeed shutdown set?	_____	_____
14. Are rod packings sealing properly?	_____	_____
15. Have all safety functions been tested to ensure shutdown of unit upon malfunction?	_____	_____

START UP CHECK LIST - RECIPROCATING COMPRESSORS



Compressor Model _____ Serial/No. F- _____

YES NO

16. Have coupling dial indicator readings been taken after reaching normal operating temperatures and components become heat soaked? Shutdown, vent gas system² and record dial indicator readings, in the hot condition within 30 minutes, in inches (mm) at the 3, 6, 9 and 12 o'clock positions on lines provided below:



17. If discharge bottle or head end cylinder supports are used, have they been adjusted when components are heat soaked to ensure there are no excessive forces that would cause detrimental cylinder deflection?

18. Has fastener torque on gas nozzle flange, valve cap, cylinder head and compressor rod packing flange bolting been re-checked² when components are heat soaked?

19. Complete Ariel's "Compressor Warranty Notification and Installation List Data", copy this completed "Start-up Checklist" and mail both to Ariel Corporation, 35 Blackjack Road, Mount Vernon, OH 43050, USA, Attention: Administrative Assistant - Sales or fax to Ariel at 740-397-3856, Attention: Administrative Assistant - Sales.

Footnotes

1. Piston end clearances need not be checked on cylinders where the compressor was tested mechanically complete at the Ariel factory (compressor has an inspection tag) and the crosshead-balance nuts have not been loosened since shipment from Ariel.

2. CAUTION!

BE SURE THAT THE COMPRESSOR IS COMPLETELY VENTED TO RELIEVE ALL GAS PRESSURE, AND THE DRIVER WILL NOT EXERT TORQUE ON THE COMPRESSOR CRANKSHAFT THAT COULD RESULT IN INJURY, PRIOR TO TAKING COUPLING READINGS, RE-CHECKING BOLTING TORQUES ON PRESSURE CONTAINING COMPONENTS OR REMOVING ACCESS COVERS FOR PERFORMING INTERNAL INSPECTION OR MAINTENANCE ON THE COMPRESSOR. IN THE CASE OF A DIRECT DRIVE MOTOR, THE BREAKER IS LOCKED OUT. FAILURE TO FOLLOW THESE STEPS CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH.

Waukesha Engine Engine Start Up Report FOR VSG, VGF, VHP Engine Models Only

Not all fields are required for all engine models or installations

Print this page and use it to assist you in obtaining the information needed to fill out the Start-up Report.
This is NOT a data entry page.

SITE INFORMATION

Site Name: _____
 Site Address 1 _____
 Site Address 2 _____
 Site City _____
 Site State _____
 Site Postal Code _____
 Site Country _____
 Site Contact _____
 Site Contact Email _____
 Site Contact Phone _____

OWNER INFORMATION

Owner Name _____
 Owner Address 1 _____
 Owner Address 2 _____
 Owner City _____
 Owner State _____
 Owner Postal Code _____
 Owner Country _____
 Owner Contact _____
 Owner Contact Email _____
 Owner Contact Phone _____

BRANCH INFORMATION

Branch Name _____
 Branch City _____
 Branch State _____
 Branch Country _____

FABRICATOR

Fabricator Name _____
 Fabricator City _____
 Fabricator State _____
 Fabricator Country _____
 Fabricator Rep _____

Engine Information

Engine Serial Number: _____
 Engine Spec: _____
 Engine Family & Model (Select Family AND Model):

- New Engine
- Certified Major Overhaul

VHP

- | | | | | |
|---------------------------------------|---------------------------------------|---------------------------------------|--|---------------------------------------|
| <input type="checkbox"/> VHP-5794LTD | <input type="checkbox"/> VHP-F2895GL | <input type="checkbox"/> VHP-F2895GSI | <input type="checkbox"/> VHP-F3514GSIE | <input type="checkbox"/> VHP-F3521G |
| <input type="checkbox"/> VHP-F3521GL | <input type="checkbox"/> VHP-F3521GSI | <input type="checkbox"/> VHP-F3524GSI | <input type="checkbox"/> VHP-F3524GSIE | <input type="checkbox"/> VHP-L5774LT |
| <input type="checkbox"/> VHP-L5774LTE | <input type="checkbox"/> VHP-L5790G | <input type="checkbox"/> VHP-L5790GL | <input type="checkbox"/> VHP-L5790GSI | <input type="checkbox"/> VHP-L5794GSI |

- VHP-L5794GSIE VHP-L5794LT VHP-L5794LTDE VHP-L5794LTE VHP-L5796LTS
- VHP-L7042G VHP-L7042GL VHP-L7042GLE VHP-L7042GSI VHP-L7042GSIE
- VHP-L7044GSI VHP-L7044GSIE VHP-P9390G VHP-P9390GL VHP-P9390GSI

VGF

- VGF-F18G VGF-F18GL / HCR VGF-F18GL / LCR VGF-F18GLD VGF-F18GLD/2
- VGF-F18GSI VGF-F18GSID VGF-H24G VGF-H24GL / HCR VGF-H24GL / LCR
- VGF-H24GLD VGF-H24GLD/2 VGF-H24GSI VGF-H24GSID VGF-L36GL
- VGF-L36GL / LCR VGF-L36GL-LCR VGF-L36GLD VGF-L36GLD/2 VGF-L36GSI
- VGF-L36GSID VGF-P48GL VGF-P48GLD VGF-P48GLD/2 VGF-P48GSI
- VGF-P48GSID VGF18GL VGF18GLD VGF18GSID VGF24GL

VSG

- VSG-F11G VSG-F11GSI VSG-F11GSID

SAA: _____

Shipped Date: _____

Startup Date: _____

Compression Ratio: _____ :1

Select English (SAE) _____ or Metric _____ measurement input

Please Note: Δ P = Pressure Differential

Application:

- Chiller
- Gas Production - Processing - Transmission - Storage - etc.
- Other Compressor - Shredder - Blower - etc.
- Power Generation
- Pump - Municipal - Oil Field - etc.

Duty Cycle:

- Continuous
- Intermittent
- Peak Shave
- Standby
- Emergency

Installation: _____

Driven Equipment:

Name: _____

Model: _____

**Lubrication, Cooling & Fuel
Lubrication Information**

Oil Brand: _____

Viscosity: _____

Oil Change Hours: _____

Oil Filter Brand: _____

Advised customer of WED's recommendations: YES ___ NO ___

Cooling Information

Cooling System:

- Heat Exchanger
- Radiator
- Remote
- Water Connect

Cooling Type:

- Alternate Fuels
- Elevated
- Ebullient
- Standard
- Solid Water

Water Hardness: _____

Treatment Used: _____

Maintained By: _____

Primary Fuel Information

Fuel Type:

- Gasoline
- Landfill Gas
- Liquefied Propane Gas (LPG)
- Commercial Quality Natural Gas
- Sewage/Digester Gas
- Field Gas
- Gasoline Vapor
- Propane Vapor
- Coal Gas
- Process Gas
- HD-5 Propane
- Dual Fuel
- Diesel
- Natural Gas (Other)

WKI™ Number: _____

BTU Content (LHV): _____

Filtration Type: _____

% of H₂S: _____

ug/l of Cl: _____

Secondary Fuel Information

Fuel Type:

- Gasoline
- Landfill Gas
- Liquefied Propane Gas (LPG)
- Commercial Quality Natural Gas
- Sewage/Digester Gas

- Field Gas
- Gasoline Vapor
- Propane Vapor
- Coal Gas
- Process Gas
- HD-5 Propane
- Dual Fuel
- Diesel
- Natural Gas (Other)

WKI™ Number: _____

BTU Content (LHV): _____

Filtration Type: _____

% of H₂S: _____

ug/l of Cl: _____

Measurements & Adjustments

Final Crankcase Deflection - Prestart (in. or mm)

Orientation: With the front of the engine to your left.
Position 1 is the top left, Pos. 2 is top center, Pos. 3 is top right,
Pos. 4 is bottom left, Pos. 5 is bottom center, Pos. 6 is bottom right.

- 1 _____
- 2 _____
- 3 _____
- 4 _____
- 5 _____
- 6 _____

HOT ALIGNMENT

Angular (in. or mm)

Reading 1 is at the 12 o'clock position, continue clockwise,
reading 2 is at 3 o'clock, reading 3 is 6 o'clock, reading 4 is 9 o'clock.

- 1 _____
- 2 _____
- 3 _____
- 4 _____

Parallel (in. or mm)

Reading 1 is at the 12 o'clock position, continue clockwise,
reading 2 is at 3 o'clock, reading 3 is 6 o'clock, reading 4 is 9 o'clock.

- 1 _____
- 2 _____
- 3 _____
- 4 _____

Crankshaft End Play: _____

Distance from center of shaft to the angular dial indicator: _____

VALVE ADJUSTMENT

Intake Valve (in. or mm): _____

Exhaust Valve (in. or mm): _____

Hydraulic Valve Turns: _____

Engine Function Tests

No Load Operation Function Test

Engine Run

Time: _____
 Idle Speed (RPM): _____
 Hi Idle Speed (RPM): _____
 Gov. Speed (RPM): _____
 Ignition Timing @ Gov.RPM °BTDC: LB (Inline) _____ RB: _____
 Intake Manifold Vacuum @ Idle (in. Hg): LB (Inline) _____ RB: _____
 Gas Over Air Ratio (in. H₂O): LB (Inline) _____ RB: _____

Safety Trip Points

High Water: (°F or °C) _____
 Low Oil: (PSI or Kpa) _____
 O.S. Gov. (RPM): _____
 Intake Manifold: (°F or °C) _____
 Fuel ShutOff: (PSI or Kpa) _____
 Rocker Arms Oiling Checked: YES NO
 Turbocharger Oiling Checked: YES NO

Loaded Operation Function Test
Engine Run

Hours: _____
 Engine Speed (RPM): _____
 Water Out Temp: (°F or °C) _____
 Oil Temp: (°F or °C) _____
 Oil Press: (PSI or Kpa) _____
 Crankcase Pressure: (PSI or Kpa) _____
 Exhaust Back Pressure: (PSI or Kpa) _____
 Load: (bhp) _____
 Ignition Timing @ GOV. RPM °BTDC LB (Inline) _____ RB _____
 Intake Manifold Vacuum/Pressure (in. Hg or mm Hg): LB (Inline) _____ RB _____
 Exhaust Temperature (°F or °C): LB (Inline) _____ RB _____
 Fuel Pressure at Regulator Inlet (PSI or Kpa): LB (Inline) _____ RB _____
 Gas Over Air Ratio (in. H₂O or mm H₂O): LB (Inline) _____ RB _____

Checkoffs

Remarks: (Note any oil or water leaks and any discrepancies which should be corrected. Explain any support systems such as fuel, cooling, air induction, exhaust or general installation features which may be detrimental to engine performance or service life.)

Discussed Warranty: Yes ____ NO ____
 Discussed Spare Parts Stock: Yes ____ NO ____
 Advised Customer Where to Obtain Parts and Service: Yes ____ NO ____
 Supplied Operation and Service Manual: Yes ____ NO ____
 Discussed Operation and Maintenance with Customer/Operator: Yes ____ NO ____
 Customer Representative: _____
 Fabricator's Representative: _____
 Serviceperson's Name: _____
 Certified Serviceperson: _____

"GL" Systems Natural Gas Only
 For In-Line Engines use only the Left Bank entry position.
 Fuel System Adjustments at Idle - No Load

O₂ Sensor Serial Number: _____
 Gas Supply Pressure to Engine Mounted Regulator (PSI or Kpa): _____

Fuel Only Regulator Pressure Differential (in. Hg Δ P) or (mm Hg Δ P):
 Prechamber Manifold _____ Intake Manifold _____ Record Difference
 Gas Over Air Ratio @ Idle No Load (in. H₂O Δ P) or (mm H₂O Δ P):
 LB (Inline) _____ RB _____

Fuel System Adjustments at 100 BMEP (10" Hg Gauge Manifold Pressure)

Exhaust Gas O₂% Before the Turbocharger (%O₂): LB _____ RB _____

Fuel System Adjustments at Full (Rated) Load

Exhaust Gas O₂% Before the Turbocharger (%O₂): LB _____ RB _____

Gas Over Air Ratio @ Full Load (in. H₂O Δ P) or (mm H₂O Δ P): LB _____ RB _____

Intake Manifold Pressure - Gauge (in. of Hg) or (mm of Hg): _____

"GL" Systems Dual Fuel & Low BTU Fuel Only
 For In-Line Engines use only the Left Bank entry position.

Fuel System Adjustments at Idle - No Load

O₂ Sensor Serial Number: _____

Gas Supply Pressure to Engine Mounted Regulator (PSI) (Kpa): _____

Fuel Only Regulator Pressure Differential (in. Hg Δ P) or (mm Hg Δ P):
 Prechamber Manifold _____ Intake Manifold _____ Record Difference

Gas Over Air Ratio @ Idle No Load: LB _____ RB _____

Lower BTU Fuel (in. of H₂O) or (cm of H₂O): LB _____ RB _____

Higher BTU Fuel (in. of H₂O) or (cm of H₂O): LB _____ RB _____

Fuel System Adjustment at 50 BMEP (0" Hg Gauge Manifold Pressure)

Exhaust Gas O₂% Before the Turbocharger (%O₂)

Lower BTU Fuel: LB _____ RB _____

Higher BTU Fuel: LB _____ RB _____

Fuel System Adjustment at 100 BMEP (10" Hg Gauge Manifold Pressure)

Exhaust Gas O₂% Before the Turbocharger (%O₂)

Lower BTU Fuel: LB _____ RB _____

Higher BTU Fuel: LB _____ RB _____

Fuel System Adjustments at Full (Rated) Load

Exhaust Gas O₂% Before the Turbocharger (%O₂)

Lower BTU Fuel: LB _____ RB _____

Higher BTU Fuel: LB _____ RB _____

Gas Over Air Ratio @ Full Load (in. H₂O Δ P) or (mm H₂O Δ P)

Lower BTU Fuel: LB _____ RB _____

Higher BTU Fuel: LB _____ RB _____

Intake Manifold Pressure - Gauge (in. Hg) or (mm Hg)

Lower BTU Fuel: LB _____ RB _____

Higher BTU Fuel: LB _____ RB _____

Questions/problems/concerns can be addressed M-F 7:30 AM - 4:30 PM CST:
 Parts and Parts Orders (262-549-2834), WEDlink accounts and Logon IDs (1-877-WED-LINK)
 OR Contact Us via [Email](#) Call the Help Desk Direct at 1-262-547-7369
 OR Toll Free at 1-877-WED-LINK (1-877-933-5465)
 M-F 6:30 AM - 3:00 PM CST or contact us via [Email](#)
 Current WED Date/Time: 05/16/2007 05:29 PM CST

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Engine Delivery Service Record

REGISTRO DE ENTREGA DEL MOTOR
RAPPORT DE LIVRAISON MOTEUR
MOTOR-AUSLIEFERUNGSBERICHT

Check if information has been entered into the CAT Product Information System.

Indique si se incluyó la información en el Sistema de Información de los Productos Cat.

Indiquer si ces renseignements sont rentrés dans le Système d'Information des Produits Caterpillar

Angaben sind im CAT Produkt-Information-System aufgeführt.

DLR. CODE <i>Código del Distribuidor</i> <i>Code du conc.</i> <i>Händler-Kode</i>	MODEL <i>Modelo,</i> <i>Modèle</i> <i>Modell</i>	ENGINE SERIAL NO. <i>No. de serie del motor</i> <i>No. de série du moteur,</i> <i>Motor-Seriennr.</i>	HR/MI/KM <i>Horas/Millas/KM</i> <i>Heures/Milles/KM</i> <i>Betriebsstunden/Meilen/KM</i>	DELIVERY DATE <i>Fecha de entrega</i> <i>Date de livraison,</i> <i>Lieferdatum</i>		
OEM MANUFACTURER'S EQUIPMENT IDENT. <i>Identificación del equipo del dist.</i> <i>Identification de L'équipement OEM</i> <i>Fremdhersteller-Gerätebezeichnung</i>		NAME <i>Nombre</i> <i>Nom</i> <i>Name</i>	TYPE MACHINE <i>Tipo de máquina</i> <i>Type de machine</i> <i>Maschinentyp</i>	SERIAL NO. <i>No. de serie</i> <i>No. de série</i> <i>Seriennr.</i>	MODEL <i>Modelo,</i> <i>Modèle,</i> <i>Modell</i>	ARRANGEMENT NO. <i>No. de conjunto</i> <i>No. de version</i> <i>Ausführungsnr.</i>

DELIVERED BY

Entregado por
Livré par
Geliefert durch

1. CATERPILLAR DEALER
Distribuidor Caterpillar, Concessionnaire CAT, Caterpillar-Händler

2. OEM DEALER
Conc., Conc. OEM., Fremdhersteller-Händler

ENGINE APPLICATION (Complete only one box below)

USO DEL MOTOR (Marque debajo un espacio solamente)
APPLICATION DU MOTEUR (A compléter seulement la partie ci-dessous)
MOTOREINSATZ (nur einen ankreuzen)

MARINE <i>Marinas, Marine, Schiffsmotoren</i>	INDUSTRIAL <i>Aplicaciones industriales, Industrie, Industriemotoren</i>	ON/OFF HIGHWAY VEHICLE <i>Aplicaciones para toda clase de vehículos, Vehicule, Strassen- und Geländefahrzeug</i>	GENERATOR SET <i>Grupos electrógenos, Groupe electrogene, Stromaggregat</i>
<input type="checkbox"/> A. MARINE & SELF PROPELLED DREDGE <i>Marina y dragas autopropulsadas</i> <i>Marine ou drague automotrice</i> <i>Schiffs- und selbstfahrende Bagger</i>	<input type="checkbox"/> C. POWERING AGRICULTURAL VEHICLE <i>Para propulsión de vehículos agrícolas</i> <i>Propulsion de véhicules de chantier</i> <i>Antrieb für Landwirtschafts-Fahrzeug</i>	<input type="checkbox"/> E. POWERING ON-HIGHWAY VEHICLE <i>Para propulsión de vehículos de carretera</i> <i>Propulsion de véhicules routiers</i> <i>Antrieb für Strassenfahrzeug</i>	<input type="checkbox"/> L. PRIME <i>Principal</i> <i>Service permanent</i> <i>Hauptstromversorgung</i>
<input type="checkbox"/> B. DREDGE <i>Dragas</i> <i>Drague</i> <i>Bagger</i>	<input type="checkbox"/> D. AGRICULTURAL - OTHER <i>Agricultura - otras</i> <i>Autres applications agricoles</i> <i>Andere landwirtschaftliche Geräte</i>	<input type="checkbox"/> J. POWER OFF-HIGHWAY TRUCK <i>Para propulsión de vehículos de toda clase de terreno</i> <i>Propulsion de véhicules de chantier</i> <i>Antrieb für Geländefahrzeug</i>	<input type="checkbox"/> M. STAND-BY <i>Auxiliar</i> <i>Service auxiliaire</i> <i>Notstromversorgung</i>
	<input type="checkbox"/> F. PETROLEUM DRILL RIG <i>Petróleo - perforación</i> <i>Industrie pétrolière - forage</i> <i>Erdölbohrturn</i>		OTHER (DRILL, COMPRESSOR, ROAD MCHY, CRANE, ETC) <i>Otras aplicaciones (compresor de barrenas, maquinaria vial y grúas)</i> <i>Autres applications</i> <i>Andere Einsätze (Bohrgeräte, Kompressor, Strassenbaufahrzeuge, Krane, usw.)</i>
	<input type="checkbox"/> G. PETROLEUM - OTHER <i>Petróleo - otras</i> <i>Industrie pétrolière - autres</i> <i>Erdölindustrie - songstiges</i>		K. (specify) <i>(Especificar)</i> <i>(Préciser)</i> <i>(Bezeichnung)</i> _____
	<input type="checkbox"/> H. LOCOMOTIVE <i>Locomotoras</i> <i>Locomotive</i> <i>Lokomotive</i>		

SERVICE AT DELIVERY

Durante la entrega

A la livraison:

Kundendienst bei Auslieferung

1. Check if proper literature included.
Se verificó que el material impreso correspondiente venia incluido.
La littérature technique appropriée a-t-elle été fournie?
Zugehörige Anleitungen sind enthalten.
2. Check fluid levels in all compartments.
Se verificó el nivel de fluidos en todos los compartimentos.
Vérifier les niveaux de liquide de tous les circuits.
Flüssigkeitsstand in allen Gehäusen prüfen.
3. Review safe start, stop and operating procedures with user.
Se verificaron con el usuario los procedimientos de arranque, parada y funcionamiento.
Revoir avec le client les instructions exactes pour le démarrage, l'arrêt et le fonctionnement.
Sichere Start-, Abstell- und Bedienungsmethoden mit dem Kunden besprechen.
4. Review maintenance service and adjustments with user.
Se verificó con el usuario el servicio de conservación y ajustes.
Revoir avec le client les réglages et l'entretien.
Wartungsdienst und Einstellungen mit dem Kunden besprechen.

This engine inspected and started. Este motor se inspeccionó y se hizo arrancar. Ce moteur a été vérifié et mis en marche.
Dieser Motor wurde überprüft und angelassen.

CUSTOMER OR USER <i>Usuario o prop.</i> <i>Client ou utilisateur</i> <i>Kunde</i>	NAME <i>Nombre, Nom, Name</i>	MAILING ADDRESS <i>Dirección comercial, Adresse postale, Adresse</i>		
	USER'S SIGNATURE <i>Nombre del dist., Kundenunterschrift</i> <i>Signature du client,</i>	CITY <i>Ciudad, Ville, Stadt</i>	STATE <i>Estado o Provincia, Département</i>	
		COUNTRY <i>Pais, Pays, Land</i>	POSTAL CODE <i>Código Postal, No. Postal, Postleitzahl</i>	
DELIVERING DEALER <i>Entregado por</i> <i>Livré par</i> <i>Geliefert durch (Händler)</i>	DEALER'S NAME <i>Nombre del dist., Nom du conc., Händlername</i>	CITY <i>Ciudad, Ville, Stadt</i>	STATE <i>Estado o Provincia, Dépt.</i>	
	DEALER REP. SIGNATURE <i>Signature du représentant du conc., Unterschrift des Handlervertreters</i>	COUNTRY <i>Pais, Pays, Land</i>	POSTAL CODE <i>Código Postal, No. Postal, Postleitzahl</i>	
	ENGINE LOCATION <i>Lieu de travail du moteur, Motor-Standort</i> <i>Lugar de trabajo del motor,</i>	OEM DEALER <i>Conc. OEM, Conc. OEM, Fremdhersteller-Händler</i>		

Do not send Factory Copy if entered into the CAT Product Information System.

No envíe copia de fábrica se la información está en el Sistema de Información de los Productos CAT.

Ne pas envoyer Copie Usine si les renseignements sont rentrés dans le Système d'Information des Produits Caterpillar.

Werkskopie nicht einsenden, falls im CAT Produkt-Information-System aufgeführt.

Caterpillar G3500 Industrial Engine Commissioning Report

General:

Selling Dealer _____ District or Subsidiary _____

Servicing Dealer _____

Equipment Suppliers and Contractors: _____

Customer _____

Address _____

Application: Prime Power _____ Continuous _____ @ _____ load
Peak Shaving _____ Standby _____

Consist:

Engine Model _____ Engine Arrangement No. _____

OT Specification No. _____ Serial No. _____

Rating _____ bhp _____ kW _____

Engine Cooling System: Separate Circuit _____ Combined Circuit _____

Governor: 3161 _____ 2301/EG3P _____ 2301A Load Share/EG3P _____

701/EG3P _____ Suction Pressure Controller _____ Discharge Pressure

Controller _____ Other (specify) _____

High Idle: Specified _____ OT Specification _____

Low Idle: Specified _____ % Droop Specified _____

Fuel Used: Pipeline Natural Gas _____ Field Gas _____ Landfill Gas _____

Digester Gas _____ Propane (HD-5) _____ Other (Specify) _____

Fuel Lower Heat Value _____ Btu/scf mJ/m³) Methane number _____

Specific Gravity _____ Wobbe Index _____

Minimum Fuel Pressure _____ kPa (psi) Fuel Filtration _____

Filter Efficiency _____

Engine Coolant: Antifreeze _____ % Corrosion Inhibitor _____ Heat Recovery _____

Separate Circuit Coolant: Antifreeze _____ % Corrosion Inhibitor _____

Oil to be used in engine _____

Engine site conditions: Elevation _____

Typical Ambient Temperature range for the year: _____ to _____

Atmospheric conditions: Typical relative humidity level _____ %

Air Quality: Salty _____ Dusty _____ Clean _____

Application Summary

The following parties have discussed and agreed to the results and required action during the commissioning process.

Field Engineer Signature _____ Date _____
Builder/Installer Signature _____ Date _____
Owner Signature _____ Date _____

DRESSER-RAND

Gas Field Compressors

D-R Reference Number

Warranty Initiation Form

Packager: _____ Customer: _____

Customer Contact: _____ Phone Number: _____

Unit Location: _____

Dresser-Rand Contact: _____

Driver Type/Mfg: _____ Model: _____ Rated HP: _____ Rated RPM: _____

Compressor Model: _____ S/N: _____ D-R Order Number: C- _____ - _____

Operating Conditions:

Cylinder #1
Bore Size: _____
S/N: _____
Suction Pressure: _____ psig
Suction Temperature: _____ °
Discharge Pressure: _____ psig
Discharge Temperature: _____ °

Cylinder #4
Bore Size: _____
S/N: _____
Suction Pressure: _____ psig
Suction Temperature: _____ °
Discharge Pressure: _____ psig
Discharge Temperature: _____ °

Cylinder #2
Bore Size: _____
S/N: _____
Suction Pressure: _____ psig
Suction Temperature: _____ °
Discharge Pressure: _____ psig
Discharge Temperature: _____ °

Cylinder #5
Bore Size: _____
S/N: _____
Suction Pressure: _____ psig
Suction Temperature: _____ °
Discharge Pressure: _____ psig
Discharge Temperature: _____ °

Cylinder #3
Bore Size: _____
S/N: _____
Suction Pressure: _____ psig
Suction Temperature: _____ °
Discharge Pressure: _____ psig
Discharge Temperature: _____ °

Cylinder #5
Bore Size: _____
S/N: _____
Suction Pressure: _____ psig
Suction Temperature: _____ °
Discharge Pressure: _____ psig
Discharge Temperature: _____ °

Number of Hours in Service: _____ Type of Service: _____

Oil Type: _____ Last Analysis: _____ Last Oil Change: _____

Type of Problem: _____

Parts Return Required: Yes _____ No _____ Return to: Painted Post _____ RMT Number: _____

DRESSER-RAND COMPANY
100 CHEMUNG STREET
PAINTED POST, NY 14870
TELEPHONE: (607) 937-2731
FAX: (607) 937-2342

FORM WC-002 FEBRUARY, 2003

DRESSER-RAND

Gas Field Compressors

Compressor Startup Form

Packager: _____ Customer: _____

Customer Contact: _____ Field Phone Number: _____

Unit Location: _____ Start-Up Date: _____ D-R Serviceman: _____

Driver Type/Mfg. _____ Model: _____ Rated HP: _____ Rated RPM: _____

Operating Conditions:

Cylinder #1	Cylinder #2	Cylinder #3
Bore Size: _____	Bore Size: _____	Bore Size: _____
S/N: _____	S/N: _____	S/N: _____
Suction Pressure: _____ psig	Suction Pressure: _____ psig	Suction Pressure: _____ psig
Suction Temperature: _____ °	Suction Temperature: _____ °	Suction Temperature: _____ °
Discharge Pressure: _____ psig	Discharge Pressure: _____ psig	Discharge Pressure: _____ psig
Discharge Temperature: _____ °	Discharge Temperature: _____ °	Discharge Temperature: _____ °
Cylinder #4	Cylinder #5	Cylinder #5
Bore Size: _____	Bore Size: _____	Bore Size: _____
S/N: _____	S/N: _____	S/N: _____
Suction Pressure: _____ psig	Suction Pressure: _____ psig	Suction Pressure: _____ psig
Suction Temperature: _____ °	Suction Temperature: _____ °	Suction Temperature: _____ °
Discharge Pressure: _____ psig	Discharge Pressure: _____ psig	Discharge Pressure: _____ psig
Discharge Temperature: _____ °	Discharge Temperature: _____ °	Discharge Temperature: _____ °

Operating Conditions Compared to Original Performance: Yes ___ No ___ RPM: _____ Oil Pressure: _____

Rod Run Out Checked/Verified to Manual: Yes ___ No ___ Piston End Clearance Verified-Factory Setting: Yes ___ No ___

Cylinder Supports: Inboard: Yes ___ No ___ Outboard: Yes ___ No ___ Support Properly Shimmed: Yes ___ No ___

Suction Screen Installed: Yes ___ No ___ Number of Screens: _____ Location of Screens: _____

Coupling Alignment Verified Not to Exceed .005 TIR: Yes ___ No ___

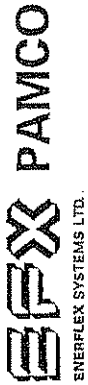
Frame Oil Level Verified: Yes ___ No ___ Frame Oil Type and Viscosity: _____

Compressor Oil Temp. Out of Frame to Cooler: _____ Out of Cooler to Frame: _____ Oil Filter Differential: _____

Lubricators Set to Maximum Flow: Yes ___ No ___ Cylinder Oil Type and Viscosity: _____

Start Up Performed By: _____ Date: _____ D-R Representative: _____ Date: _____

List any Problems Encountered During Start Up: _____



ENERFLEX SYSTEMS LTD.

START-UP COMPRESSOR REPORT & CLEARANCE RECORD

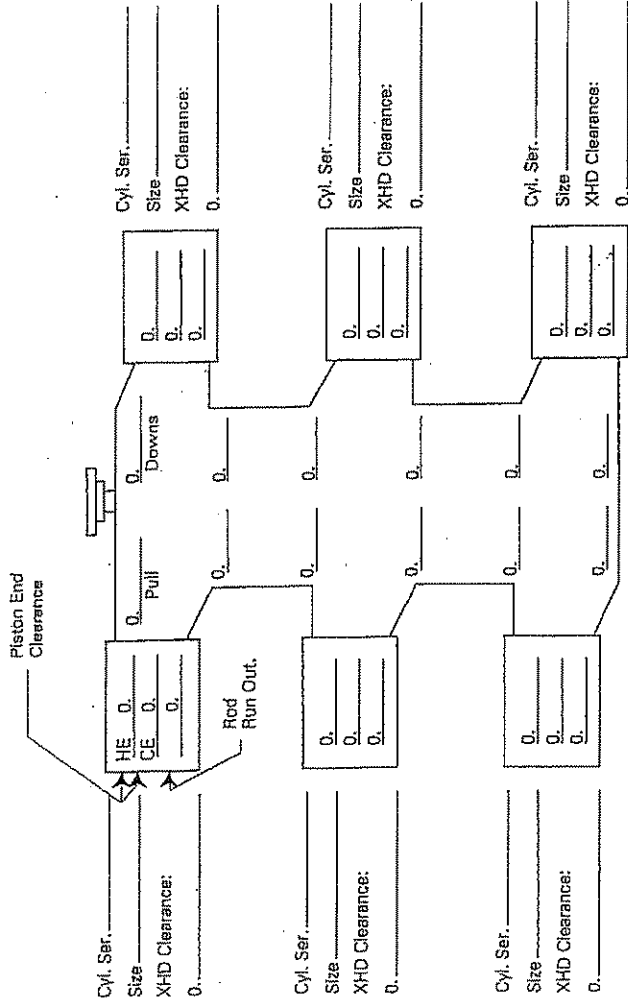
CUSTOMER: _____ UNIT #: _____
 MAKE: _____ START UP WO: # _____
 FRAME SERIAL: _____ MODEL: _____ START UP DATE: _____
 SWEET SOUR SERVICEMAN: _____
 OIL TYPE: _____ UNIT LOCATION: _____

COMPRESSOR PERFORMANCE

.000 _____ .000 _____

(A) _____ (P) _____

Coupling Alignment
Gas Temperature and Pressure



SUCTION

#1 _____ PSI AT _____ ° #1 _____ PSI AT _____ °
 #2 _____ PSI AT _____ ° #2 _____ PSI AT _____ °
 #3 _____ PSI AT _____ ° #3 _____ PSI AT _____ °
 #4 _____ PSI AT _____ ° #4 _____ PSI AT _____ °
 #5 _____ PSI AT _____ ° #5 _____ PSI AT _____ °
 #6 _____ PSI AT _____ ° #6 _____ PSI AT _____ °

DISCHARGE

CRANKCASE OIL

BRAND: _____
 GRADE: _____
 VISCOSITY: _____
 OIL PRESSURE: _____
 FRAME OIL TEMPERATURE IN: _____

LUBRICATOR OIL

BRAND: _____
 GRADE: _____
 VISCOSITY: _____
 CYCLE TIME: _____

POCKET SETTINGS % OPEN

CLEARANCE ASSEMBLIES INSTALLED

	SUCTION		DISCHARGE	
	HE	CE	HE	CE
Cyl. #1	_____	_____	_____	_____
Cyl. #2	_____	_____	_____	_____
Cyl. #3	_____	_____	_____	_____
Cyl. #4	_____	_____	_____	_____
Cyl. #5	_____	_____	_____	_____
Cyl. #6	_____	_____	_____	_____

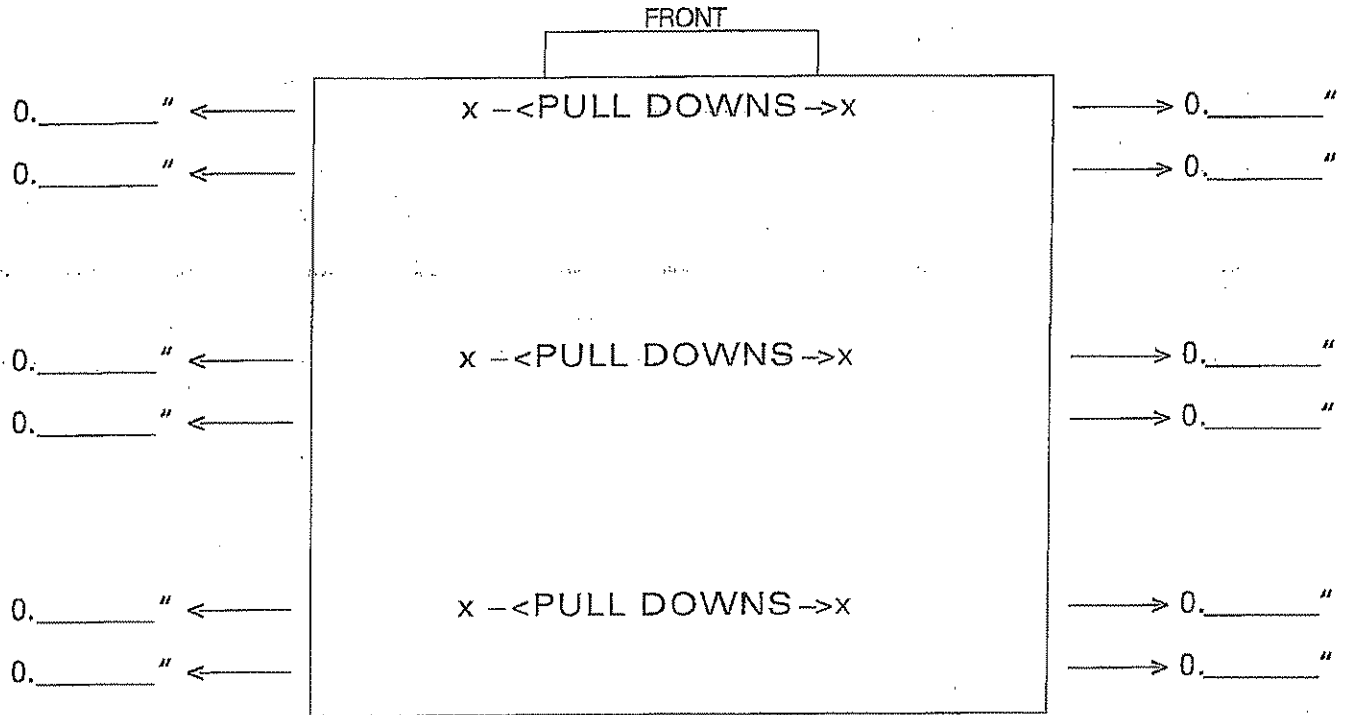
COMMENTS:

LOAD STEP #: _____

ENGINE MFG: _____ ARRANG #: _____ SERIAL #: _____

SIGNED: _____ DATE: _____

LASER ALIGNED: _____ DIAL ALIGNED: _____



CRANK END PLAY

0. _____ "

FINAL READING

FACE

0. _____ "

0. _____ "

0. _____ "

0. _____ "

RIM

0. _____ "

0. _____ "

0. _____ "

0. _____ "

ENERFLEX

DATE OPERATOR UNIT #

ROTATING EQUIPMENT
ALIGNMENT FORM - SERVICE

REASON FOR
ALIGNMENT

NEW UNIT START UP :
COUPLING FAILURE :

500 HPR :
OTHER :

ROUTINE MAINTENANCE :

DIMENSIONS



TOLERANCES

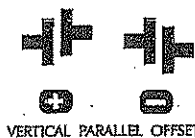
If no other tolerances are available, use table below

1 2 3 4 5

RPM	MAX PARALLEL OFFSET		MAX ANGULAR OFFSET	
	Ex	Acc	Ex	Acc
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>



COUPLING



VERTICAL PARALLEL OFFSET



HORIZONTAL PARALLEL OFFSET



VERTICAL ANGULAR OFFSET



HORIZONTAL ANGULAR OFFSET



TARGET

AS-FOUND

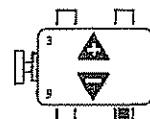
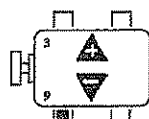
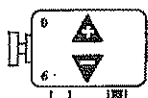
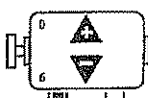
RESULTS AT COUPLING

AS-LEFT

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>



FEET



F4 THERMAL GROWTH

AS-FOUND

CORRECTIONS AT FEET

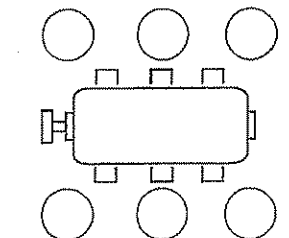
AS-LEFT

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
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<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

SOFT FOOT



For machines with six feet, check soft foot four feet at a time. Remove all shims and loosen the bolts on the feet not been checked.



Only to be used with two highs & two lows kitty corner.

Sum of HIGHS = _____
Sum of LOWS = _____
DIFFERENCE = _____
÷ 2 = _____
x 80 % = _____

Place this amount under the two highs.

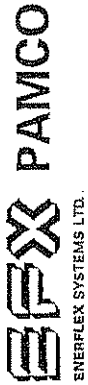
ALIGNMENT TOLERANCES AT THE COUPLING

Rotational Speed (RPM)	parallel offset mils	angular offset per 10" of Diam.
600	5	10
1200	2.5	5
1800	2	3
3600	1	2
7200	0.5	1

SOFT FOOT TOLERANCE - Less than 2 mils at any foot.

As per Profeschnik: Dieter Busch + Partner & Co.

NOTES



START-UP COMPRESSOR REPORT & CLEARANCE RECORD

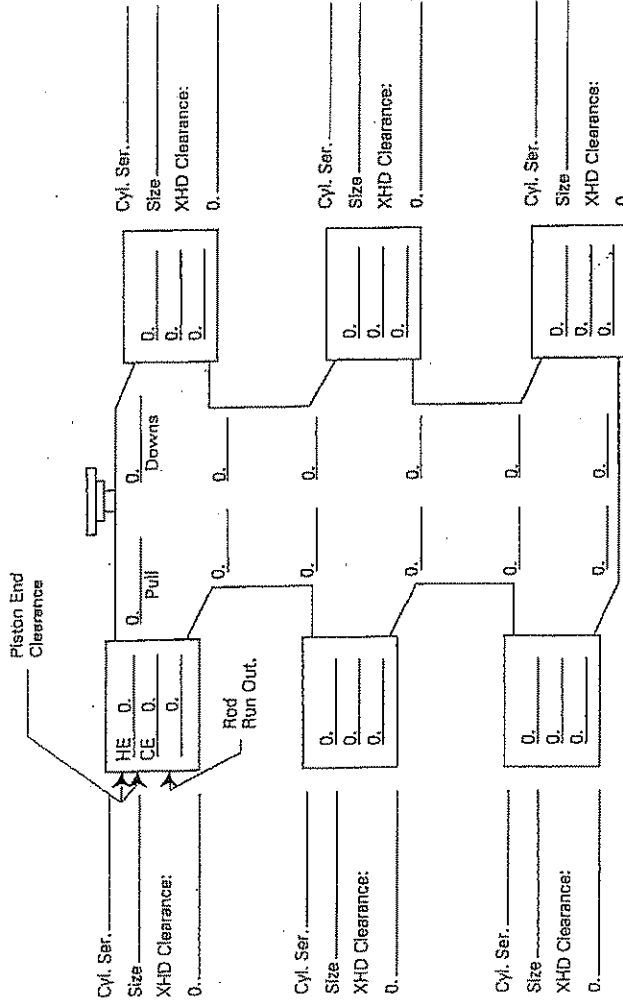
CUSTOMER: _____ UNIT #: _____
 MAKE: _____ START UP WO: # _____
 FRAME SERIAL: _____ MODEL: _____ START UP DATE: _____
 SWEET SOUR SERVICEMAN: _____
 OIL TYPE: _____ UNIT LOCATION: _____

COMPRESSOR PERFORMANCE

.000

(A) _____ (P) _____

Coupling Alignment
Gas Temperature and Pressure



SUCTION

#1 _____ PSI AT _____ ° #1 _____ PSI AT _____ °
 #2 _____ PSI AT _____ ° #2 _____ PSI AT _____ °
 #3 _____ PSI AT _____ ° #3 _____ PSI AT _____ °
 #4 _____ PSI AT _____ ° #4 _____ PSI AT _____ °
 #5 _____ PSI AT _____ ° #5 _____ PSI AT _____ °
 #6 _____ PSI AT _____ ° #6 _____ PSI AT _____ °

DISCHARGE

CRANKCASE OIL

BRAND: _____
 GRADE: _____
 VISCOSITY: _____
 OIL PRESSURE: _____
 FRAME OIL TEMPERATURE IN: _____

LUBRICATOR OIL

BRAND: _____
 GRADE: _____
 VISCOSITY: _____
 CYCLE TIME: _____

POCKET SETTINGS % OPEN

CLEARANCE ASSEMBLIES INSTALLED

	SUCTION		DISCHARGE	
	HE	CE	HE	CE
Cyl. #1	_____	_____	_____	_____
Cyl. #2	_____	_____	_____	_____
Cyl. #3	_____	_____	_____	_____
Cyl. #4	_____	_____	_____	_____
Cyl. #5	_____	_____	_____	_____
Cyl. #6	_____	_____	_____	_____

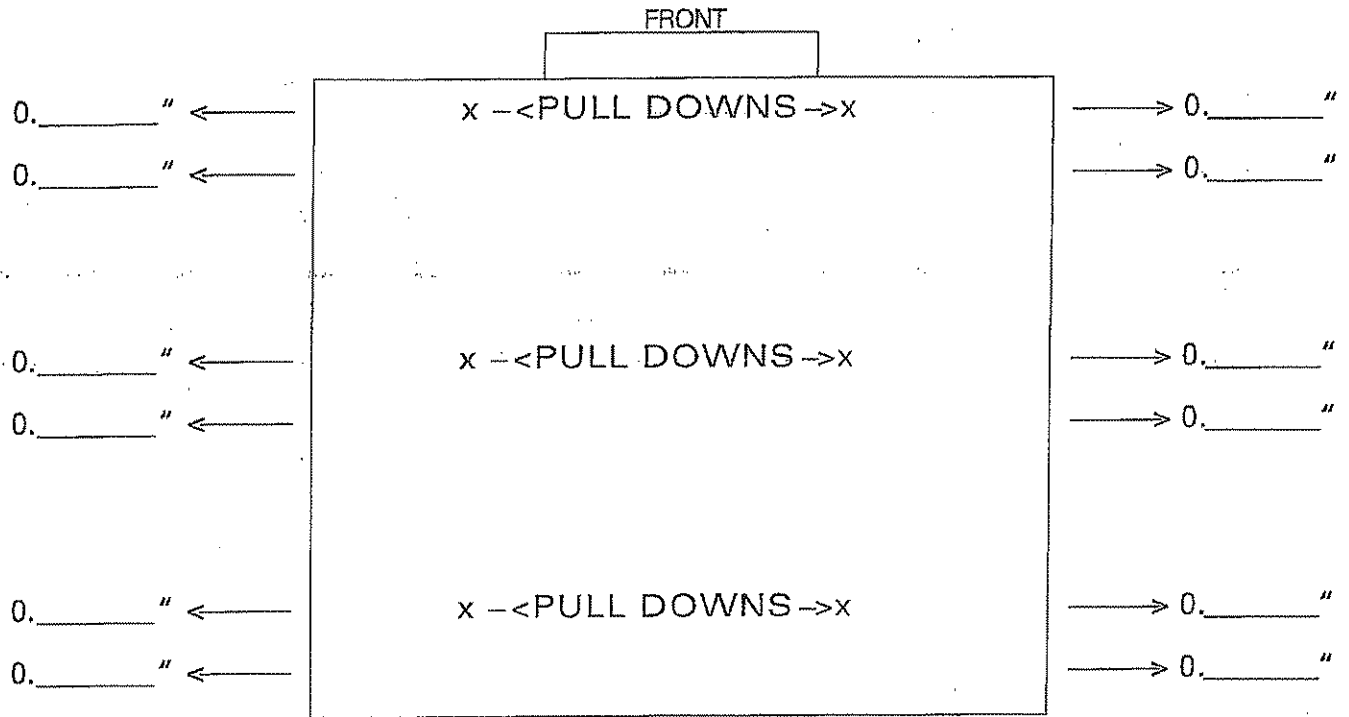
COMMENTS:

LOAD STEP #: _____

ENGINE MFG: _____ ARRANG #: _____ SERIAL #: _____

SIGNED: _____ DATE: _____

LASER ALIGNED: _____ DIAL ALIGNED: _____



CRANK END PLAY

0. _____ "

FINAL READING

FACE

0. _____ "

0. _____ "

0. _____ "

0. _____ "

RIM

0. _____ "

0. _____ "

0. _____ "

0. _____ "

ENERFLEX

DATE OPERATOR UNIT #

ROTATING EQUIPMENT
ALIGNMENT FORM - SERVICE

REASON FOR
ALIGNMENT

NEW UNIT START UP :
COUPLING FAILURE :

500 HRS :
OTHER :

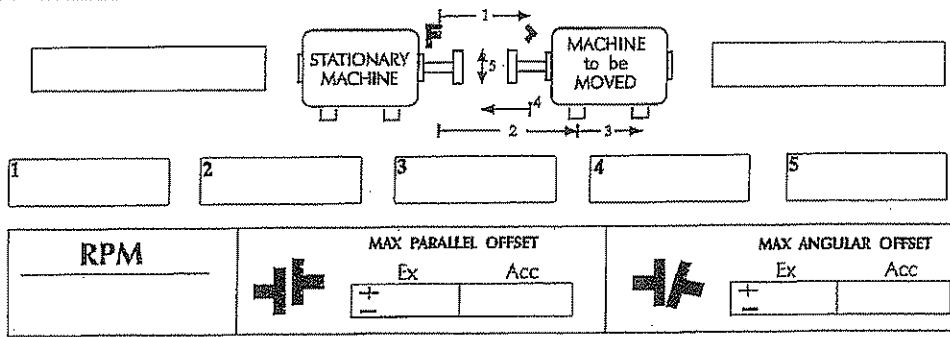
ROUTINE MAINTENANCE :

DIMENSIONS

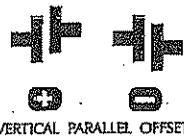


TOLERANCES

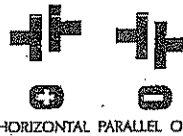
If no other tolerances are available, use table below



COUPLING



VERTICAL PARALLEL OFFSET



HORIZONTAL PARALLEL OFFSET



VERTICAL ANGULAR OFFSET



HORIZONTAL ANGULAR OFFSET



TARGET

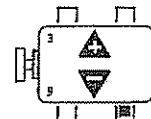
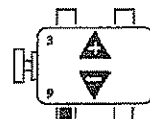
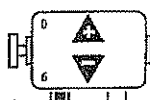
AS-FOUND

RESULTS AT
COUPLING

AS-LEFT



FEET



F4 THERMAL GROWTH

AS-FOUND

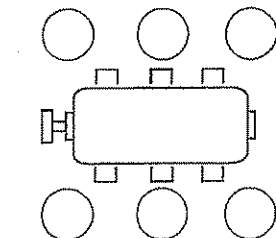
CORRECTIONS
AT FEET

AS-LEFT

SOFT FOOT



For machines with six feet, check soft foot four feet at a time. Remove all shims and loosen the bolts on the feet not been checked.



Only to be used with two highs & two lows kitty corner.

Sum of HIGHS = _____
Sum of LOWS = _____
DIFFERENCE = _____
÷ 2 = _____
x 80 % = _____

Place this amount under the two highs.

ALIGNMENT TOLERANCES AT THE COUPLING

Rotational Speed (RPM)	parallel offset mils	angular offset per 10" of Diam.
600	5	10
1200	2.5	5
1800	2	3
3600	1	2
7200	0.5	1

SOFT FOOT TOLERANCE - Less than 2 mils at any foot.

As per Proftechnik Dieter Busch + Partner & Co.

NOTES

Service Bulletins

SUBJECT: Heat Growth Values**UNITS/MODELS AFFECTED:** Waukesha/Cat/Ariel models

The purpose of this Service Bulletin is to document the vertical growth and crankshaft elongations toward the driven equipment of major engines and compressors for alignment purposes.

VERTICAL GROWTH

Waukesha Engines	Value	Ariel Compressor	Value
8L-AT	.010 – .013	JGA	.006
12V-AT	.010 - .013	JG	.006
16V-AT	.012 – .015	JGC/D	.013
VHP – 16 Cyl.	.017	JGE/H/K	.010
VHP – 6 and 12 Cyl	.014	JGP	.005
VGf	.007	JGR/W	.007
VSG	N/A		
Cat Engines			
G3608	.011		
G3500 10" Rail	.016		
G3500 13" Rail	.018		

This table lists the vertical change in crankshaft height that will occur due to the change from 70°F (20°C) to normal operating temperature. Measurements are taken from the mounting surface on the base type oil pan on VHP engines, from the base of the engine supports on VGf in-line engines, and from the bottom of the crankcase pan rails on AT engines.

The engine and compressor values must be subtracted to yield the difference in growth between the two machines. The height difference is the amount that the two machines should be offset.

SUBJECT: Heat Growth Values**UNITS/MODELS AFFECTED:** Waukesha/Cat/Ariel models

CRANKSHAFT ELONGATIONS

Waukesha Engines	Forward (in.)	Rearward (in.)	End Play (in.)
8L-AT	.083	.006	.006 - .012
12V-AT	.074	.006	.006 - .012
16V-AT	.097	.006	.006 - .012
VHP – 16 Cyl.	.107	.007	.005 - .018
VHP – 6 and 12 Cyl	.012	.072	.005 - .018
VGf	N/A	N/A	.009
VSG	N/A	N/A	.0035 - .0115

This table lists the change in crankshaft length that will occur due to the change from 70°F (20°C) to normal operating temperature. The amount of crankshaft growth towards the REAR is dependent upon the material of the engine components and the location of the thrust bearings within the engine.



SERVICE BULLETIN

TOPIC: Flywheels
IDENT NO: 5-2306A
SUPERSEDES: 5-2306
DATE: July 31, 1991

SUBJECT: Flywheel Ring Gears.

MODEL: All.

This Service Bulletin contains information concerning the number of teeth on various engine flywheels. This information can be used to aid the use of electronic governors or solid state tachometers.

The following chart lists the standard and optional ring gears for all current engines.

NOTE: Always use the engine's G-spec or serial number to identify proper part numbers.

FLYWHEEL RING GEARS		
Engine	Ring Gear Part Number	Number of Teeth
VR	190065	123
	190066	121
	180069	105
	117923	125
	180165	125
	180089	107
	216075	111
	220175	111
	220075	142
VSG	351056	148
F817	8564	138
	7180	158
	8768	195

FLYWHEEL RING GEARS		
Engine	Ring Gear Part Number	Number of Teeth
F1197	7180	158
	100284	144
VGF (F18)	701696	150
VGF (H24)	701696	150
VGF (L36)	305237	165
VGF (P48)	305237	165
VHP (6, 12 & 16)	153381B	208
VHP (12)	153381	208
	153381A	208
AT (12V)	280075	291
AT (8L)	295605	267



SERVICE BULLETIN

ALL

TOPIC: Accessories
IDENT NO: 1-2620D
SUPERSEDES: 1-2620C
DATE: December 15, 2001

SUBJECT: Engine Protection Shutdown

MODELS AFFECTED: All Waukesha Engines

The tables in this Service Bulletin list "Alarm" and "Shutdown" setpoints by engine series for various engine operating parameters. These values can be used as a guide when designing engine protection or monitoring systems.

The "Alarm" values shown are suggested values; they can be changed to suit a specific application or measurement device.

WARNING

Do not allow an engine to operate in excess of temperature shutdown limits or below pressure shutdown limits. Engine shutdown limits are set to ensure the engine will operate within its designed parameters. Engine operation outside of the shutdown limits may cause severe engine damage, severe personal injury, or death.

CAUTION

When setting engine overspeed shutdown, do not exceed the lesser of engine or driven equipment's speed limits. To avoid equipment damage consult the driven equipment manufacturer for maximum overspeed value.

The temperature "shutdown" values shown in the tables are maximum permissible values which cannot be exceeded regardless of application. The pressure "shutdown" values shown in the tables, are minimum permissible values which cannot be reduced regardless of application.

Alarm and shutdown values shown are based on dry natural gas (900 Btu/cu. ft. SLHV). Refer to the following Specification Sheets and Service Bulletins for changes in operating temperatures when running on landfill or digester gas fuels:

- Specification Sheets - S7884-7 and S1015-29
- Service Bulletins - 9-2702A and 12-1880Y

By using controls that simultaneously shut off the fuel supply and ignition system upon reaching a "shutdown" value, the potential for engine damage is reduced.

Service Bulletin No. 1-2620D

Table 1. AT25GL/AT27GL

JACKET WATER OUTLET TEMPERATURE	
Standard Cooling System	
Normal	180° F (82° C) for continuous rating 200° F (93° C) for intermittent rating
Alarm	10° F (5.5° C) above normal/design temperature
Shutdown	20° F (11° C) above normal/design temperature
Elevated Temperature Solid Water Cooling System	
Normal	210 - 250° F (99 - 121° C) solid water
Alarm	5° F (3° C) above normal/design temperature ¹
Shutdown	10° F (5.5° C) above normal/design temperature ¹
LUBE OIL HEADER TEMPERATURE	
Normal	172° F (78° C)
Alarm	187° F (86° C)
Shutdown	197° F (92° C)
LUBE OIL HEADER PRESSURE	
Normal	60 - 65 psi (414 - 448 kPa) ²
Alarm	50 psi (345 kPa)
Shutdown	45 psi (310 kPa)
INTAKE MANIFOLD TEMPERATURE - AT25GL	
Normal	Up to 10° F (5.5° C) above design intercooler water inlet temperature
Alarm	20° F (11° C) above design intercooler water inlet temperature
Shutdown	30° F (17° C) above design intercooler water inlet temperature
INTAKE MANIFOLD TEMPERATURE - AT27GL	
Normal	Up to 10° F (5.5° C) above design intercooler water inlet temperature
Alarm	15° F (8.5° C) above design intercooler water inlet temperature
Shutdown	20° F (11° C) above design intercooler water inlet temperature
INTAKE MANIFOLD PRESSURE	
See SB 14-2748C (or current revision)	
MAIN BEARING TEMPERATURE	
Shutdown	250° F (121° C)
OVERSPEED	
Shutdown	Not to exceed 10% over governed speed or driven machine limits

NOTE:

¹ Waukesha Power Systems Code 1105, 1105A, or equivalent pressure/temperature shutdown system is recommended when jacket water temperature exceeds 210° F (99° C).

² AT25GL models may not attain this specification without oil pressure feedback. Refer to SB 12-2810A (or current revision) for more information.

Table 2. VHP

JACKET WATER OUTLET TEMPERATURE	
Standard Cooling System	
Normal	180° F (82° C) for continuous rating 200° F (93° C) for intermittent rating
Alarm	10° F (5.5° C) above normal/design temperature
Shutdown	20° F (11° C) above normal/design temperature
Elevated Temperature Solid Water Cooling System	
Normal	210 - 235° F (99 - 113° C) solid water
Alarm	5° F (3° C) above normal/design temperature ¹
Shutdown	10° F (5.5° C) above normal/design temperature ¹
Ebullient Water Cooling System	
Normal	212 - 250° F (100 - 121° C)
Alarm	See Note 2
Shutdown	See Note 2
LUBE OIL HEADER TEMPERATURE	
Normal	180° F (82° C)
Alarm	195° F (91° C)
Shutdown	205° F (96° C)
LUBE OIL HEADER PRESSURE	
6 and 12 Cylinder Models	
Normal	50 - 60 psi (345 - 415 kPa)
Alarm	35 psi (241 kPa)
Shutdown	30 psi (207 kPa)
16 Cylinder Models	
Normal	50 - 60 psi (345 - 415 kPa)
Alarm	30 psi (207 kPa)
Shutdown	25 psi (172 kPa)
INTAKE MANIFOLD TEMPERATURE (GSI & GL ENGINES)	
Normal	Up to 10° F (5.5° C) above design intercooler water inlet temperature
Alarm	15° F (8.5° C) above design intercooler water inlet temperature
Shutdown	20° F (11° C) above design intercooler water inlet temperature
INTAKE MANIFOLD PRESSURE	
See SB 14-2755B (or current revision)	
MAIN BEARING TEMPERATURE	
Shutdown	250° F (121° C)
OVERSPEED	
Shutdown	10% over governed speed or driven machine limits

NOTE:

¹ Waukesha Power Systems Code 1105, 1105A, or equivalent shutdown system is recommended when jacket water temperature exceeds 210° F (99° C).

² Waukesha Power Systems Code 1106, 1106A, or equivalent shutdown system is required for ebulliently cooled engines.

Table 3. VGF

JACKET WATER OUTLET TEMPERATURE	
Standard Cooling System (176 BMEP Engines)	
Normal	180° F (82° C) for continuous rating 200° F (93° C) for intermittent rating
Alarm	10° F (5.5° C) above normal/design temperature
Shutdown	20° F (11° C) above normal/design temperature
Elevated Temperature Solid Water Cooling System (176 BMEP Engines)	
Normal	210 - 265° F (99 - 130° C) solid water
Alarm	5° F (3° C) above normal/design temperature ¹
Shutdown	10° F (5.5° C) above normal/design temperature ¹
Elevated Temperature Solid Water Cooling System (200 BMEP Engines)	
Normal	210° F (99° C) solid water
Alarm	10° F (5.5° C) above normal/design temperature ¹
Shutdown	15° F (8.5° C) above normal/design temperature ¹
LUBE OIL HEADER TEMPERATURE	
With a Jacket Water Temperature of 180° F (82° C) and Intercooler Temperature of 85 - 130° F (29 - 54° C) (176 BMEP Engines Only)	
Normal	170 - 195° F (76.5 - 90.5° C)
Alarm	200° F (93° C)
Shutdown	205° F (96° C)
With a Jacket Water Temperature of 265° F (129° C) and Intercooler Temperature of 85 - 130° F (29 - 54° C) (176 BMEP Engines Only)	
Normal	170 - 195° F (76.5 - 90.5° C)
Alarm	200° F (93° C)
Shutdown	205° F (96° C)
With a Jacket Water Temperature of 210° F (99° C) and Intercooler Temperature of 158 - 176° F (70 - 80° C) (200 BMEP GLD Engines Only)	
Normal	190° F (88° C)
Alarm	200° F (93° C)
Shutdown	205° F (96° C)
LUBE OIL HEADER PRESSURE	
F18/H24 Models	
Normal	67 - 83 psi (462 - 572 kPa)
Alarm	40 psi (276 kPa)
Shutdown	35 psi (241 kPa)
L36/P48 Models	
Normal	47 - 63 psi (324 - 434 kPa)
Alarm	40 psi (276 kPa)
Shutdown	35 psi (241 kPa)

INTAKE MANIFOLD TEMPERATURE	
With Standard Intercooler Water Temperatures 85 - 130° F (29 - 54° C) (176 BMEP GL/GLD/GSID Engines)	
Normal	Up to 10° F (5.5° C) above design intercooler water inlet temperature
Alarm	15° F (8.5° C) above design intercooler water inlet temperature
Shutdown	20° F (11° C) above design intercooler water inlet temperature
With Elevated Intercooler Water Temperatures 131 - 176° F (55 - 80° C) (176 BMEP GL/GLD/GSID Engines)	
Normal	Up to 10° F (5.5° C) above design intercooler water inlet temperature
Alarm	10° F (5.5° C) above design intercooler water inlet temperature
Shutdown	15° F (8.5° C) above design intercooler water inlet temperature
With Elevated Intercooler Water Temperatures 158 - 176° F (70 - 80° C) (200 BMEP GLD Engines Only)	
Normal	Up to 10° F (5.5° C) above design intercooler water inlet temperature
Alarm	10° F (5.5° C) above design intercooler water inlet temperature
Shutdown	15° F (8.5° C) above design intercooler water inlet temperature
INTAKE MANIFOLD PRESSURE	
See SB 14-2749D (or current revision)	
MAIN BEARING TEMPERATURE	
Contact Waukesha Engine Sales Engineering	
OVERSPEED	
Shutdown	Not to exceed 15% over governed speed or drive machine limits

NOTE:
¹ Waukesha Power Systems Code 1105, 1105A, or equivalent pressure/temperature shutdown system is recommended when jacket water temperature exceeds 210° F (99° C).

Service Bulletin No. 1-2620D

Table 4. VSG

JACKET WATER OUTLET TEMPERATURE	
Normal	180° F (82° C)
Alarm	200° F (93° C)
Shutdown	210° F (99° C)
LUBE OIL HEADER TEMPERATURE	
With a Jacket Water Temperature of 180° F (82° C)	
F11G Model	
Normal	205° F (96° C)
Alarm	215° F (102° C)
Shutdown	225° F (107° C)
F11GSI/GSID Model	
Normal	190° F (89° C)
Alarm	200° F (93° C)
Shutdown	210° F (99° C)
LUBE OIL HEADER PRESSURE	
Normal	65 - 87 psi (448 - 600 kPa)
Alarm	40 psi (276 kPa)
Shutdown	30 psi (207 kPa)
INTAKE MANIFOLD TEMPERATURE (GSI/GSID)	
Normal	Up to 15° F (8.5° F) above design intercooler water inlet temperature
Alarm	20° F (11° C) above design intercooler water inlet temperature
Shutdown	25° F (14° C) above design intercooler water inlet temperature
INTAKE MANIFOLD PRESSURE (GSI/GSID)	
See SB 14-2707A (or current revision)	
MAIN BEARING TEMPERATURE	
Not Applicable	
OVERSPEED	
Shutdown	Not to exceed 15% over governed speed or drive machine limits

Table 5. F1197

JACKET WATER OUTLET TEMPERATURE	
Normal	180° F (82° C)
Alarm	200° F (93° C)
Shutdown	210° F (99° C)
LUBE OIL HEADER TEMPERATURE	
Normal	160 - 210° F (71 - 99° C)
Alarm	225° F (107° C)
Shutdown	235° F (113° C)
LUBE OIL HEADER PRESSURE	
Normal	40 - 50 psi (276 - 345 kPa)
Alarm	15 psi (103 kPa)
Shutdown	10 psi (69 kPa)
INTAKE MANIFOLD TEMPERATURE	
Not Applicable	
INTAKE MANIFOLD PRESSURE	
Not Applicable	
MAIN BEARING TEMPERATURE	
Not Applicable	
OVERSPEED	
Shutdown	Not to exceed 15% over governed speed or drive machine limits

Table 6. F817

JACKET WATER OUTLET TEMPERATURE	
Normal	180° F (82° C)
Alarm	195° F (91° C)
Shutdown	205° F (96° C)
LUBE OIL HEADER TEMPERATURE	
Normal	160 - 230° F (71 - 110° C)
Alarm	240° F (116° C)
Shutdown	250° F (121° C)
LUBE OIL HEADER PRESSURE	
Normal	35 - 45 psi (241 - 310 kPa)
Alarm	15 psi (103 kPa)
Shutdown	10 psi (69 kPa)
INTAKE MANIFOLD TEMPERATURE	
Not Applicable	
INTAKE MANIFOLD PRESSURE	
Not Applicable	
OVERSPEED	
Shutdown	Not to exceed 15% over governed speed or drive machine limits