DIAPHRAGM COMPRESSOR MANUAL

MODEL 4100

apeks SUPERCRITICAL	Equipment Model Customer P.O. No. Customer	DIAPHRAGM COMPRESSOR SYSTEM 4100-APEKS

FINAL DATA PACKAGE

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COMPRESSOR DATA

OPERATION AND MAINTENANCE MANUAL

COMPRESSOR SPECIFICATIONS Form 238.F063

Customer ______________________ Date: 9/29/2015

Customer P.O. No. ______________________

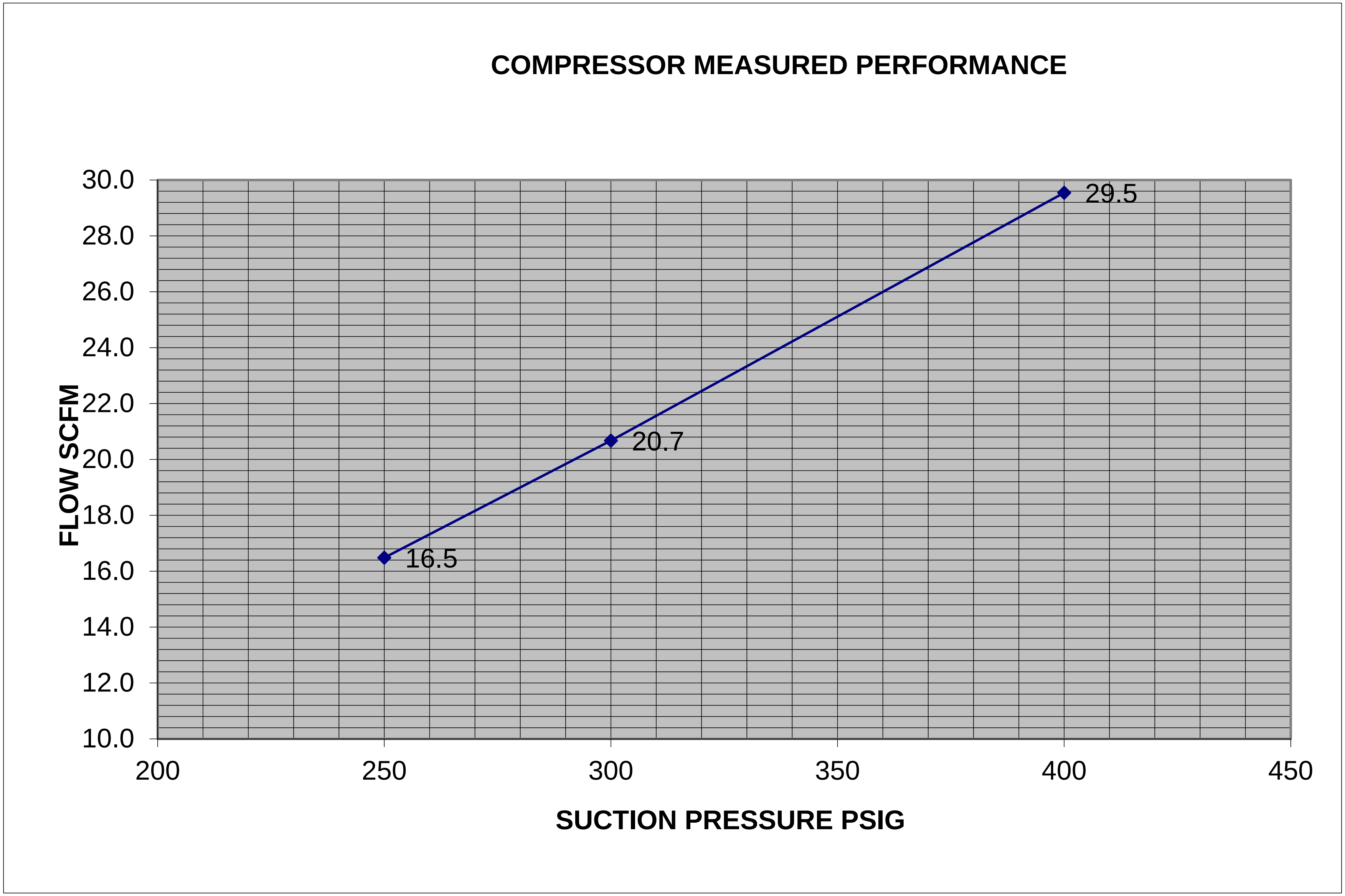
Compressor Model: 4100-APEKS Serial No TYPICAL

CAUTION

DO NOT EXCEED THE CONDITIONS LISTED BELOW. THEY ARE MAXIMUM CONDITIONS AND EXCEEDING THEM WITHOUT WRITTEN CONSENT OF THE FACTORY MAY RESULT IN SERIOUS INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT.

1.	Max. Suction Pressure		400.0	psig				
2.	Max. Suction Temperature		20	°F				
3.	Max. Discharge Pressure		2,000	psig				
4.	Hydraulic Overpump Valve Setting:	1st	2,350	psig	2nd		psig	
5.	"Bootstrap" Pressure:	1st		psig	2nd		psig	
6.	Performance Curve		enclosed					
7.	Specified Suction Pressure		300.0	psig	at	20	°F	
8.	Specified Discharge Pressure		1,800	psig				
9.	Specified Capacity		15.0	scfm*		CO2	gas	
10.	Equivalent Capacity with Test Gas		19.4	scfm*		Argon	test gas	
11.	Actual Test Capacity		20.7	scfm*		Argon	test gas	
12.	Hydraulic Oil Ambient Temp > 50 °F		ISO 68	**	Qty:	11.6	Qts	
	Hydraulic Oil Ambient Temp < 50 °F		ISO 68					
13.	Water Flow Rate-Total		1	gpm				
14.	Horsepower		15	hp				
15.	Motor Enclosure Classification			Class/Group/Div				
16.	Motor Electrical		220-208/1/60	Volts / Phase / Hz				
18.	Control Electrical			Volts / Phase / Hz				

* Referenced to 14.7 psia at 60°F. ** Oil in compressor as shipped from the factory

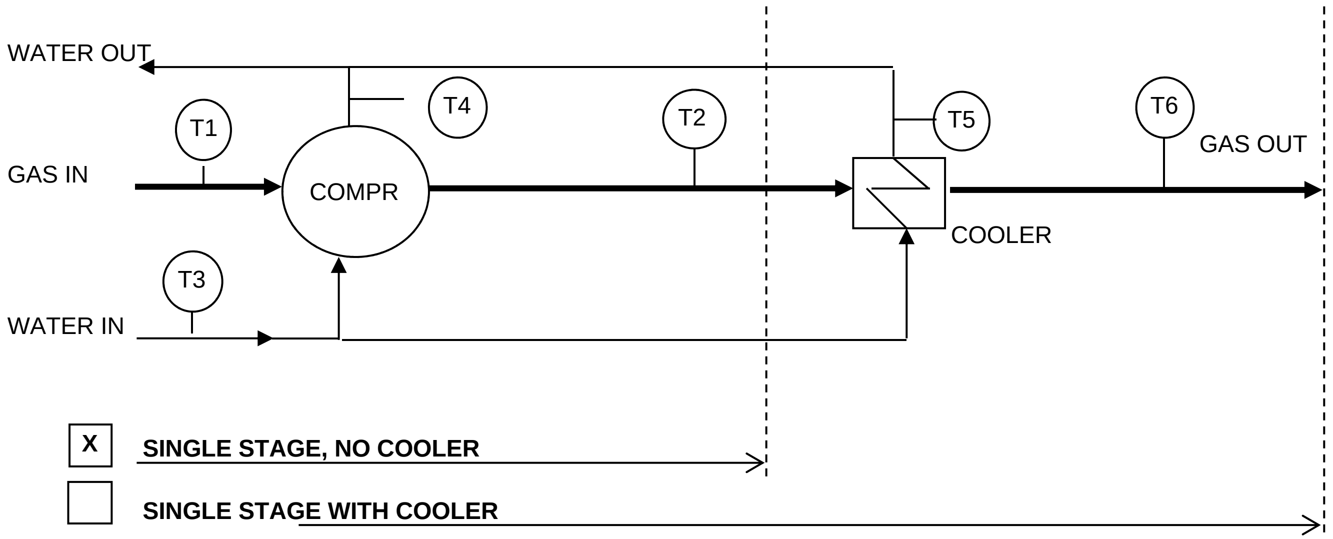


ORDER NUMBER 4100-APEKS	**MODEL** 4100-APEKS	**DISCHARGE** 1,800 psig	**TEST GAS** Argon	**SPEED** 428 rpm

COMPRESSOR HEAT TRANSFER DATA (SINGLE- STAGE)

PPI Order N TYPICAL   Model 4100-APEKS   Operating Speed 428 rpm

Data Point	Test Gas	Suction pressure, psig	Disharge pressure, psig	Gas Flow Rate, scfm	Water Flow Rate, gpm	T1	T2	T3	T4	T5	T6
						TEMPERATURE, °F					
1	Argon	250.0	1,800	16.5	2.0	72	281	74	76		
2	Argon	400.0	1,800	29.5	2.0	66	319	75	76		
3	Argon	300.0	1,800	20.7	2.0	67	296	74	76		
4	Argon	300.0	2,000	16.2	2.0	65	312	76	77		
5	Argon	400.0	2,000	32.3	2.0	63	335	76	78		
6											



Form 238.F005

DOCUMENTATION

Recommended Spare Parts and Rebuild Kits: 4100-APEKS

Quantity A	Quantity B	Quantity C	Quantity D	Description	Part Number
1	**1**	**1**	**2**	**Head Assembly Rebuild Kit**	**4100APEKS-HA1-KIT ***
				Rebuild kit includes the following:	
				Qty **Part Number**	**Description**
				1 4100APEKS-HA1-DIASET	upper/ middle/ lower diaphragm set
				1 275-680	process o-ring
				1 279-680	leak detection o-ring
				1 274-477	hydraulic o-ring
				1 021-680	annulus plug o-ring
1	**0**	**0**	**1**	**Compressor Suction/Discharge Check Valve**	**B15312-102**
2	**2**	**2**	**4**	**Compressor Check Valve Rebuild Kit**	**B15312-102-KIT ***
				Rebuild kit includes the following:	
				Qty **Part Number**	**Description**
				1 A39038-501-00	poppet
				1 A39040	spring
				1 017-680	o-ring
				2 022-680	o-ring
1	**0**	**0**	**1**	**Frame Assembly Rebuild Kit**	**4100APEKS-FRM-KIT**
				Rebuild kit includes the following:	
				Qty **Part Number**	**Description**
				1 B15000-104	hydraulic overpump valve
				1 A39533-101	oil check valve
				1 A39460-00	oil filter
				3 CX-120	vee-belts

A = Quanitity required per unit
B = Quanitity of commissioning spares
C = Quantity of one year consumables
D = Quantity of two year consumables

* Recommended for Annual Preventative Maintenance

Recommended Spare Parts and Rebuild Kits: 4100-APEKS

Quantity				Description	Part Number
A	B	C	D		
1	**1**	**1**	**1**	**<u>Other Spares</u>**	
				Oil Filter	**A39460-00 ***

A = Quanitity required per unit
B = Quanitity of commissioning spares
C = Quantity of one year consumables
D = Quantity of two year consumables

* Recommended for Annual Preventative Maintenance

BILL OF MATERIALS

ASSEMBLY NUMBER: 4100-APEKS
DRAWING: D-12527
DESCRIPTION: MODEL 4100 COMPRESSOR ASSEMBLY

ITEM	QTY	UOM	PART NO.	DESCRIPTION
1	1	EA	4100APEKS-GA	GENERAL ARRANGEMENT, MOD 4100
2	1	EA	4100APEKS-FRM	COMPRESSOR FRAME ASSEMBLY
3	1	EA	4100APEKS-HA	HEAD ASSEMBLY, MOD 4100
4	1	EA	4100APEKS-HYD	HYDRAULIC PIPING

BILL OF MATERIALS

ASSEMBLY NUMBER: 4100APEKS-GA
DRAWING: D-12527
DESCRIPTION: GENERAL ARRANGEMENT FOR APEKS MODEL 4100

ITEM	QTY	UOM	PART NO.	DESCRIPTION
1	1	EA	L3912T	MOTOR, 15HP, 1745 RPM, 256T
2	1	EA	PPI-256T	SLIDE BASE, FOR 256 MOTOR
3	1	EA	FW3C7.0X1.625	SHEAVE, 3 GROOVE, "C" SECTION
4	3	EA	CX-120	BELT, "C" SECTION
5	1	EA	D9423-100	BELTGUARD, ALUMINUM
6	4	EA	HHB.625-11X3	HEX HEAD BOLT, 5/8"-11 X 3" L
7	4	EA	LW.625	LOCKWASHER, 5/8" BOLT SIZE
8	4	EA	91152A035	SQUARE BEVELED WASHER
9	4	EA	.625-11 UN-2B-075	HEAVY HEX NUT SA-194 GR2H
10	4	EA	HHB.50-13X1.0	HEX HEAD BOLT, 1/2"-13 X 1" L
11	4	EA	LW.5	LOCKWASHER, 1/2" BOLT SIZE
12	1	EA	D12528-100	BASEPLATE, MOD 4100 SPECIAL

BILL OF MATERIALS

ASSEMBLY NUMBER: 4100APEKS-FRM
DRAWING:
DESCRIPTION: RECIPROCATING FRAME ASSEMBLY APEKS MODEL 4100

ITEM	QTY	UOM	PART NO.	DESCRIPTION
1	1	EA	4LHRCP-07-00-8C	4L COMPRESSOR BASE

BILL OF MATERIALS

ASSEMBLY NUMBER: 4LHRCP-07-00-8C
DRAWING: D-9300
DESCRIPTION: 4L COMPRESSOR BASE

ITEM	QTY	UOM	PART NO.	DESCRIPTION
1	1	EA	D9300-100	COMPRESSOR BASE ASSEMBLY
2	1	EA	D9300-101	CYLINDER/PISTON ASSEMBLY
3	1	EA	B15555-035-00	CYLINDER COVER PLATE
4	1	EA	A39582	INJECTION PUMP PLUG
5	1	EA	A39556	CLAMP, 2-PIECE
6	1	EA	A39465	FLYWHEEL WITH BUSHING

BILL OF MATERIALS

ASSEMBLY NUMBER: 4100APEKS-HA
DRAWING:
DESCRIPTION: HEAD ASSEMBLY APEKS MODEL 4100

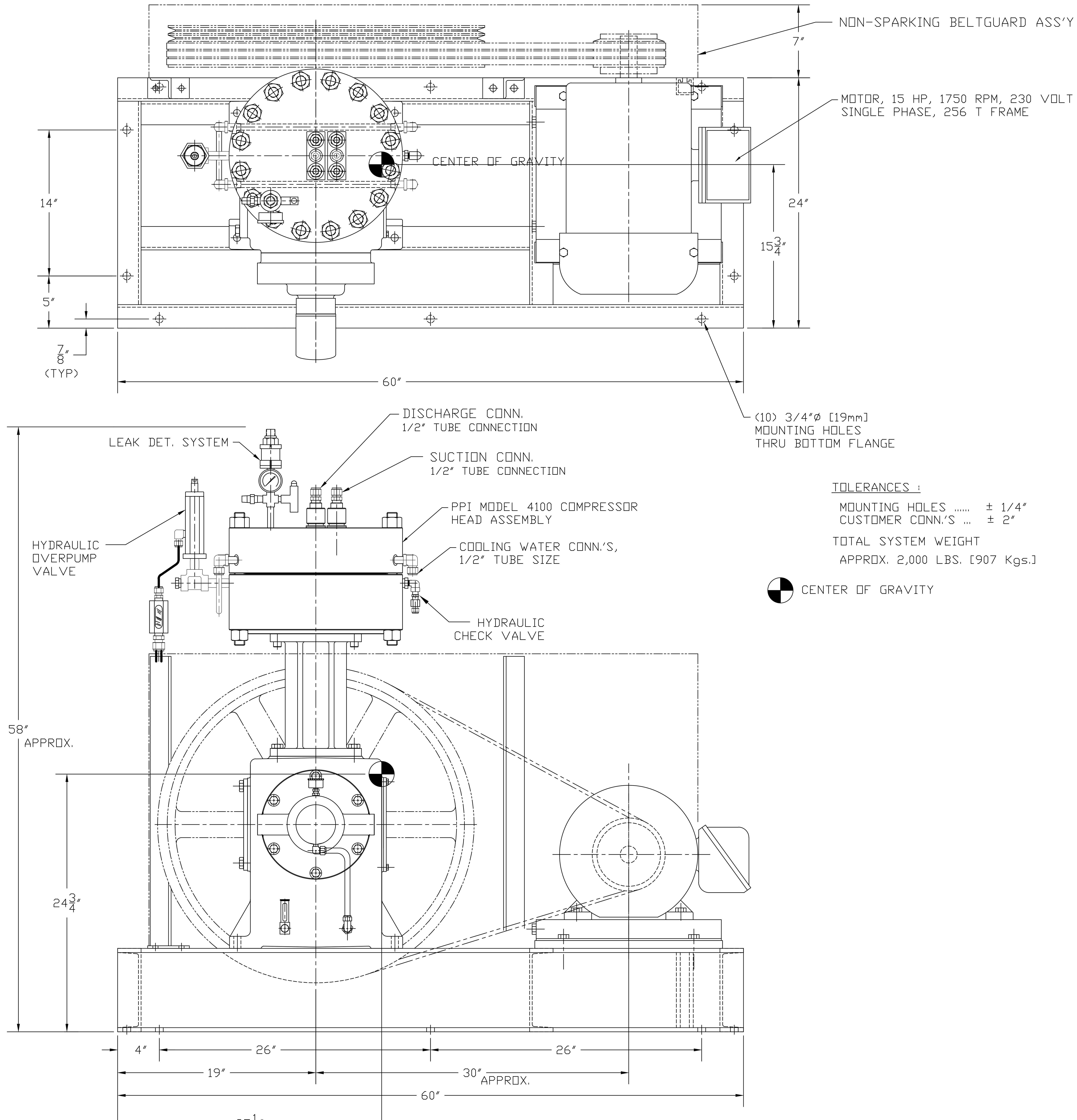
ITEM	QTY	UOM	PART NO.	DESCRIPTION
1	1	EA	4LHA100N-APEKS	HEAD ASSY, MODEL 4100
2	1	EA	C11700-100	PPI STANDARD LEAK DET. SYSTEM
3	2	EA	B15312-102	CHECK VALVE ASSEMBLY
4	1	EA	4LHA100N-HA-DIASET	DIAPHRAGM SET, MODEL 4100

BILL OF MATERIALS

ASSEMBLY NUMBER: 4LHA100N-APEKS
DRAWING: D-12368
DESCRIPTION: HEAD ASSEMBLY APEKS MODEL 4100

ITEM	QTY	UOM	PART NO.	DESCRIPTION
1	1	EA	D12369-168-00	PROCESS HEAD MODEL 4100
2	1	EA	D10326-407-00	HYDRAULIC HEAD
3	1	EA	B8513-241	PLUNGER/SLEEVE ASSEMBLY
4	1	EA	274-477	O-RING, #274, VITON, 90 DURO
5	1	EA	275-680	O-RING, #275, BUNA N, 90 DURO
6	1	EA	279-680	O-RING, #279, BUNA N, 90 DURO
7	1	EA	227-477	O-RING, #227, VITON, 90 DURO
8	1	EA	B15561-001-14	CHECK VALVE BACKER
9	1	EA	B15561-001-15	CHECK VALVE BACKER
10	0	EA	B16601-029-51	DIAPHRAGM
11	0	EA	B12682-081-82	*DIAPHRAGM (WT=0.65#)
12	2	EA	B15562-156-00	CHECK VALVE BACKER FLANGE
13	16	EA	1-8X12.75 R-238X	STUD 1"-8UN-2A X 12 3/4" LG
14	32	EA	1-8 UN-2B-075	HEAVY HEX NUT SA-194 GR2H
15	16	EA	A10970-06	1" FLAT WASHER 18-8 SST
16	6	EA	SH.5-13X1.5	SOCKET HEAD CAP SCREW
17	6	EA	LW.5	LOCKWASHER, 1/2" BOLT SIZE
18	6	EA	SH.625-11X3.0	SOCKET HEAD CAP SCREW
19	0	EA	B18084-003-00	ANNULUS PLUG
20	3	EA	HWS8-32X.25	HEX WASHER SCREW
21	1	EA	B14928-035-01	BACK-UP RING
22	1	EA	258-479	O-RING, #258, VITON, 75 DURO
23	1	EA	021-680	O-RING, #021, BUNA N, 90 DURO
24	4	EA	.625-11X4.25 R-238X	STUD, 5/8-11 UNC-2A X 4-1/4 L
25	4	EA	.625-11 UN-2B-075	HEAVY HEX NUT SA-194 GR2H
26	12	EA	SP-391735	BELLEVILLE WASHER, 5/8 BOLT
27	2	EA	Q4324VT75	QUAD RING, #324, VITON
28	2	EA	P.50P3KSTEEL	PLUG, 1/2" NPT, 3000#
29	1	EA	P.50X.375B3KSTEEL	BUSHING
31	4	EA	19-818	ELBOW,F,1/2"TX3/8"NPT
32	2	EA	19-273	CONN,M,1/2"TX1/2"NPT
33	4	EA	N.375X2.040316Y	NIPPLE, 3/8 SCH 40 X 2" LG
34	18	IN	YTF038X065DH	TUBE,.038"ODX.065WALL

DRAWINGS



TOLERANCES :

MOUNTING HOLES ...... ± 1/4"
CUSTOMER CONN.'S ... ± 2"

TOTAL SYSTEM WEIGHT

APPROX. 2,000 LBS. [907 Kgs.]

CENTER OF GRAVITY

REV	DATE	DESCRIPTION	BY	QA	PE

ECCN EAR99

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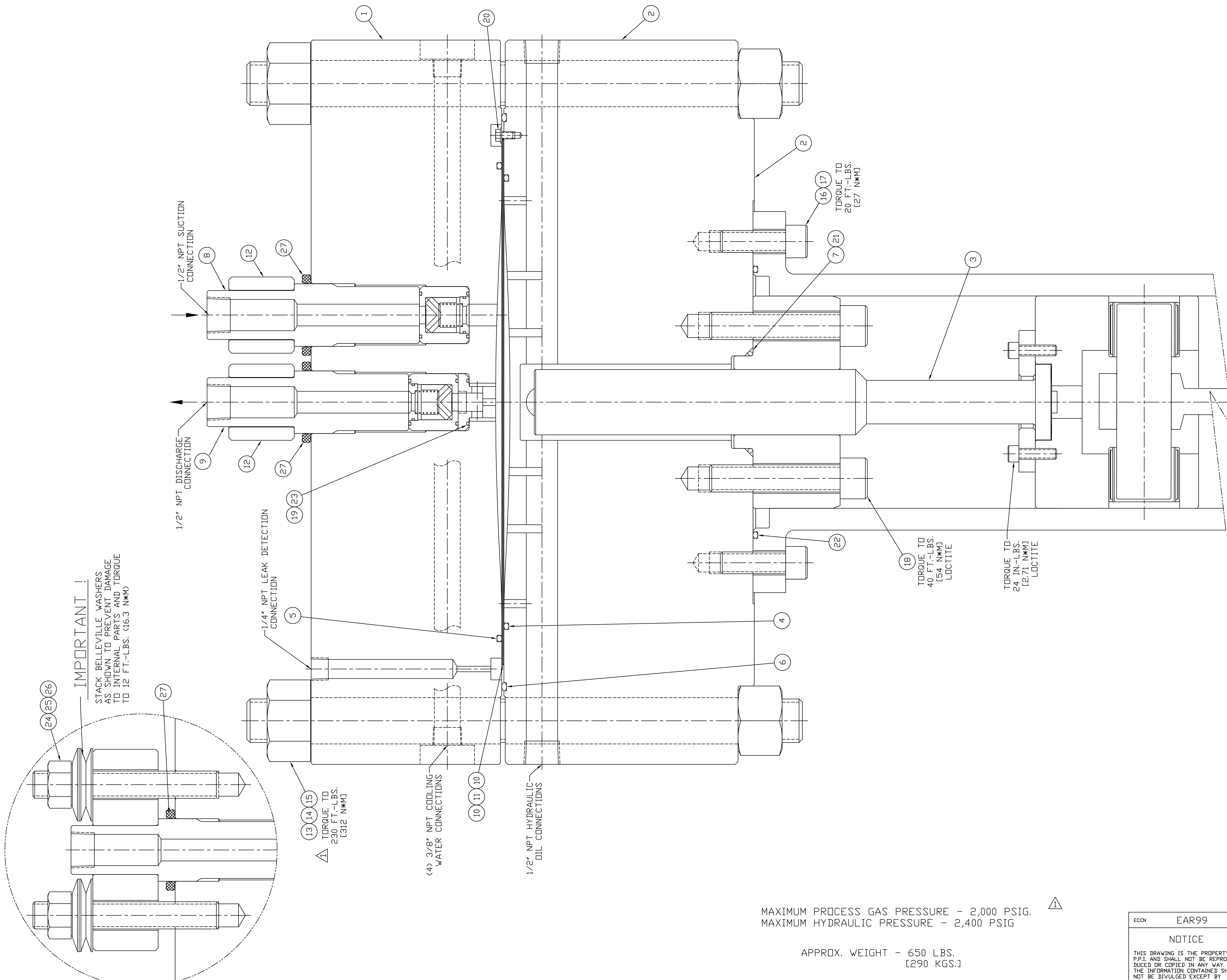
REF. DWG. D12381

U.D.N.
FINISH √
BREAK ALL SHARP CORNERS
TOL. FRAC. ANG.
CONCENTRICITY T.I.R.
INSIDE CORNERS RAD.

PPI PRESSURE PRODUCTS INDUSTRIES MILTON ROY

TITLE COMPRESSOR LAYOUT MODEL 4100

DATE 5/23/15 | JOB SPCL | REL. CODE | DWG. NO.
BY | ASSY. ------ | . | D-12527-0
CH. | SCALE .1875=1
QA | PE | DATE | SHEET 1 OF 1



MAXIMUM PROCESS GAS PRESSURE - 2,000 PSIG.
MAXIMUM HYDRAULIC PRESSURE - 2,400 PSIG

APPROX. WEIGHT - 650 LBS. [290 KGS.]

THIS DOCUMENT OR FILE CONTAINS NO TECHNICAL DATA. ECCN EAR99

REV	DATE	DESCRIPTION	BY	QA	PE
1	3/9/15	REVISED HEAD WORKING PRESSURE, WAS 1,550 PSI	PLM		

ECCN EAR99

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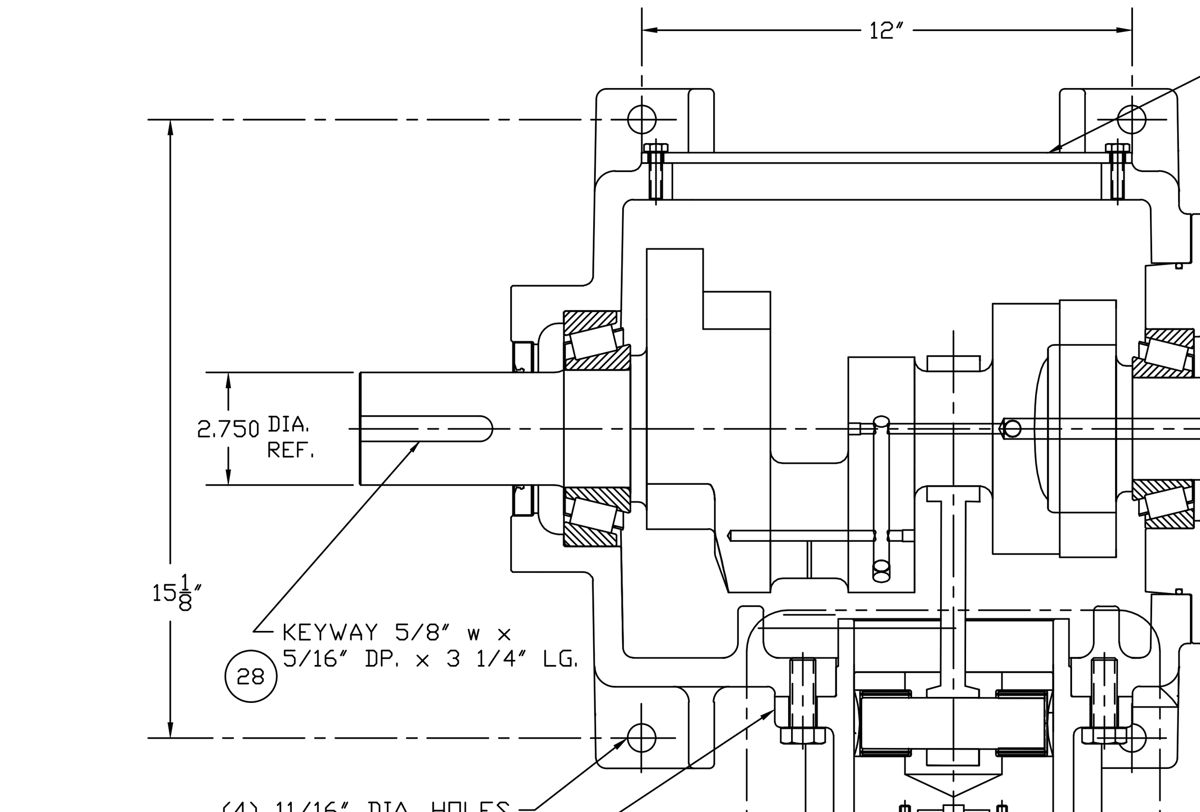
REF. DWG. D-12235

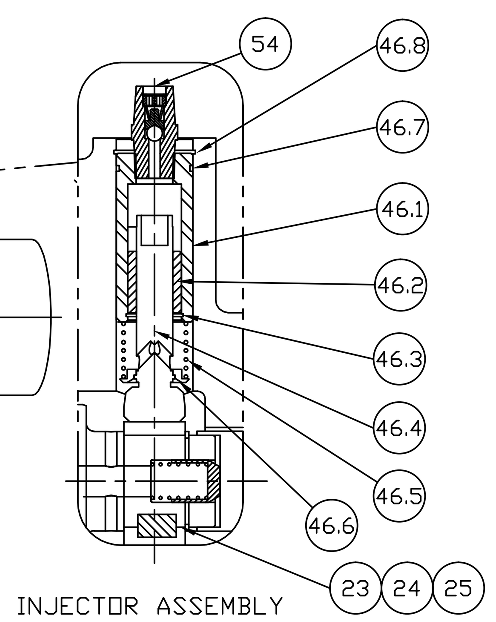
U.O.N.
FINISH ✓
BREAK ALL SHARP CORNERS
TOL. FRAC. ANG.
CONCENTRICITY T.I.R.
INSIDE CORNERS RAD.

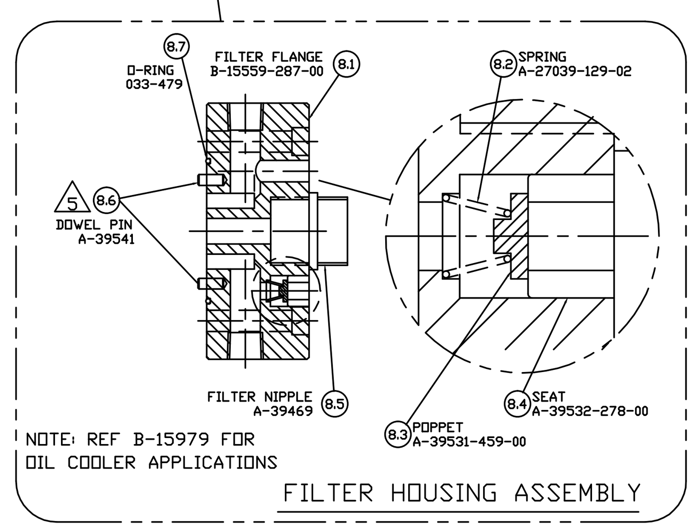
PRESSURE PRODUCTS INDUSTRIES
MILTON ROY

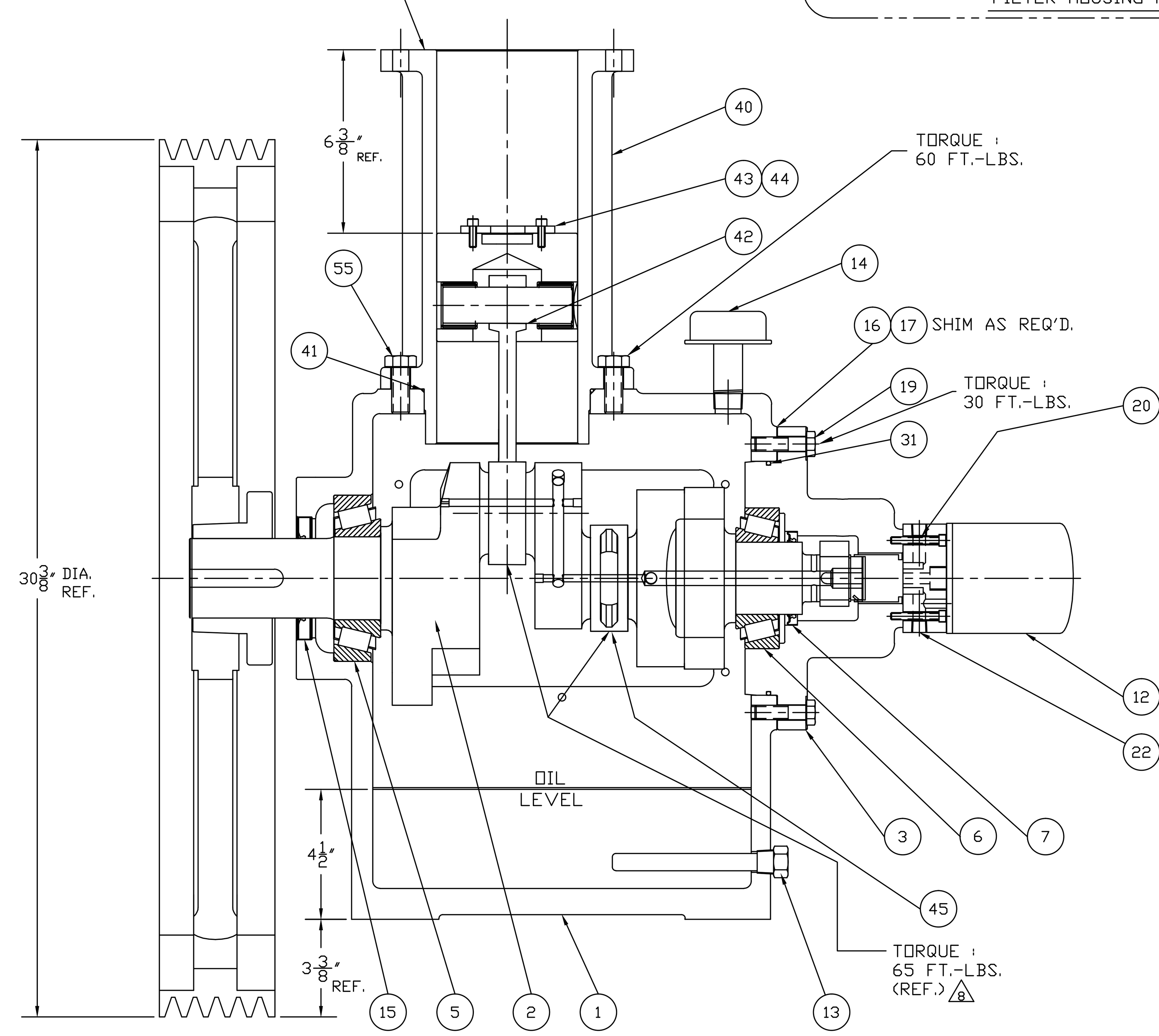
TITLE
HEAD ASSEMBLY
MODEL 4100 COMPRESSOR

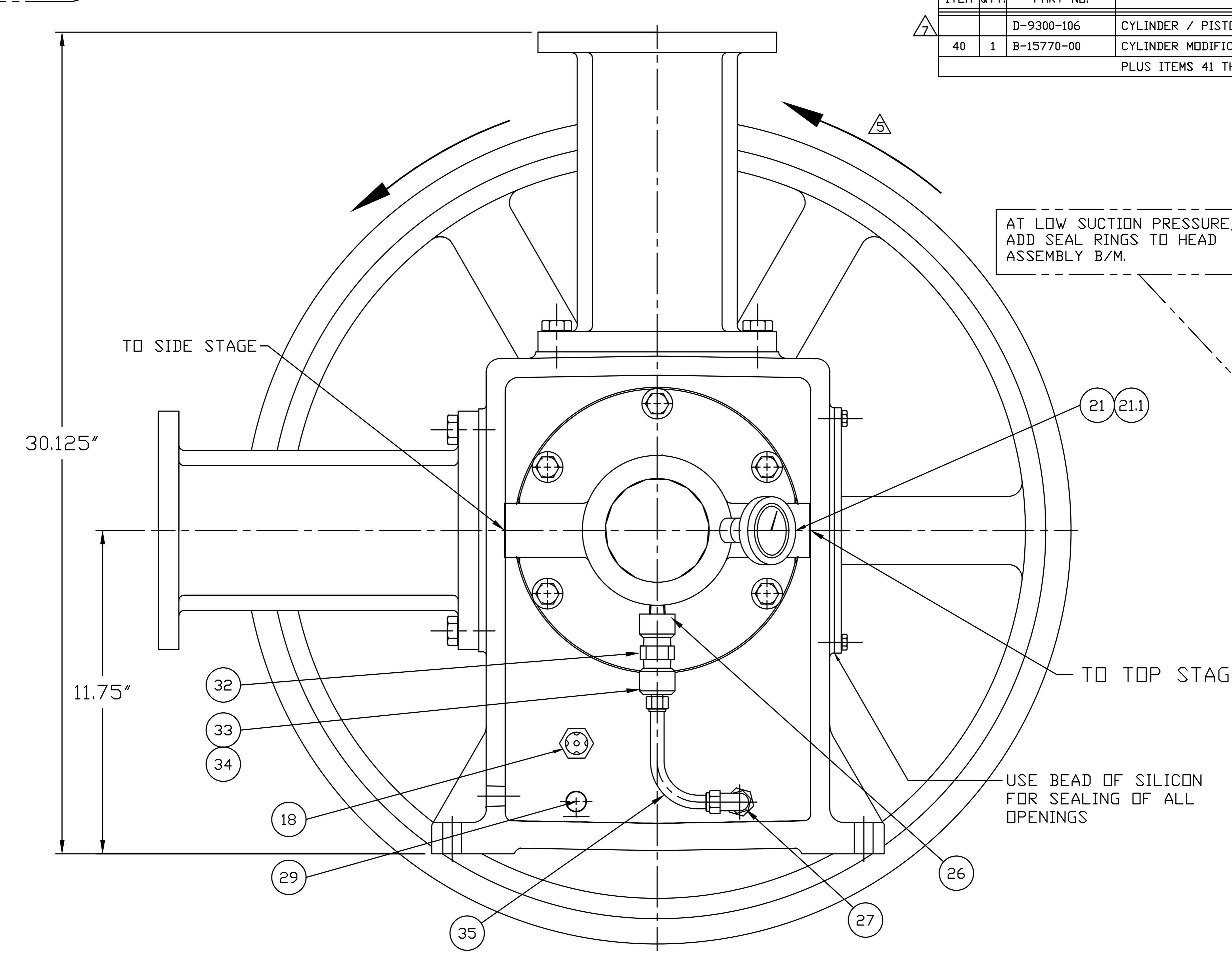
DATE 2/18/14	JOB M196	REL. CODE	DWG. NO.
BY MJS	ASSY. ------	.	D-12368-1
CH.	SCALE 7/8		
QA	PE	DATE	SHEET 1 OF 1

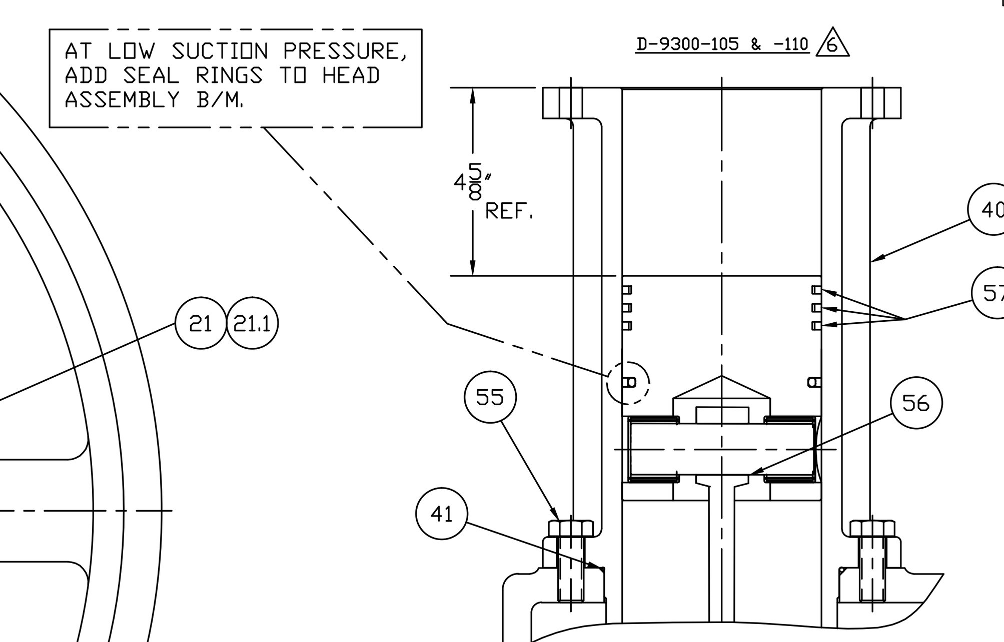












ITEM	QTY.	PART NO.	DESCRIPTION	MATERIAL
		D-9300-100	COMPRESSOR FRAME ASS'Y (CONSISTING OF:)	
1	1	D-9308-127-00	DRIVE CASE	DUCT. IRON 60-45-15
2	1	D-9306-300-00	CRANKSHAFT	DUCT. IRON 80-55-6
3	1	D-9310-127-00	PUMP FLANGE	DUCT. IRON 60-45-15
4	1	B-15554-324-00	ACCESS PLATE	CARBON STEEL
5	1	A-39455	TAPERED ROLLER BEARING	MANUF. STD.
6	1	A-39474	TAPERED ROLLER BEARING	MANUF. STD.
7	1	A-39468	SHAFT SEAL	MANUF. STD.
8	1	A-39530	FILTER HOUSING ASSEMBLY	
8.1	1	B-15559-287-00	FILTER HOUSING	LEDLOY
8.2	1	A-27039-129-02	SPRING	SPRING STEEL
8.3	1	A-39531-459-00	POPPET	RULON
8.4	1	A-39532-278-00	SEAT	MANUF. STD.
8.5	1	A-39469	NIPPLE,FILTER	MANUF. STD.
8.6	3	A-39541	DOWEL PIN (REF:5/32 DIA."X1/2"LG.)	MANUF. STD.
8.7	1	033-479	FILTER HOUSING O-RING	VITON, 75 DURO
9	1	A-36894	GEAR PUMP	
10	1	A-38752	SPRING,PUMP	
11	1	A-38850	TRANSFER BUSHING	
12	1	A-39460-00	FILTER	
13	1	A-39470	SUMP STRAINER, PLUG STYLE	MANUF. STD.
14	1	A-31653	BREATHER	MANUF. STD.
15	1	A-39462	SHAFT SEAL	MANUF. STD.
16	3	A-39463	SHIM	MYLAR
17	3	A-39464	SHIM	MYLAR
18	1	A-39466	SIGHT GLASS	MANUF. STD.
19	6	HHB.5-13X1.75	HEX. HD. CAPSCREW, 1/2"-13UNC-2A X 1 3/4" LG.	PLATED STEEL
20	6	SH.25-20X1.5	SHCS, 1/4"-20UNC-2A X 1-1/2" LG.	PLATED STEEL
21	1	A-31660	GAUGE	BRASS
21.1	1	A31670	GAUGE SNUBBER	BRASS
22	2	P.25P150STLNT	PLUG, 1/4" NPT(M)	
23	1	SEE CAM TABU.	ECCENTRIC (CAM)	
24	1	.50X.25X.875-012	KEY -1/2"x1/4"x7/8" LG.	
25	1	5100-150	SNAP RING	MANUF. STD.
26	1	SS-12-RA-4	REDUCING ADAPTER, 3/4" NPT(F) x 1/4" NPT(M)	316 SST.
27	1	SS-810-2-8	MALE ELBOW, 1/2" NPT X 1/2" TUBE	STAINLESS STEEL
28	1	.625 Q-012	KEY- 5/8" SQ.X 3 5/8" LG.	PLATED STEEL
29	5	P.50P150STLNT	HEX. PLUG, 1/2" NPT	STEEL
30	6	HHB.3125-18X.75	HEX. HD. CAPSCREW, 5/16"-18UNC-2A X 3/4" LG.	PLATED STEEL
31	1	265-479	O-RING	VITON, 70 DURO
32	1	A-40576	HYDRAULIC CHECK VALVE ASS'Y	STAINLESS STEEL
33	1	4464K529	REDUCING COUPLING, 3/4" NPT(F) x 1/2" NPT(F)	304 STAINLESS STEEL
34	1	SS-810-1-8-PPI	MALE CONNECTOR, 1/2" T x 1/2" NPT(M)	STAINLESS STEEL
35	24	YTF050X065DH	TUBING, 1/2" O.D. x .065" WALL x 24" LONG	316L SST.

ITEM	QTY.	PART NO.	DESCRIPTION	MATERIAL
		D-9300-101	CYLINDER / PISTON ASSEMBLY (CONSISTING OF)	
40	1	D-9307-127-00	CYLINDER	DUCT. IRON 60-45-15
41	1	161-479	O-RING	VITON, 70 DURO
42	1	B-15553-100	PISTON / CONN. ROD ASS'Y	
43	1	B-15605-035-00	PISTON ADAPTER PLATE	C-1045 STEEL
44	4	SH.3125-18X.75	SHCS, 5/16"-18UNC-2A X 3/4" LG.	PLATED STEEL
45	1	A-39467-00	ROD BEARINGS	MANUF. STD.
46	1	B-15981-100	4L INJECTION PUMP ASS,Y	
46.1	1	A-39537-287-00	INJECTOR SLEEVE	
46.2	1	A-39507	BUSHING	
46.3	1	N-5000-87-S	SNAP RING	
46.4	1	B-15120-07	INJECTOR ASS'Y	MANUF. STD.
46.5	1	A-39538	SPRING	
46.6	1	B-15120-21	SPRING SUPPORT	MANUF. STD.
46.7	1	024-479	O-RING	VITON, 70 DURO
46.8	1	N-5000-125-S	SNAP RING	MANUF. STD.
54	1	A39533-100	HYDRAULIC CHECK VALVE	
55	4	SH.625-11X1.75-ALSTL	SHCS, 5/8"-11UNC-2A X 1 3/4" LG.	

ITEM	QTY.	PART NO.	DESCRIPTION	MATERIAL
		D-9300-102	CYLINDER / PISTON ASSEMBLY (CONSISTING OF)	
40	1	D-9557-127-02	CYLINDER (6-1/2" BORE)	DUCT. IRON 60-45-15
			PLUS ITEMS 41 THRU 55 AS SHOWN ABOVE	

ITEM	QTY.	PART NO.	DESCRIPTION	MATERIAL
		D-9300-103	CYLINDER / PISTON ASSEMBLY (CONSISTING OF)	
40	1	D-9557-127-01	CYLINDER (5-3/4" BORE)	DUCT. IRON 60-45-15
			PLUS ITEMS 41 THRU 55 AS SHOWN ABOVE	

ITEM	QTY.	PART NO.	DESCRIPTION	MATERIAL
		D-9300-104	CYLINDER / PISTON ASSEMBLY (CONSISTING OF)	
40	1	D-9557-127-03	CYLINDER (7-1/2" BORE)	DUCT. IRON 60-45-15
			PLUS ITEMS 41 THRU 55 AS SHOWN ABOVE	

ITEM	QTY.	PART NO.	DESCRIPTION	MATERIAL
		D-9300-105	CYLINDER / PISTON ASSEMBLY (CONSISTING OF)	
40	1	D-9307-127-02	CYLINDER (4 7/8" BORE)	DUCT. IRON 60-45-15
41	1	161-479	"O"-RING	VITON, 70 DURO
			PLUS ITEMS 45 THRU 55 AS SHOWN ABOVE	
56	1	B-15969-100	PISTON / CONNECTING ROD ASSEMBLY	
57	3	B-10962-052-19	PISTON RINGS	CAST IRON
58	1	PS1400-78	PISTON SEAL (MAXX HYDRAULIC)	PTFE/RUBBER

ITEM	QTY.	PART NO.	DESCRIPTION	MATERIAL
		D-9300-106	CYLINDER / PISTON ASSEMBLY (CONSISTING OF)	
40	1	B-15770-00	CYLINDER MODIFICATION	DUCT. IRON 60-45-15
			PLUS ITEMS 41 THRU 55 AS SHOWN ABOVE	

ITEM	QTY.	PART NO.	DESCRIPTION	MATERIAL
		D-9300-107	CYLINDER / PISTON ASSEMBLY (CONSISTING OF)	
40	1	B-15770-00	CYLINDER MODIFICATION	DUCT. IRON 60-45-15
41	1	161-479	O-RING	VITON, 70 DURO
42	1	D-9846-100	PISTON / CONN. ROD ASSY. (JOURNAL BEARINGS)	
			PLUS ITEMS 43 THRU 55 AS SHOWN ABOVE	

ITEM	QTY.	PART NO.	DESCRIPTION	MATERIAL
		D-9300-108	CYLINDER / PISTON ASSEMBLY (CONSISTING OF)	
40	1	D-9307-127-00	CYLINDER	DUCT. IRON 60-45-15
41	1	161-479	O-RING	VITON, 70 DURO
42	1	D-9846-100	PISTON / CONN. ROD ASSY. (JOURNAL BEARINGS)	
			PLUS ITEMS 43 THRU 55 AS SHOWN ABOVE	

ITEM	QTY.	PART NO.	DESCRIPTION	MATERIAL
		D-9300-109	CYLINDER / PISTON ASSEMBLY (CONSISTING OF)	
40	1	D-9557-127-03	CYLINDER (FOR 7 1/2" BORE)	DUCT. IRON 60-45-15
41	1	161-479	O-RING	VITON, 70 DURO
42	1	D-9846-100	PISTON / CONN. ROD ASSY. (JOURNAL BEARINGS)	
			PLUS ITEMS 43 THRU 55 AS SHOWN ABOVE	

ITEM	QTY.	PART NO.	DESCRIPTION	MATERIAL
		D-9300-110	CYLINDER / PISTON ASSEMBLY (CONSISTING OF)	
40	1	D-9307-127-02	CYLINDER (4 7/8" BORE)	DUCT. IRON 60-45-15
41	1	161-479	"O"-RING	VITON, 70 DURO
			PLUS ITEMS 45 THRU 55 AS SHOWN ABOVE	
56	1	D-10373-100	PISTON / CONN. ROD ASS'Y (JOURNAL BEARINGS)	
57	3	B-10962-052-19	PISTON RINGS	CAST IRON
58	1	PS1400-78	PISTON SEAL (MAXX HYDRAULIC)	PTFE/RUBBER

ITEM	QTY.	PART NO.	DESCRIPTION	MATERIAL
		D-9300-111	CYLINDER / PISTON ASSEMBLY (CONSISTING OF)	
40	1	D-9557-127-02	CYLINDER (6-1/2" BORE)	DUCT. IRON 60-45-15
41	1	161-479	O-RING	VITON, 70 DURO
42	1	D-9846-100	PISTON / CONN. ROD ASSY. (JOURNAL BEARINGS)	
			PLUS ITEMS 43 THRU 55 AS SHOWN ABOVE	

ITEM	QTY.	PART NO.	DESCRIPTION	MATERIAL
		D-9300-112	CYLINDER / PISTON ASSEMBLY (CONSISTING OF)	
40	1	D-9557-127-01	CYLINDER (5 3/4" BORE)	DUCT. IRON 60-45-15
41	1	161-479	O-RING	VITON, 70 DURO
42	1	D-9846-100	PISTON / CONN. ROD ASSY. (JOURNAL BEARINGS)	
			PLUS ITEMS 43 THRU 55 AS SHOWN ABOVE	

ITEM	QTY.	PART NO.	DESCRIPTION	MATERIAL
		D9300-200	COMPRESSOR FRAME ASSEMBLY (CONSISTING OF:)	
			SAME AS D9300-100 EXCEPT THE ITEMS BELOW	
27	1	19-793	MALE ELBOW, 1/2" T x 1/2" NPT(M) (GYROLOK)	STAINLESS STEEL
34	1	19-776	MALE CONNECTOR, 1/2" T x 1/2" NPT(M) (GYROLOK)	STAINLESS STEEL

ASSEMBLY NO.	CAM, ITEM 23
D-9300-100	A39576-102
D-9300-100-062	A39576-101

SPECIFICATIONS

SINGLE STAGE COMPR. WT. = 615 LB.
TWO STAGE COMPR. WT. = 700 LB.
INCLUDING FLYWHEEL

NOTE:
REFER TO DWG. A-39755 FOR ASSEMBLY PROCEDURE

DYNAMIC LOAD :

SINGLE STAGE
MAX. HORIZONTAL - 166 LBS. [75. 3 KGS.]
MAX. VERTICAL - 81 LBS. [36. 7 KGS.]

TWO STAGE
MAX. HORIZONTAL -
MAX. VERTICAL -

REV	DATE	DESCRIPTION	BY	QA	PE
16	6/8/09	ADDED ITEM 21.1 GAUGE SNUBBER	PLM		
15	8/7/08	ITEM 12 WAS A-39460 FILTER	VMM		
14	1/2/08	ITEM 8.1 WAS B-15559-260, ALUM	TM		
13	12/22/06	13.1 ITEM 26 WAS (1) B-810-2-4 MALE CONN. 13.2 ITEM 27 WAS (1) SS-810-1-8 MALE CONN. 13.3 ADDED ITEMS 32 & 33	TM		
12	1/5/05	ADDED OPTION -109	VMM		
11	9/16/04	ADDED CAM TABULATION	GH		
10	11/24/03	ADDED OPTION -107 AND -108	VMM		
9	11-3-03	ADDED OPTION -106	ARS		
8	10-13-03	ITEM # 43 WAS B-14924-324-00	ARS		
7		REVISED INJEC. ASS'Y	JPD		
6		ADDED OPTION -105	TM		
5		REF. ECN #962	JPD		
4		ADDED ITEM 31	GH		
3		GENERAL REVISION	JPD		
2		REVISED CAM ASSEMBLY ITEM 23	JPD		
1		GENERAL REVISION	JPD		

ECCN 2B999

NOTICE

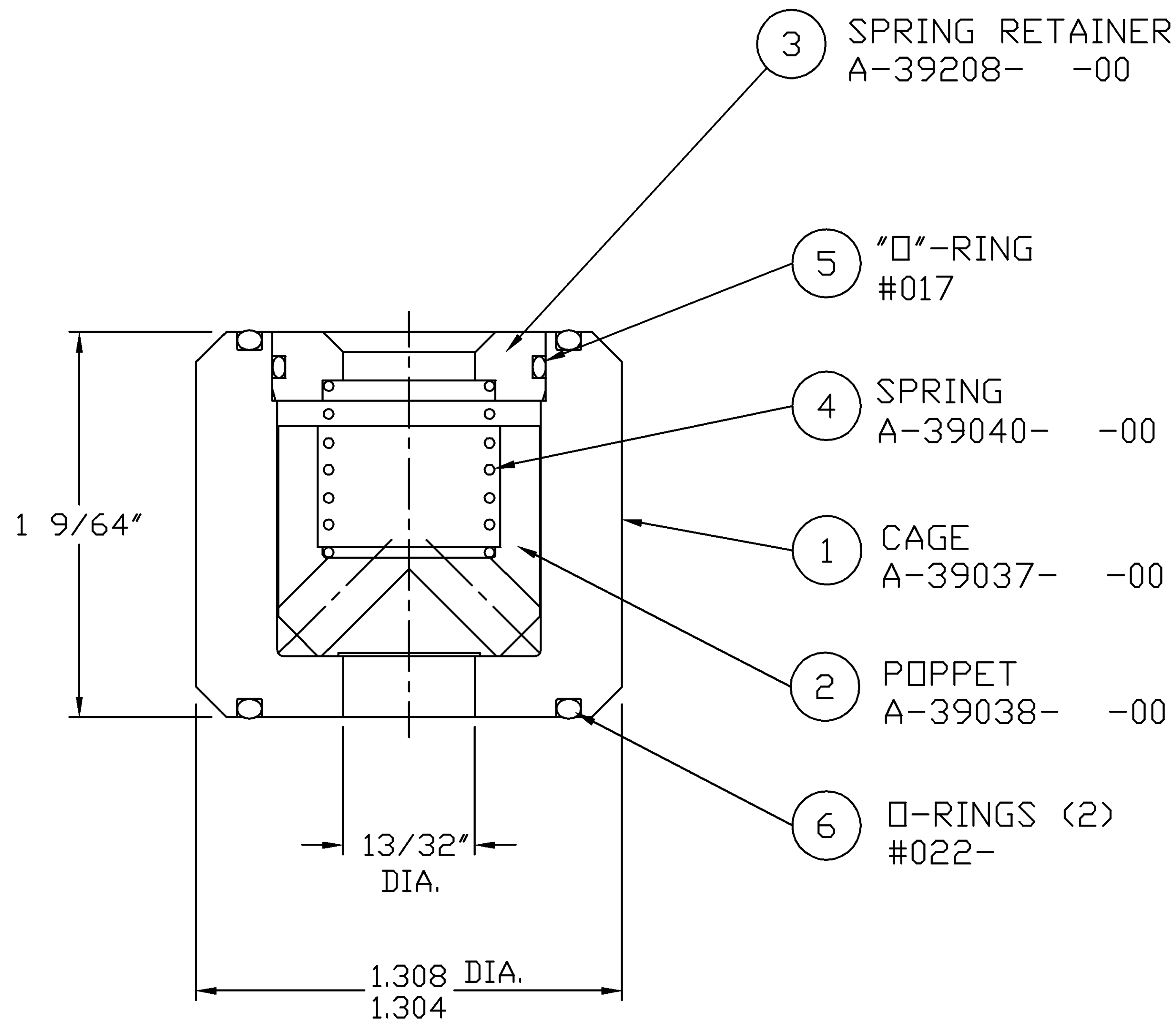
REF. DWG.

U.O.N.
FINISH 65
BREAK ALL SHARP CORNERS
TOL. FRAC. 1/64" ANG. 2°
CONCENTRICITY .005" T.I.R.
INSIDE CORNERS .015 RAD.

PRESSURE PRODUCTS INDUSTRIES
MILTON ROY

TITLE
COMPRESSOR BASE ASSEMBLY MODEL 4L SERIES

DATE 4/2/01	JOB STD.	REL. CODE	DWG. NO.
BY GH	ASSY. ----		D-9300-16
CH.	SCALE 1/4		
QA	PE	DATE	SHEET 1 OF 1



ORIFICE ...... .406 DIA.
FLOW AREA ..... .130 IN.^{2}
LIFT .... .087"
CLEARANCE VOLUMES:
SUCTION VALVE .... .17 IN.^{3}
DISCH. VALVE ..... .024 IN.^{3}

* CHEM. TEST REPORTS REQ'D
** CHEM. & PHYS. TEST REPORTS REQ'D

	- ITEM NO. MATERIAL CODES -					
ASS'Y NO.	1	2	3	4	5	6
B-15312-100	156	501 ⚠1	001	063	479	479
B-15312-101	001	501	001	063	479	479
B-15312-102	156	501	001	063	680	680
B-15312-103	001	501	001	063	450	450
B-15312-104	156	501	001	063	450	450
B-15312-105	156	501	001	063	477	477
B-15312-106	156	470	001	063	479	479
B-15312-107						
B-15312-108						
B-15312-109						

REV	DATE	DESCRIPTION	BY	QA	PE
1	1/11/00	MATERIAL FOR ITEM #2 WAS CODE -470-	GH		

NOTICE

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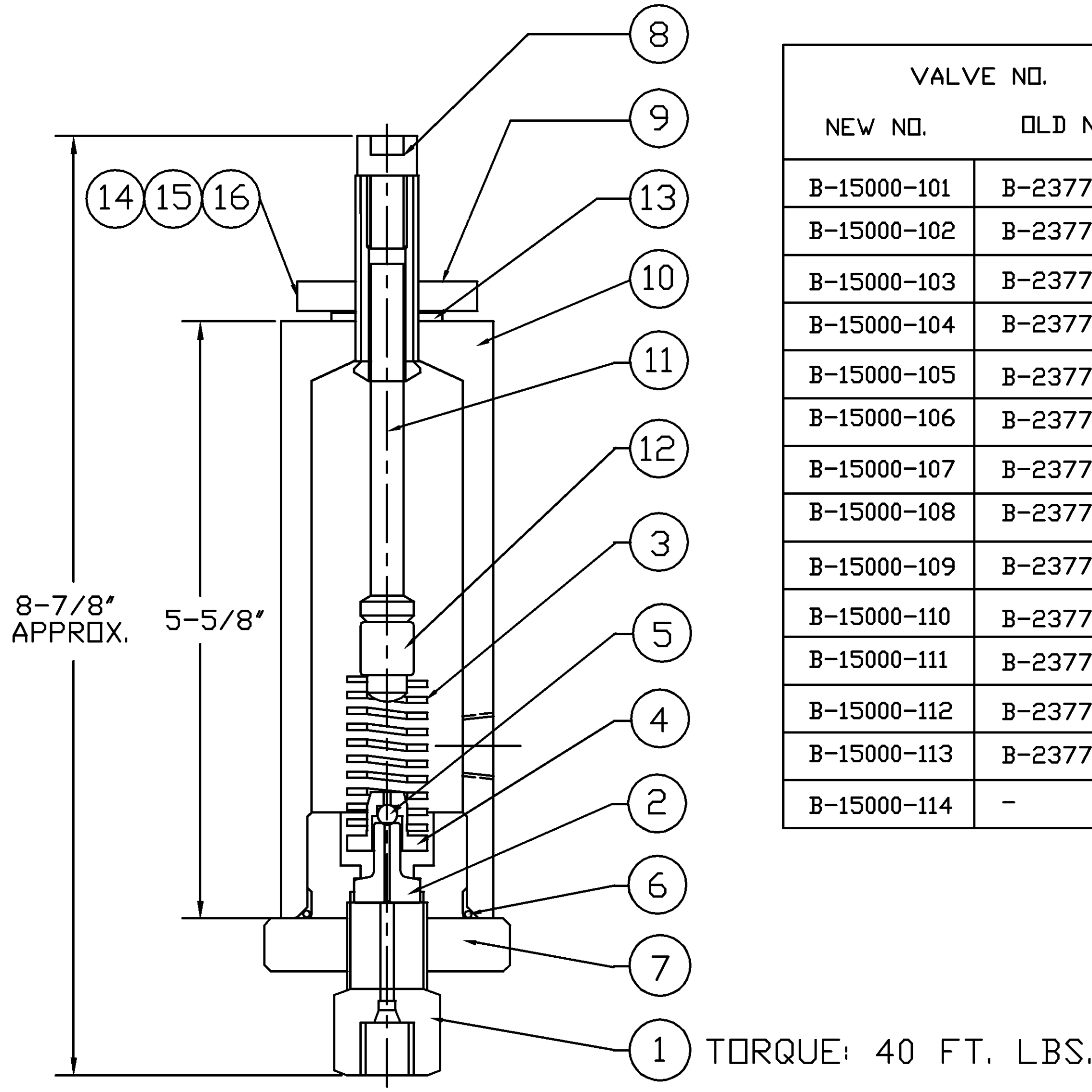
FINISH ✓
BREAK ALL SHARP CORNERS
TOL.
FRAC. ±
ANG. ±
CONCENTRICITY
T.I.R.
INSIDE CORNERS
RAD.

PRESSURE PRODUCTS INDUSTRIES, INC.
900 LOUIS DRIVE * WARMINSTER, PA 18974 USA

TITLE
CHECK VALVE ASSEMBLY
13/32"Ø ORIFICE

DATE 2/2/99 | JOB STANDARD | REL. CODE | DWG. NO. B-15312-1
BY JJS | ASSY. ------
CH. | SCALE N.T.S.
QA | PE | DATE | SHEET 1 OF 1



VALVE NO. NEW NO.	OLD NO.	MAX PSI PRESSURE	SPRING RATE LBS/IN	SEAT NUT 316 S.S HD ITEM 1	SEAT (17-4 PH SS, 40-45 Rc) ITEM 2	CONNECTION	SPRING NO. ITEM 3	SPRING CAP 416 S.S. ITEM 4	BALL DIA. CARBIDE ITEM 5
B-15000-101	B-2377-101	1,200	60	A-26532-01	B-7401-156-02	1/4 HP	A-31616	A-5466	3/16
B-15000-102	B-2377-102	1,200	60	A-26532-02	B-7401-156-02	3/8 HP	A-31616	A-5466	3/16
B-15000-103	B-2377-103	4,000	120	A-26532-01	B-7401-156-02	1/4 HP	A-31617	A-5466	3/16
B-15000-104	B-2377-104	4,000	120	A-26532-02	B-7401-156-02	3/8 HP	A-31617	A-5466	3/16
B-15000-105	B-2377-105	6,000	175	A-26532-01	B-7401-156-02	1/4 HP	A-31620	A-5466	3/16
B-15000-106	B-2377-106	6,000	175	A-26532-02	B-7401-156-02	3/8 HP	A-31620	A-5466	3/16
B-15000-107	B-2377-107	25,000	770	A-26532-01	B-7401-156-02	1/4 HP	A-31621	A-5466	3/16
B-15000-108	B-2377-108	25,000	770	A-26532-02	B-7401-156-02	3/8 HP	A-31621	A-5466	3/16
B-15000-109	B-2377-109	55,000	770	A-26532-01	B-7401-156-01	1/4 HP	A-31621	A-5467	1/8
B-15000-110	B-2377-110	55,000	770	A-26532-02	B-7401-156-01	3/8 HP	A-31621	A-5467	1/8
B-15000-111	B-2377-111	35,000	310	A-26532-01	B-7401-156-01	1/4 HP	A-31622	A-5467	1/8
B-15000-112	B-2377-112	35,000	310	A-26532-02	B-7401-156-01	3/8 HP	A-31622	A-5467	1/8
B-15000-113	B-2377-113	12,000	310	A-26532-02	B-7401-156-02	3/8 HP	A-31622	A-5466	3/16
B-15000-114	-	12,000	310	A-26532-02	B-7401-156-02	3/8 HP	A-31622	A-5466	3/16

NOTES :

1 - REPLACE LOCK COLLAR SET SCREW WITH ITEM #11. SLIDE WIRE THRU SCREW & INSERT WARNING TAG, ITEM #15 & ALLEN WRENCH, ITEM #17 (BE SURE WIRE IS LONG ENOUGH TO USE WRENCH) LOCK SEAL (WITH PPI LOGO) AFTER SETTING VALVE

ITEM	QTY.	PART NO.	DESCRIPTION	MATERIAL
6	1	126-468	"O"-RING	BUNA-N
7	1	B-15079-287-00	END PLUG	304 SS
8	1	B-15078-100	ADJUSTING NUT	ALLOY STEEL
9	1	A-38880	SHAFT COLLAR (LOCK NUT)	ALLOY STEEL
10	1	B-8524-287-00	BODY	LEADLOY
11	1	A-28364-069-00	STEM	410 S.S.
12	1	A-38881	SPACER	ALLOY STEEL
13	1	A-39581	THREAD SEAL	
14	1	93235A244	SET SCREW	ALLOY STEEL
15	1	A-40684	WARNING TAG	
16	1	A&T STOCK	WIRE WITH LEAD SEAL	COPPER/LEAD
17	1	A-41064-00	5/16" ALLEN WRENCH	ALLOY STEEL

REV	DATE	DESCRIPTION	BY	QA	PE
4	8/12/08	ADDED ALLEN WRENCH TO NOTE, ADDED ITEM #17	MJS		
3	1/8/07	ADDED NOTE #1, ADDED ITEMS 14, 15, 16	VMM		
2	8/08/03	MODIFIED OPT.#114 ITEM #2 WAS B-15854-01	JPD		
1	10/11/01	ADDED ITEM # 13	JPD		

U.O.N.

FINISH ✓

BREAK ALL SHARP CORNERS

TOL. FRAC. ± ANG. ±

CONCENTRICITY T.I.R.

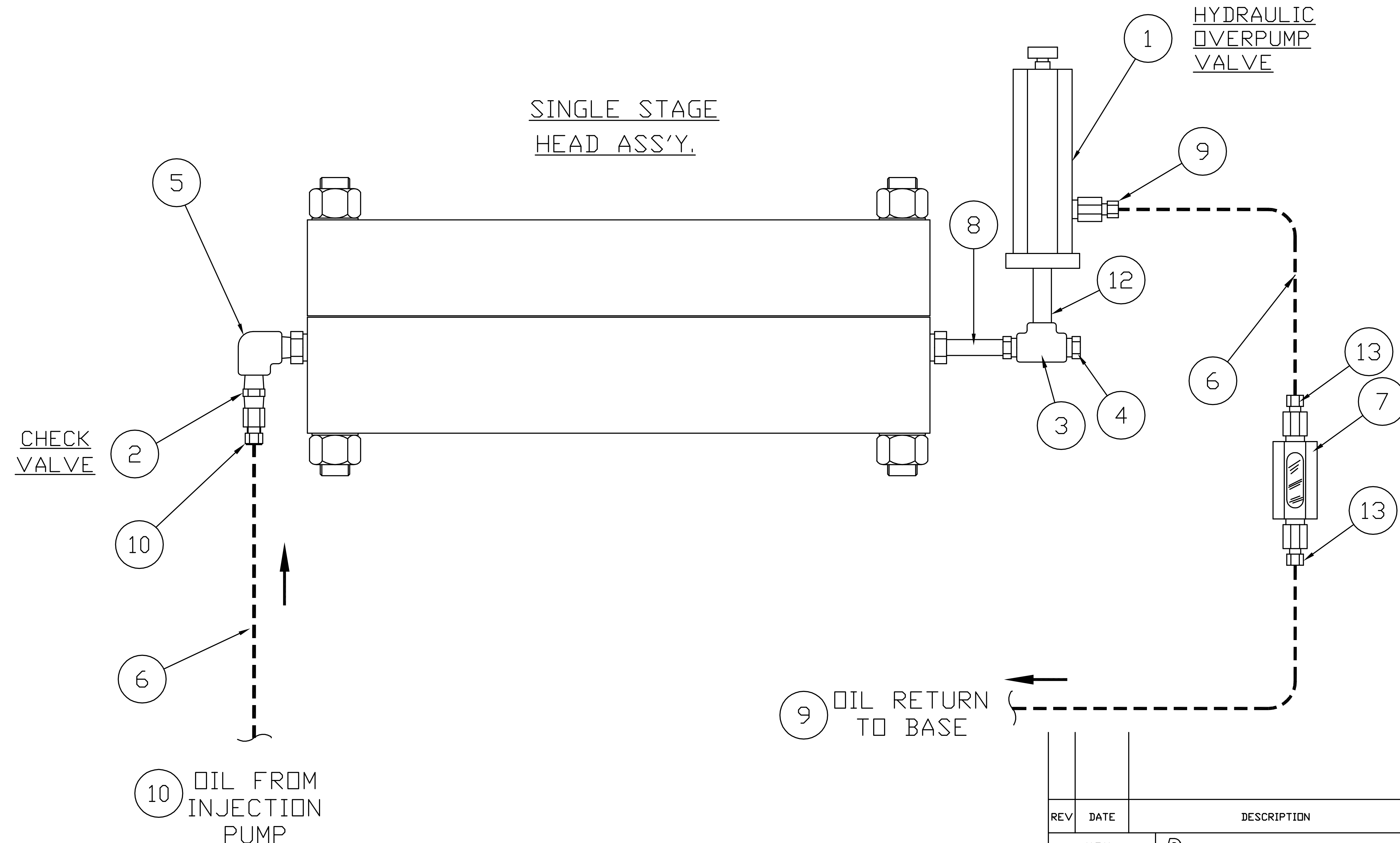
INSIDE CORNERS RAD.

PRESSURE PRODUCTS INDUSTRIES, INC.

900 LOUIS DRIVE * WARMINSTER, PA 18974 USA

TITLE: HYDRAULIC OVER-PUMP VALVE ASSEMBLY

DATE 7/1/98	JOB STANDARD	REL. CODE	DWG. NO. B-15000-4
BY JJS	ASSY. ------		
CH.	SCALE N.T.S.		
QA	PE	DATE	SHEET 1 OF 1



REV	DATE	DESCRIPTION	BY	QA	PE

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REF. DWG. B-15813

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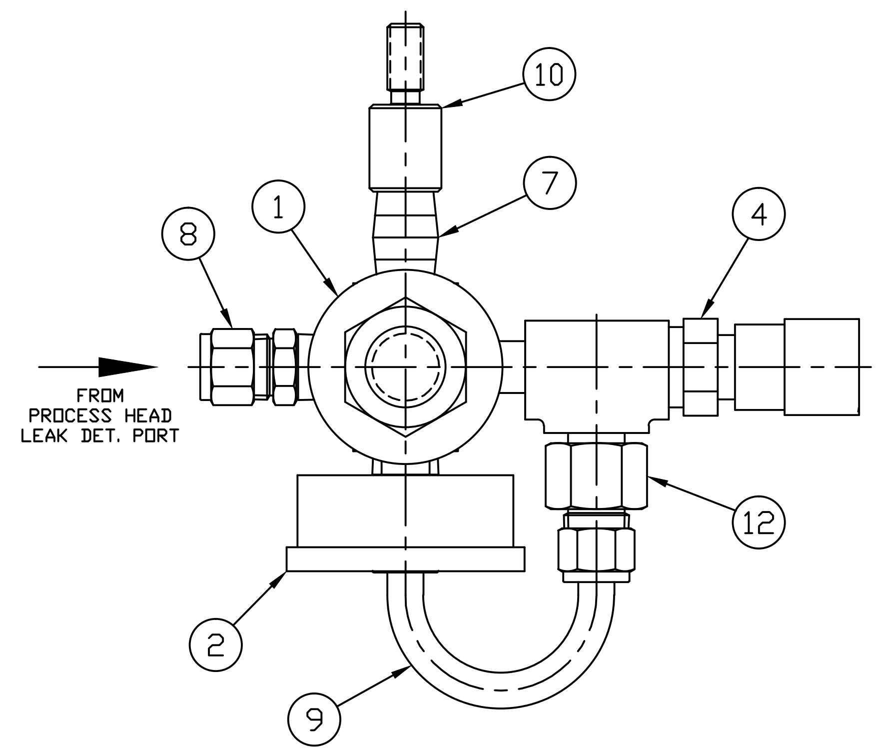
BREAK ALL SHARP CORNERS
TOL. FRAC. ± ANG. ±
CONCENTRICITY T.I.R.
INSIDE CORNERS RAD.

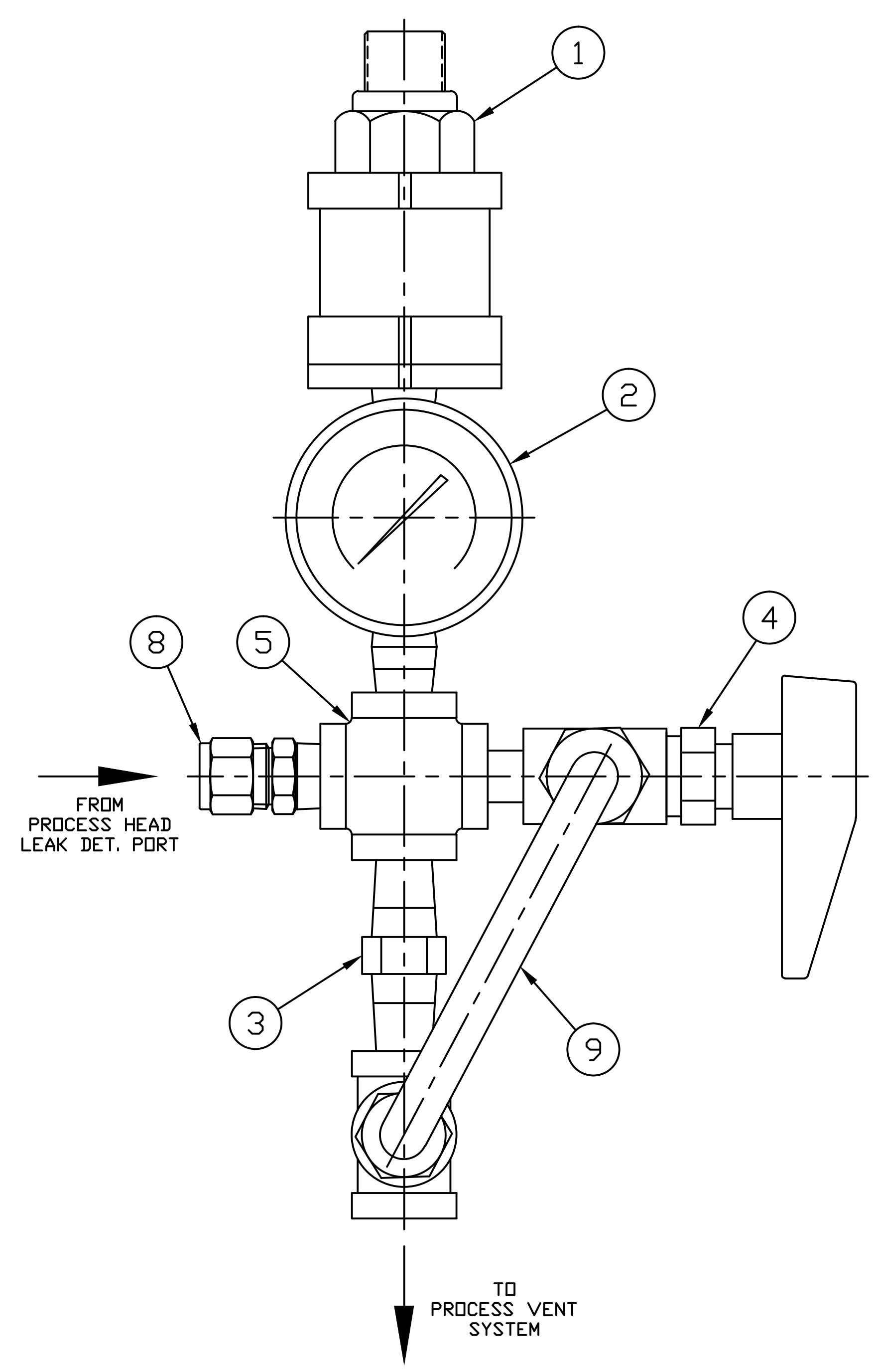
PRESSURE PRODUCTS INDUSTRIES, INC.
900 LOUIS DRIVE * WARMINSTER, PA 18974 USA

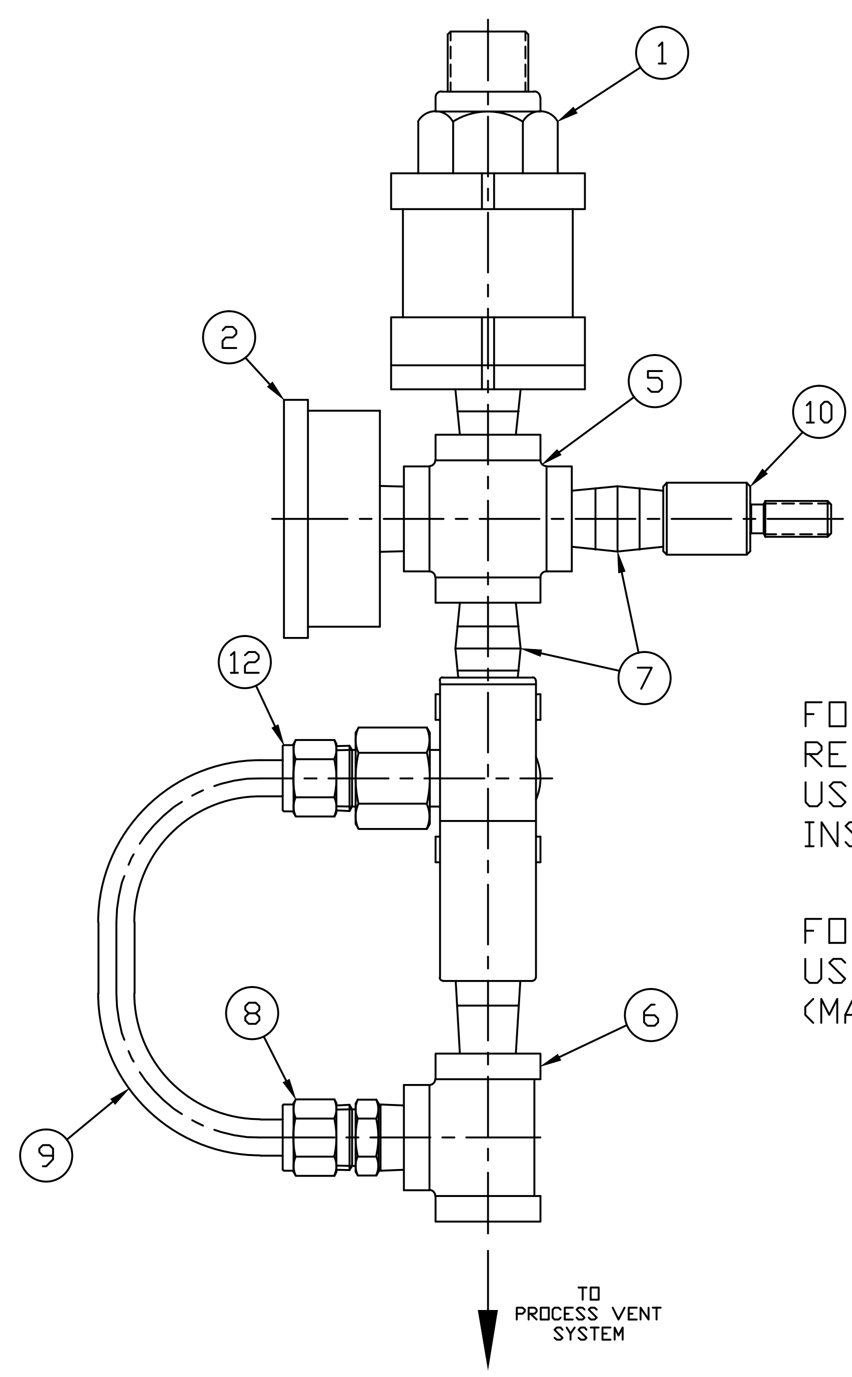
TITLE
HYDRAULIC SYSTEM SCHEMATIC
SINGLE STAGE COMPRESSOR

DATE 8/10/15	JOB STANDARD	REL. CODE	DWG. NO. B-18200-0
BY PLM	ASSY. ------		
CH.	SCALE NONE		
QA	PE	DATE	SHEET 1 OF 1

ASSEMBLY No.	(1) PRESSURE SWITCH	(2) PRESSURE GAUGE	(3) CHECK VALVE	(4) BLOWDOWN VALVE	(5) PIPE CROSS	(6) PIPE TEE	(7) PIPE NIPPLE	(8) MALE CONNECTOR	(9) TUBE	(10) MOUNTING STUD	(11) PIPE NIPPLE	(12) FEMALE CONNECTOR
C11700-100 (STANDARD)	A31634	187-0-30PSIDS	SS-4CP2-25	SS-1GM4-A	P.25C304150NT (2) REQUIRED	P.25T304150NT	SS-4-HN (2) REQUIRED	19-272 (2) REQUIRED	YTF025X065DH 12" REQUIRED	A41638-001-00	SS-4-HLN-3.00	19-282
C11700-101 (W/O SWITCH)	SEE KIT B.O.M.	187-0-30PSIDS	SS-4CP2-25	SS-1GM4-A	P.25C304150NT (2) REQUIRED	P.25T304150NT	SS-4-HN (2) REQUIRED	19-272 (3) REQUIRED	YTF025X065DH 12" REQUIRED	A41638-001-00	SS-4-HLN-3.00	19-282
C11700-102 (W/O GAUGE)	A31634	SEE KIT B.O.M.	SS-4CP2-25	SS-1GM4-A	P.25C304150NT (2) REQUIRED	P.25T304150NT	SS-4-HN (2) REQUIRED	19-272 (3) REQUIRED	YTF025X065DH 12" REQUIRED	A41638-001-00	SS-4-HLN-3.00	19-282
C11700-103 (HARDWARE ONLY)	SEE KIT B.O.M.	SEE KIT B.O.M.	SS-4CP2-25	SS-1GM4-A	P.25C304150NT (2) REQUIRED	P.25T304150NT	SS-4-HN (2) REQUIRED	19-272 (4) REQUIRED	YTF025X065DH 12" REQUIRED	A41638-001-00	SS-4-HLN-3.00	19-282
C11700-201 (W/O SWITCH)	SEE KIT B.O.M.	187-0-30PSIDS	SS-4CP2-25	SS-1GM4-A	P.25C304150NT (2) REQUIRED	P.25T304150NT	SS-4-HN (2) REQUIRED	4CM4-316 (3) REQUIRED (HOKE GYROLOK)	YTF025X065DH 12" REQUIRED	A41638-001-00	SS-4-HLN-3.00	4CF4-316 (HOKE GYROLOK)







FOR UNITS WITHOUT SWITCH OR GAUGE
REPLACE WITH ITEM #8 (MALE CONN.) &
USE 1/4" TUBING TO CONNECT WITH REMOTE
INSTRUMENT LISTED ON KIT BILL OF MATERIAL

FOR UNITS MOUNTED DIRECTLY TO HEAD ASSEMBLY
USE ITEM #11 (NIPPLE) IN PLACE OF ITEM #8
(MALE CONNECTOR)

REV	DATE	DESCRIPTION	BY	QA	PE
1	7/13/15	DELETED (1) ITEM #8 FROM EACH OPTION ADDED ITEMS #11 & #12	mgs		

ECCN EAR99

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REF. DWG. D-6692

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U.O.N.
FINISH ✓
BREAK ALL SHARP CORNERS
TOL. FRAC. ± ANG. ±
CONCENTRICITY T.I.R.
INSIDE CORNERS RAD.

PPI PRESSURE PRODUCTS INDUSTRIES MILTON ROY

TITLE STANDARD LEAK DETECTION SYSTEM

DATE 9/16/14 | JOB STANDARD | REL. CODE .
BY mgs | ASSY. ------
CH. | SCALE NONE
QA | PE | DATE

DWG. NO. C-11700-1

SHEET 1 OF 1

VENDOR DATA

A MEMBER OF THE ABB GROUP

Product Information Packet

SUNDYNE LLC

L3912T

15HP,1760RPM,1PH,60HZ,256T,3956LC,TEFC,F

Part Detail							
Revision:	V	Status:	PRD/A	Change #:		Proprietary:	No
Type:	AC	Prod. Type:	3956LC	Elec. Spec:	39WGX522	CD Diagram:	CD1084
Enclosure:	TEFC	Mfg Plant:		Mech. Spec:	39T044	Layout:	39LYT044
Frame:	256T	Mounting:	F1	Poles:	04	Created Date:	04-20-2006
Base:	RG	Rotation:	R	Insulation:	F	Eff. Date:	03-19-2015
Leads:	2#6 A PH,2#12 B PH					Replaced By:	
Literature:		Elec. Diagram:					

Nameplate NP1256L							
CAT.NO.	L3912T						
SPEC.	39T044X522G1						
HP	15						
VOLTS	208-230						
AMP	66-58						
RPM	1725						
FRAME	256T	HZ	60	PH	1		
SER.F.	1.00	CODE	E	DES	L	CLASS	F
NEMA-NOM-EFF	86.5	PF	96				
RATING	40C AMB-CONT						
CC		USABLE AT 208V					
DE	6309	ODE	6307				
ENCL	TEFC	SN					

Parts List

Part Number	Description	Quantity
SA141806	SA 39T044X522G1	1.000 EA
RA131139	RA 39T044X522G1	1.000 EA
OC3050F09SP	CYL OIL CAP 50MFD/370V	2.000 EA
RE0045A00	RELAY, 25 AMP	1.000 EA
EC1216C06SP	ELEC CAP, 216-259 MFD, 250V, 2.06D X 4.	4.000 EA
37CB3804A43	CONDUIT BOX MACH.	1.000 EA
37GS3015	GASKET, CAPAC BOX	1.000 EA
51XW2520A12	.25-20 X .75, TAPTITE II, HEX WSHR SLTD	4.000 EA
HA6003A47	CAPAC CLAMP	1.000 EA
HA7419	SPL BRACKET FOR MTG. CONTACT TO SINGLE P	1.000 EA
51XW1032A06	10-32 X .38, TAPTITE II, HEX WSHR SLTD S	7.000 EA
HA6003A45	CAPAC CLAMP - CLIP (WHITE ZINC PLATED)	2.000 EA
51XB1016A08	10-16X 1/2HXWSSLD SERTYB	2.000 EA
WD1000D90	T&B RC2577FM,90 DEG INSUL. FLAG TERMINAL	2.000 EA
WD1000A03	41531 AMP FLG.TERM,4M/REEL(2.5MIL)	30.000 EA
WD1000D101	T&B #C10-250A,12-10 GA.,RT ANG FLAG TERM	1.000 EA
39EP1100A21	SPL FREP ENCL TEFC W/STATIONARY SWITCH M	1.000 EA
HA4051A00	PLASTIC CAP FOR GREASE FITTING	1.000 EA
SP5165	MODEL 39 DOUBLE ARM STATIONARY SWITCH	1.000 EA
51XW0832A07	8-32 X .44, TAPTITE II, HEX WSHR SLTD SE	1.000 EA
NS2605	SWITCH INSULATOR 09 FRAME	1.000 EA
HW5100A08	W3118-035 WVY WSHR (WB)	1.000 EA
10XN2520K28	1/4-20 X 1.75" HX HD SCRWGRADE 5, ZINC P	4.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	4.000 EA

Parts List (continued)

Part Number	Description	Quantity
39EP1101A02	STD PU EP-ENCL-TEFC	1.000 EA
HA4051A00	PLASTIC CAP FOR GREASE FITTING	1.000 EA
HA3154A05	THRUBOLT STUD 3/8-16 X 16.875	4.000 EA
XY3816A12	3/8-16 FINISHED NUT	8.000 EA
09FH4000A08	FAN COVER, STAMPED	1.000 EA
HA2001B08	SPL SPACER FOR AIR DEFLECTOR .50 O.D. X	3.000 EA
10XN2520K16	1/4-20 X 1" HX HD SCRW GRADE 5, ZINC P	3.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	3.000 EA
37CB4509	CAPAC BOX LID, STAMPED	1.000 EA
37GS3016	GASKET, CAPAC BOX LID	1.000 EA
51XW0832A07	8-32 X .44, TAPTITE II, HEX WSHR SLTD SE	6.000 EA
HW2501G25	KEY, 3/8 SQ X 2.875	1.000 EA
LB1115N	LABEL,LIFTING DEVICE (ON ROLLS)	1.000 EA
MN416A01	TAG-INSTAL-MAINT no wire (1200/bx) 11/14	1.000 EA
HW4500A03	GREASE FITTING, .125 NPT 1610(ALEMITE) 8	1.000 EA
HW4500A17	317400 ALEMITE GREASE RELIEF	1.000 EA
MJ1000A75	GREASE, POLYREX EM EXXON (USe 4824-15A)	0.030 LB
HW4500A03	GREASE FITTING, .125 NPT 1610(ALEMITE) 8	1.000 EA
HW4500A17	317400 ALEMITE GREASE RELIEF	1.000 EA
09FN2001A02	EXTERNAL FAN, MACH	1.000 EA
80XN3816A08	3/8-16X1/2 SET SCREW SAME A	1.000 EA
MG1000G27	MED CHARCOAL METALLIC GREY	0.050 GA
85XU0407S04	4X1/4 U DRIVE PIN STAINLESS	2.000 EA
LC0017	CONN LABEL-1 PHASE-SINGLE VOLT-REV ROTNO	1.000 EA

LB1119N	WARNING LABEL	1.000 EA
NP1256L	ALUM UL CSA CC	1.000 EA
40PA1000	PACKAGING GROUP	1.000 EA

AC Induction Motor Performance Data
Record # 49675 - Typical performance - not guaranteed values

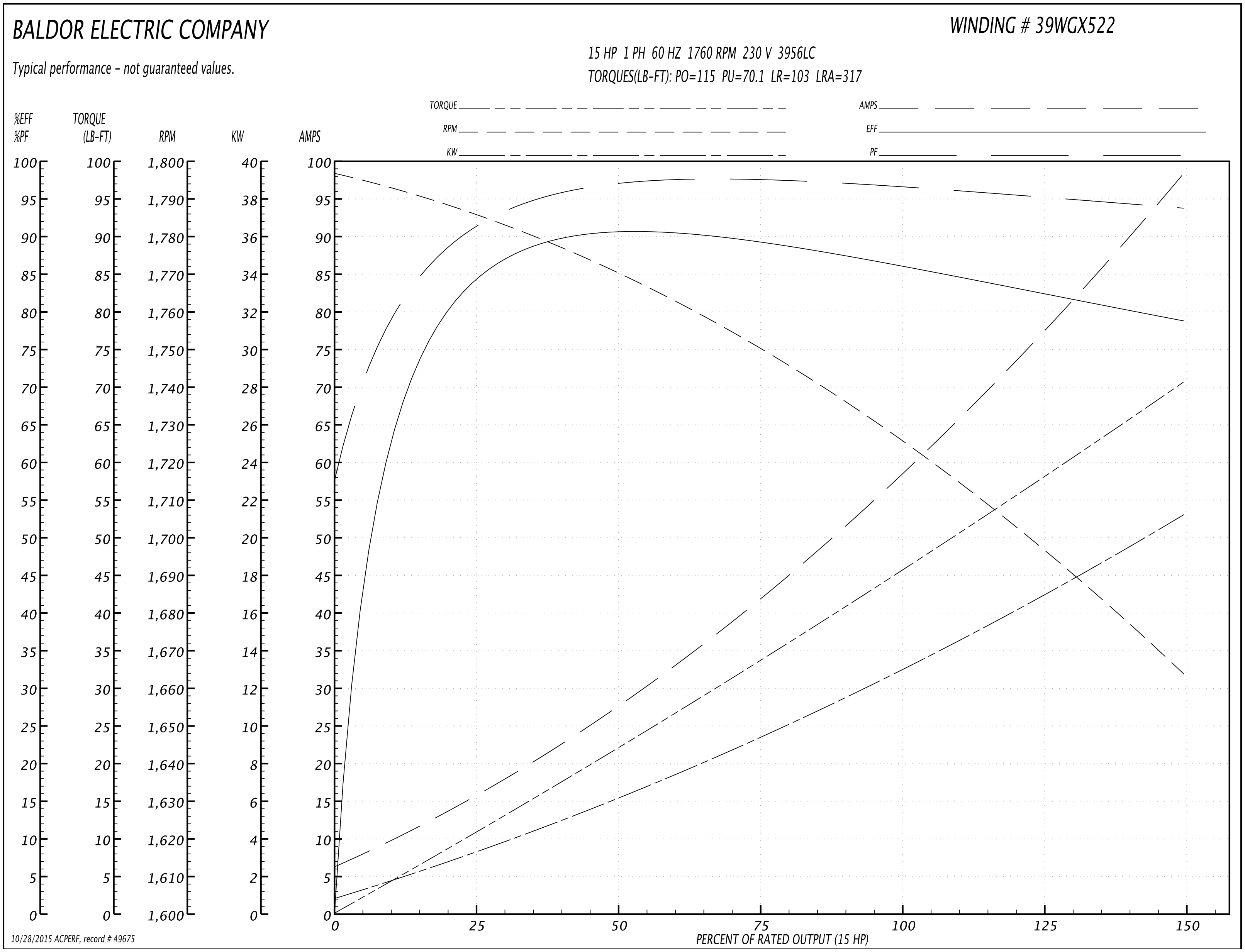
Winding: 39WGX522-R007	**Type:** 3956LC	**Enclosure:** OPSB

Nameplate Data				230 V, 60 Hz: Single Voltage Motor	
Rated Output (HP)	15			Full Load Torque	45.4 LB-FT
Volts	208-230			Start Configuration	direct on line
Full Load Amps	66-58			Breakdown Torque	115 LB-FT
R.P.M.	1760			Pull-up Torque	70.1 LB-FT
Hz	60	Phase	1	Locked-rotor Torque	103 LB-FT
NEMA Design Code	L	KVA Code	F	Starting Current	317 A
Service Factor (S.F.)	1			No-load Current	5.96 A
NEMA Nom. Eff.	86.5	Power Factor	96	Line-line Res. @ 25ºC	0.11493 Ω A Ph 0.32051 Ω B Ph
Rating - Duty	40C AMB-CONT			Temp. Rise @ Rated Load	105°C

Load Characteristics 230 V, 60 Hz, 15 HP

% of Rated Load	25	50	75	100	125	150
Power Factor	94	97	97	97	95	94
Efficiency	82.2	88.6	88.8	87	83.4	78.2
Speed	1783.4	1768.4	1749.9	1728.4	1699.7	1661.3
Line amperes	15.9	28.4	42.3	57.7	76.1	99.3

Performance Graph at 230V, 60Hz, 15.0HP Typical performance - Not guaranteed values



BALDOR
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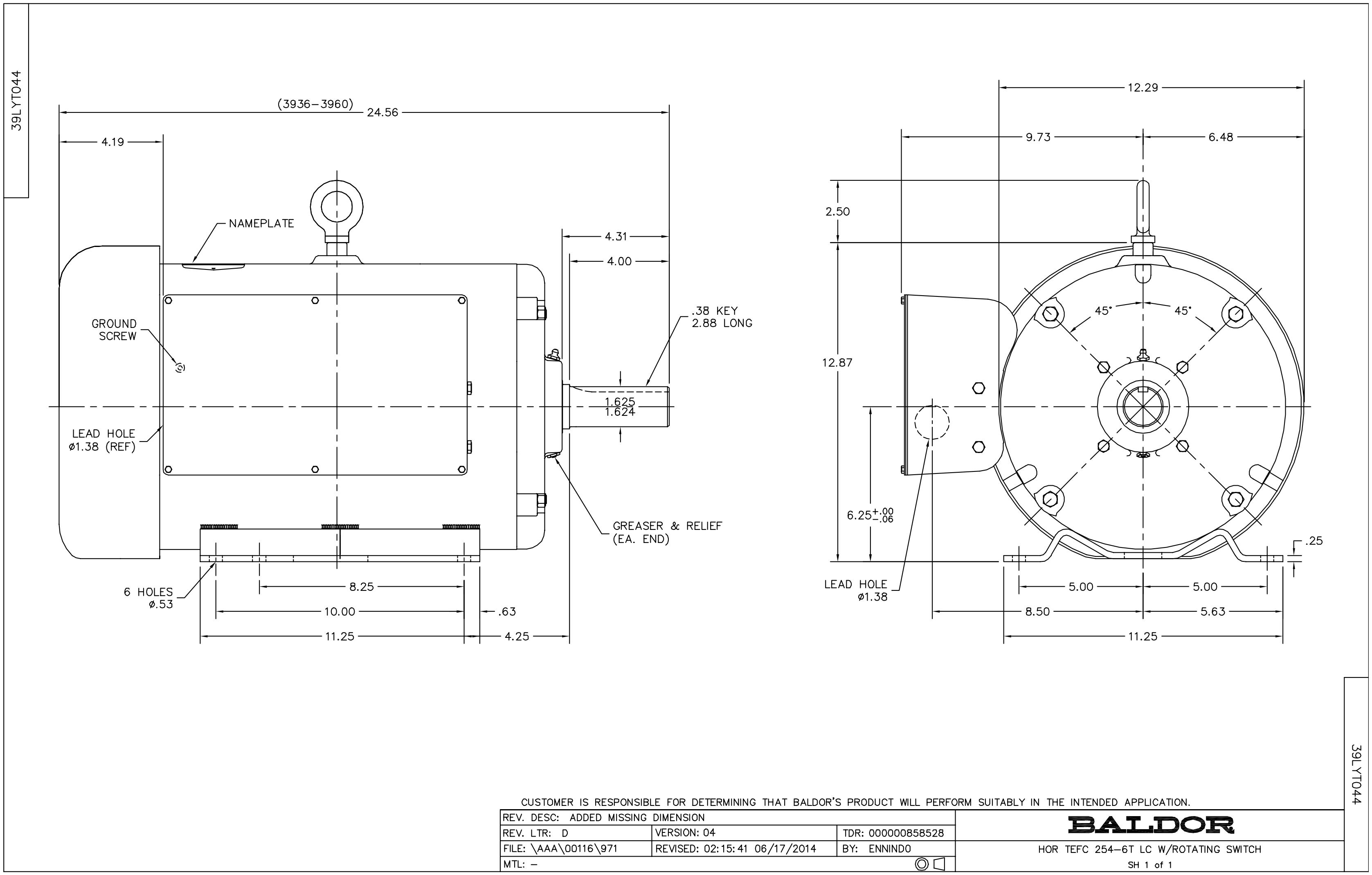
39LYT044
(3936–3960)
24.56
4.19
NAMEPLATE
4.31
4.00
.38 KEY
2.88 LONG
GROUND
SCREW
1.625
1.624
LEAD HOLE
ø1.38 (REF)
GREASER & RELIEF
(EA. END)
6 HOLES
ø.53
8.25
10.00
.63
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12.29
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HOR TEFC 254–6T LC W/ROTATING SWITCH
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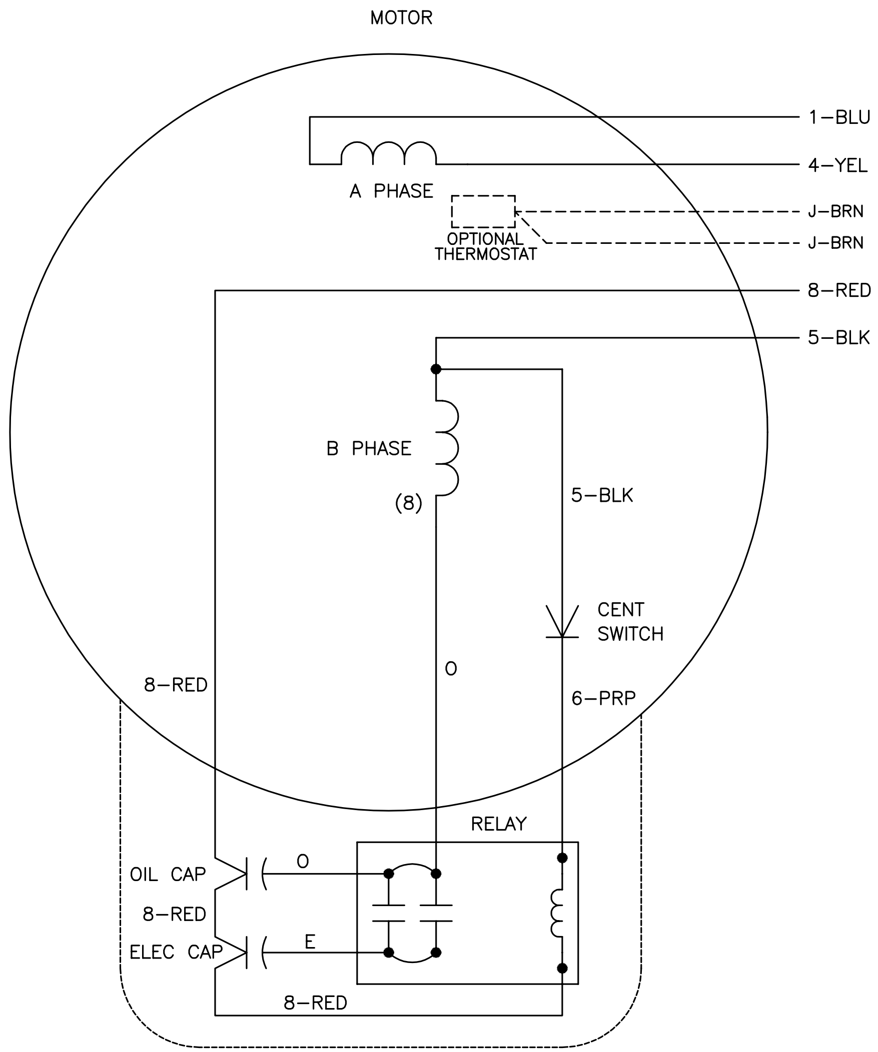
CD1084



	LINE A	LINE B
STD	1,8	4,5
OPP	1,5	4,8

NOTES:

1. STANDARD ROTATION IS CCW FACING END OPPOSITE SHAFT EXTENSION.
2. OPTIONAL THERMOSTAT IS PROVIDED WHEN SPECIFIED.
3. MULTIPLE CAPACITORS ARE CONNECTED IN PARALLEL UNLESS OTHERWISE SPECIFIED.
4. USE GE CR353CB2AB1, OR FURNAS 45DG20AG, OR EQUIVALENT POTENTIAL RELAY.
5. DRESS LEADS AWAY FROM RELAY TO AVOID INTERFERENCE.
6. CAPS AND RELAY MAY BE SEPERATELY MOUNTED.
7. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

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MTL: –

BALDOR ELECTRIC Co.

TYPE LC, SV, REV, 4LD, RELAY W/CENT SW, ON/OFF SW

Hazardous Areas
Adjustable / Pre-Set Pressure Switch

611G*E & 611V*E - Diaphragm Sensor

CustomControlSensors

DESCRIPTION

- Highly reliable devices utilizing the CCS Dual-Snap® Belleville disc spring principle pioneered by CCS' engineers.
- Engineering based on aerospace technology.
- Rigid, compact and externally adjustable for factory setting or convenient field set point adjustment.
- Repeatable and stable set points.
- Vibration and shock resistant.
- High cycle life.
- High over-pressure capability.
- (System and Proof)
- Certified explosion proof hermetically sealed electrical assembly for environmental protection.
- Various options for wetted materials and electrical ratings to meet a wide range of application requirements and media capability.

SHIPPING WEIGHT: APPROXIMATELY 10-20 OUNCES (283-567 GRAMS)

SERIES:

611GE*
611GZE*
611VE*

SET POINT RANGE:

GAGE PRESSURE:

.75 to 180 PSIG
.052 to 12.4 bar
5.17 to 1241 kPa

VACUUM:

1.5 to 28.5" Hg
38 to 724 mm Hg

OPERATING TEMPERATURE:

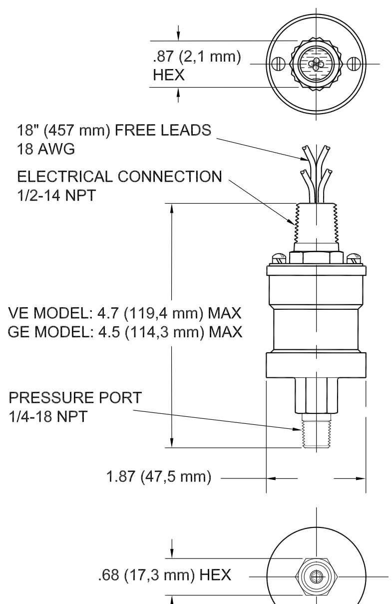
Temperature limits change with o-ring selection.

-40° to 186°F
-40° to 86°C

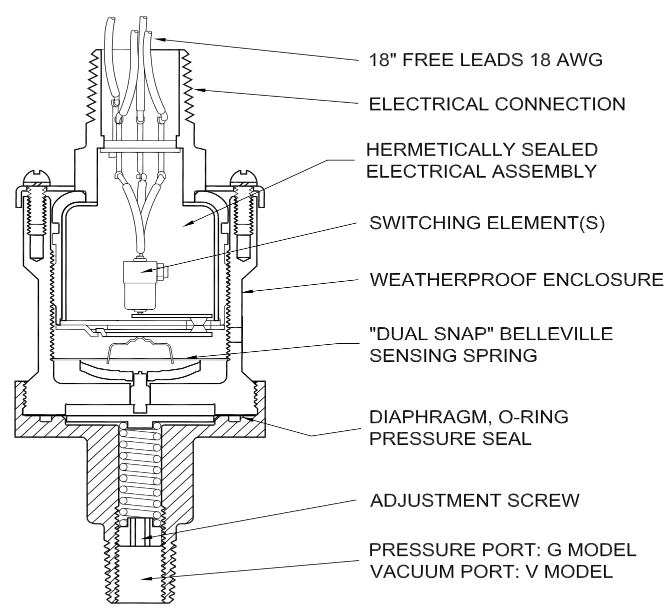
STANDARD FEATURES:

- Hermetically Sealed Electrical Assembly
- CE Mark
- NACE MR0175:2003 (GZ & VZ model only)
- NEMA: 4, 7, 9,13 / IP66
- U.L. / CSA Listed

INSTALLATION DRAWING



DESIGN PRINCIPLES



SERIES 611GE & 611VE

FIELD SETTING: Insert 1/8" Allen wrench into adjustment screw (located in pressure port) and turn. Clockwise to decrease settings, short of actuating the electrical. Counterclockwise to increase setting. Do not turn beyond flush with port.

NOTE: DO NOT USE ELECTRICAL HEX FOR TORQUING.

Hazardous Areas
Adjustable / Pre-Set Pressure Switch

611G*E & 611V*E - Diaphragm Sensor

CCS®
CustomControlSensors

OPERATING AND ORDERING DATA

SERIES 611GE*	WETTED PARTS: 1/4"-18 NPT ALUMINUM PRESSURE PORT, POLYIMIDE DIAPHRAGM , BUNA N O-RING					
	FIXED SET POINT RANGE (SPECIFY SET POINT ON ORDER)		AVERAGE DEAD BAND PSI (BAR)		SYSTEM PRESSURE PSIG (BAR)	PROOF PRESSURE PSIG (BAR)
	INCREASING PRESSURE PSIG (BAR)	DECREASING PRESSURE PSIG (BAR)	AT BOTTOM OF RANGE PSI (BAR)	AT TOP OF RANGE PSI (BAR)		
611GE*1	1.5-25 (0.103-1.72)	1-23 (0.069-1.59)	.75 (0.052)	2 (.138)	250 (17.2)	500 (34.5)
611GE*2	26-80 (1.79-5.51)	23-73.5 (1.59-5.07)	3 (0.21)	6.5 (0.448)	500 (34.5)	1000 (68.9)
611GE*3	81-180 (5.58-12.41)	66-153 (4.55-10.55)	15 (1.03)	27 (1.86)	500 (34.5)	1000 (68.9)

SERIES 611GE*800*	WETTED PARTS: 1/4"-18 NPT ALUMINUM PRESSURE PORT , POLYIMIDE DIAPHRAGM , BUNA N O-RING				
	ADJUSTABLE SET POINT RANGE		APPROX. DEAD BAND PSI (BAR)	SYSTEM PRESSURE PSIG (BAR)	PROOF PRESSURE PSIG (BAR)
	INCREASING PRESSURE PSIG (BAR)	DECREASING PRESSURE PSIG (BAR)			
611GE*8001	1.5-12.1 (0.103-0.83)	.75-11.35 (0.052-0.78)	.75 (0.052)	250 (17.2)	500 (34.5)
611GE*8003	12.1-30 (0.83-2.07)	10.1-28 (0.70-1.93)	2 (.138)	500 (34.5)	1000 (68.9)
611GE*8005	30.1-70 (2.075-4.83)	27.1-67 (1.87-4.62)	3 (0.21)	500 (34.5)	1000 (68.9)
611GE*8007	70.1-180 (4.83-12.4)	63.1-173 (4.35-11.92)	7 (.483)	500 (34.5)	1000 (68.9)

SERIES 611GZE*800*	WETTED PARTS: 1/4"-18 NPT 316 STAINLESS STEEL PRESSURE PORT & DIAPHRAGM, VITON O-RING				
	ADJUSTABLE SET POINT RANGE		APPROX. DEAD BAND PSI (BAR)	SYSTEM PRESSURE PSIG (BAR)	PROOF PRESSURE PSIG (BAR)
	INCREASING PRESSURE PSIG (BAR)	DECREASING PRESSURE PSIG (BAR)			
611GZE*8101	3-12 (0.21-0.827)	1-10 (0.069-0.69)	2 (.138)	250 (17.2)	500 (34.5)
611GZE*8103	12-30 (.827-2.07)	9-27 (.62-1.86)	3 (0.21)	500 (34.5)	1000 (68.9)
611GZE*8105	30-70 (2.07-4.83)	25-65 (1.72-4.48)	5 (0.345)	500 (34.5)	1000 (68.9)
611GZE*8107	70-180 (4.83-12.41)	60-170 (4.14-11.72)	10 (.69)	500 (34.5)	1000 (68.9)

SERIES 611VE*800*	WETTED PARTS: 1/4"-18 NPT ALUMINUM PRESSURE PORT, POLYIMIDE DIAPHRAGM , BUNA N O-RING				
	ADJUSTABLE SET POINT RANGE		APPROX. DEAD BAND INCHES Hg (BAR)	SYSTEM PRESSURE PSIG (BAR)	PROOF PRESSURE PSIG (BAR)
	INCREASING VACUUM INCHES Hg (mm Hg)	DECREASING VACUUM INCHES Hg (mm Hg)			
611VE*8000	4-28.5 (102-724)	1.5-26 (38-660)	2.5 (0.08)	150 (10.3)	250 (17.2)

HOW TO ORDER

Follow these steps to build your part number:

1. Specify the series based on your required set point, range, dead band, system pressure and proof pressure.
2. Add desired options model code letter.
3. Add the applicable standard suffix number.

(Ex: 611GZEFM8105)

PRESSURE CONVERSION

1 BAR = 14.5 PSI
1 kPa = 0.145 PSI

OPTIONAL STANDARD MODIFIED SUFFIXES

7008: Gold Contacts
7054: 2 Meter Free Leads
7076: 18 inch Teflon Free Leads (Low Temp Wire)

CERTIFICATIONS

Consult CCS website for complete certification and approval listing.

OPTIONS MODEL CODES

A: Viton® O-Ring (STD on GZE models)
B: Brass Port (Fixed set point models only)
C: 316 Stainless Steel Welded Capsule (G models only - GCE*)
F: Ethylene Propylene O-Ring
M: DPDT Electrical
Y: ATEX / GOST Certified Electrical Assembly (Consult CCS Sales Department for GOST options and requirements.)

Note: Additional modified standard suffixes are available, consult CCS sales department or CCS Representative.

ELECTRICAL ENCLOSURE CERTIFICATIONS

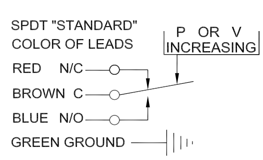
* c-UL, U.L./CSA Explosion Proof: Div. 1, 2 hermetically sealed electrical assembly P/N 46-1058 (46-1061 for M model option), listed by both Underwriter's Laboratories, Inc. (File No. E32961) and Canadian Standard Association (CSA) Testing Laboratories (File No. LR22921) for hazardous locations, Class 1, Groups A, B, C, and D; Class 2 Groups E, F, and G.
* ATEX - SIRA certified for potentially explosive atmospheres. Models 6****Y, II 2 GD Ex d IIC, 08ATEX1046X. (Option Y)
* IECEx - SIRA certified, SIR 10,0193X (Option Y)

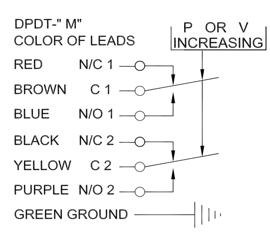
ELECTRICAL CHARACTERISTICS

RATING OF SWITCH ELEMENT

VOLTS	AMPERES	
	SPDT	DPDT "M"
	Res.	Res.
125 AC - 50/60 Hz	11	11
250 AC - 50/60 Hz	11	11
30 DC	5	5
125 DC	.5	.5
*125 AC - 50/60 Hz	1 max	1 max
*30 DC	1 max	1 max
*Gold Contacts -7008 Suffix		

SCHEMATIC AND WIRING CODE





COMPRESSOR IOM MANUALS

DIAPHRAGM COMPRESSORS

WITH

BOLTED HEADS CLOSURES

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

COMPRESSOR MODEL: 4100

SERIAL NUMBER: ______________

NUMBER OF STAGES: 01

WHEN COMMUNICATING OR ORDERING PARTS
FOR THIS EQUIPMENT PLEASE REFER TO ABOVE SERIAL No.

CAUTION: DO NOT ATTEMPT TO OPERATE THIS UNIT WITHOUT THOROUGHLY READING THESE INSTRUCTIONS

Date: 05-1-2008

OPERATION AND MAINTENANCE MANUAL

MANUAL INDEX

DIAPHRAGM COMPRESSORS

WITH

BOLTED HEADS CLOSURE

OPERATION AND MAINTENANCE MANUAL
HOW TO USE THIS MANUAL

This manual applies to single- stage or two- stage PPI diaphragm compressors with **Bolted type head closures**.
For all of these compressors, regardless of the model, the basic design concept and theory of operation are the same.
There are, however, several different design configurations for various applications.
A set of drawings for the compressor is enclosed in a separate binder - **"Final data book."**
For understanding of your machine these drawings shall be used along with detailed instructions in this manual.
The checklist shown below will help in determining the design applicable to your compressor.

Job No.

Head Assembly Type: **BOLTED HEAD CLOSURE**

Hydraulic System Type:
X Oil Injector Assembly
___ Positive feed

Hydraulic Over-pump Valve:

First Stage		Second Stage		Third stage	
___	A-12840	___	A-12840	___	A-12840
X	B-15000	___	B-15000	___	B-15000

Section I

INTRODUCTION

The PPI diaphragm compressors are designed to compress gas without contamination or leakage. The performance characteristics of the unit are detailed on the compressor specification sheet found in the front of this manual.

The purpose of this manual is to describe the operation of the diaphragm compressor and to provide sufficient information to maintain the compressor and to isolate a problem in case of trouble. This information is intended for use by qualified personnel. Use of the information by other than qualified personnel may negate the warranty extended by Pressure Products Industries to the equipment purchaser.

The user should not attempt to install, operate or service the equipment supplied without first reading and understanding this operating and maintenance manual. If any questions arise concerning the instructions or the interpretation thereof, immediately contact PPI at:

There are caution notes contained throughout the instruction manual. There is also a specific section dealing with caution notes which should be read and thoroughly understood before operating the equipment or performing maintenance. THESE NOTES WARN AGAINST PRACTICES THAT MAY CAUSE DAMAGE TO THE COMPRESSOR OR THAT MAY RESULT IN DANGER TO PERSONNEL OPERATING OR MAINTAINING THE UNIT.

<u>NOTICE</u>

This manual contains PPI proprietary information which may not be used for the benefit of others except by written permission from PPI. Distribution and availability of this manual should be restricted to activities concerned with the operation and maintenance of the equipment described herein.

Section II

THEORY OF OPERATION

INTRODUCTION

This section deals with the operational theory of diaphragm compressors.

GENERAL DESCRIPTION

The PPI Diaphragm Compressor is a combination of two systems - a hydraulic system and a gas compression system. A metal diaphragm group is the isolating component between these two systems.

The gas compression system consists of three (3) flat metal diaphragms which are clamped between two precisely contoured, concave cavities and the process gas inlet and outlet check valves.

The hydraulic system includes a motor-driven crankshaft which reciprocates a piston in the hydraulic fluid medium. This positive displacement piston causes the hydraulic fluid to be pulsed against the lower side of the diaphragm group which, in turn, causes the diaphragm group to sweep the cavity, displacing the process gas. The other components of the hydraulic system are the hydraulic check valve, the hydraulic overpump valve and, in some units, an automatic injection pump. The check valve isolates the hydraulic system from the feed lines as the fluid is being compressed. The hydraulic overpump valve is basically a pressure relief device that assures that the hydraulic pressure is such that the diaphragms must fully displace the cavity on each stroke. The automatic injection pump ensures that the hydraulic system is always full for the compression stroke and provides for fast priming after extended compressor shutdowns.

THEORY OF OPERATION

Compressors with Injection Pumps:
A full cycle of operation for the diaphragm compressor begins with the diaphragm group fully deflected to the bottom of the cavity by the process suction pressure. The hydraulic piston is at bottom dead center (BDC) and the hydraulic system has just received the output of a single stroke of the automatic hydraulic fluid injection pump. On the process side of the diaphragm group, the cavity is now filled at a given suction pressure level with the process gas which has entered through the inlet check valve. As the crankshaft rotates and the hydraulic piston moves from its bottom dead center position towards top dead center, (TDC) the hydraulic pressure increases. This occurs since the hydraulic system injection and relief lines are blocked by the hydraulic check valve and hydraulic overpump valve, respectively. As the piston continues toward top dead center, and as the hydraulic pressure reaches the pressure level of the process gas in the cavity, the diaphragm group sweeps the cavity towards its top dead center position, compressing the process gas. When the pressure of the process gas in the cavity reaches the pressure level downstream of the discharge check valve, that check valve opens and the process gas is discharged from the cavity.

With the diaphragm group in this fully deflected discharge position, the piston still has a certain amount of travel required to reach its TDC position. As the piston moves to TDC, this additional hydraulic fluid volume is "overpumped" through the hydraulic overpump valve, which is set at a pressure level above the desired process gas discharge pressure. At this point, the compression portion of the cycle has been completed.

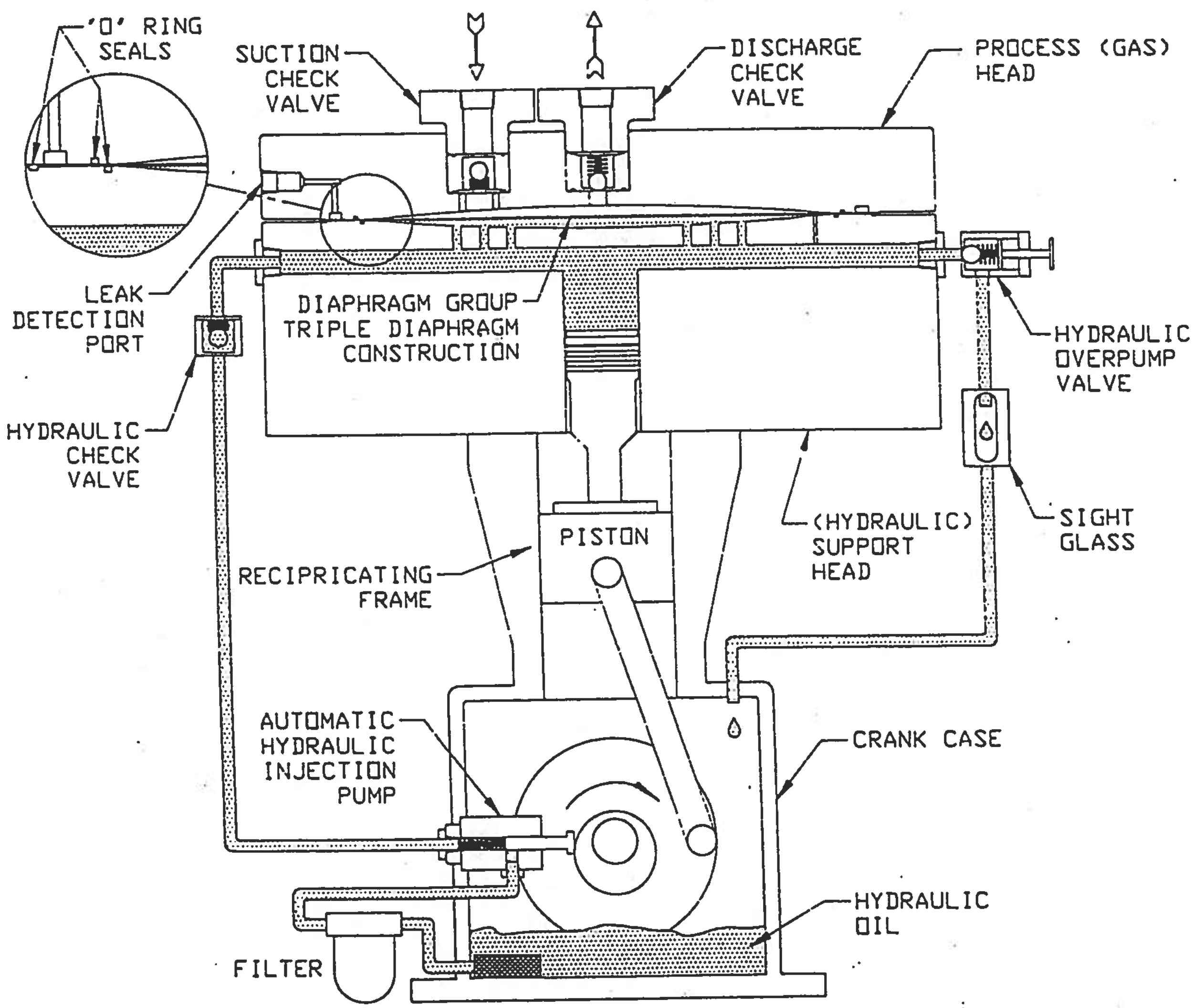


Fig.1. Components of typical system include a pulsing piston and separate chambers for hydraulic fluid and process gases. The diaphragm group is of triple layer construction: the two outer diaphragms are barriers, and the central core provides a leakage path past the static O-ring seals.

The hydraulic piston now moves toward BDC. As it does, the diaphragm group is deflected toward the bottom of the cavity by both the expansion of the residual gas contained in the clearance volume and by the additional process gas entering the cavity at suction pressure. During this suction stroke, a synchronized auxiliary eccentric cam on the crankshaft causes the hydraulic injection pump plunger to stroke, injecting an amount of hydraulic fluid equal to that which was "overpumped" through the hydraulic overpump valve at the end of the compression portion of the cycle.

When the hydraulic piston reaches its BDC position, the hydraulic system is again full. Since the diaphragm group is now in the bottom-most deflected position, a full gas cavity is assured. At this point, the cycle is complete.

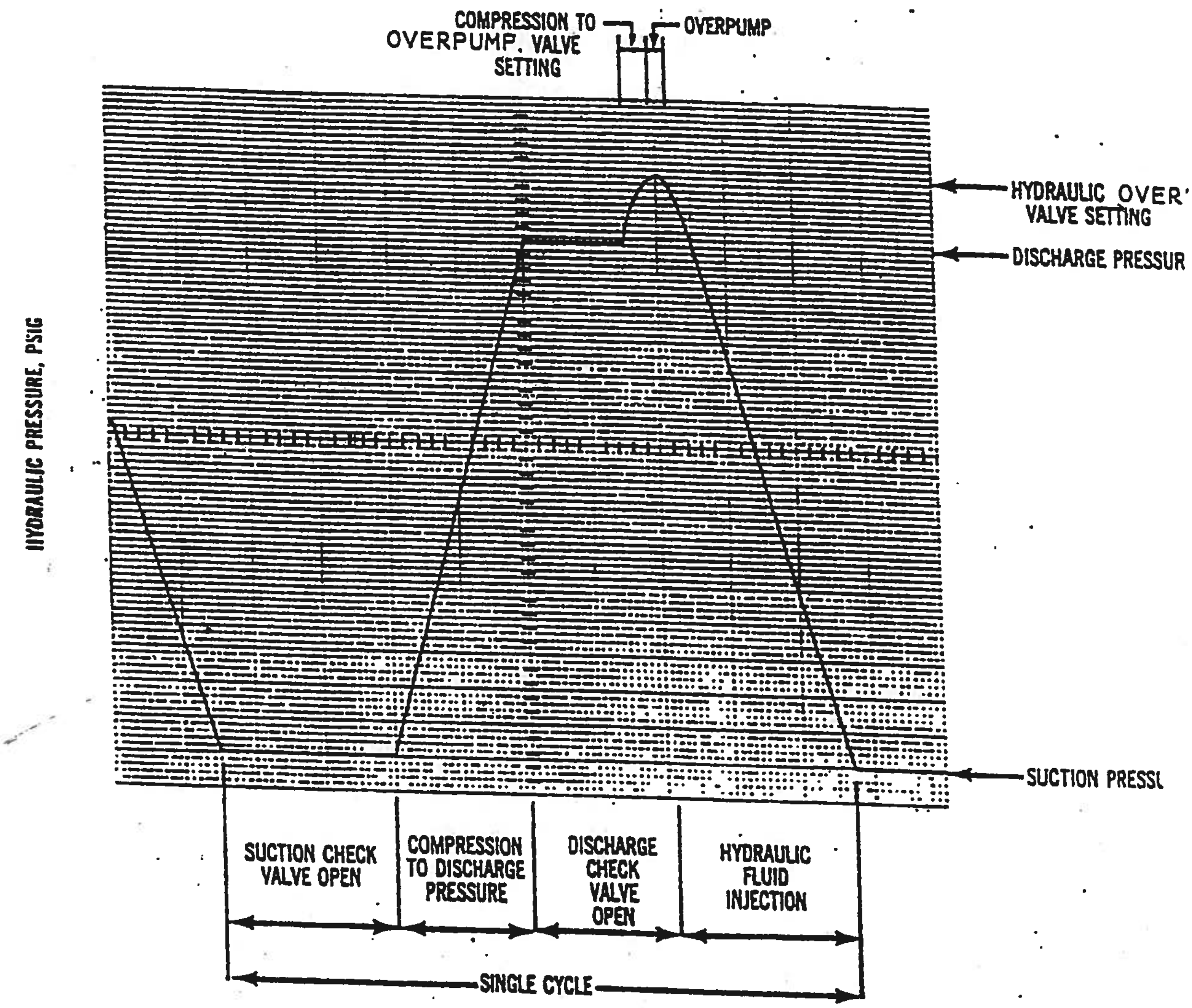


Fig.2. A single cycle is shown on an oscilloscope scan of the hydraulic system. Discharge pressure is slightly less than the hydraulic overpump valve setting. Over pumping occurs as the reciprocating piston approaches top dead center, in the region on the curve after peak pressure and before decay to discharge pressure.

Compressors with Base Oil Feed:

The full operating cycle for diaphragm compressors with a gravity feed hydraulic system begins with the diaphragm group fully deflected to the bottom of the cavity as the result of process suction pressure (see Figure 1). The hydraulic piston is at bottom dead center. On the process side of the diaphragm group, the cavity is filled with gas at a given suction pressure which has entered the cavity through the inlet check valve.

As the crankshaft rotates and the hydraulic piston moves from bottom dead center to top dead center, both the hydraulic and process gas pressures increase. By reviewing Figure 1, note that the hydraulic system is fully closed by the hydraulic check valve on the suction side and the hydraulic overpump valve on the discharge side. Likewise, the process gas system is closed by the function of the inlet and discharge check valves. As the piston continues toward top dead center and the hydraulic and process gas pressures increase, the diaphragm group sweeps the cavity toward top dead center. When the pressure of the process gas in the cavity reaches the pressure level downstream of the discharge check valve, the discharge check valve opens and the process gas is expelled from the cavity. The hydraulic system continues to maintain a pressure equal to the process gas pressure until the process gas is fully expelled through the discharge check valve and the diaphragm group comes into contact with the upper (gas) head. At this point, the piston has not reached top dead center since the piston displacement is slightly greater than the volume swept by the diaphragm group in the cavity . This volume difference assures full displacement of the diaphragm group; and therefore, full displacement of the process gas. As the piston moves to top dead center, this additional hydraulic fluid volume is over pumped through the hydraulic overpump valve which is set at a pressure level above the desired process gas discharge pressure. At this point, the compression portion of the cycle has been completed.

The hydraulic piston now moves toward bottom dead center. As it does, the diaphragm group moves away from the upper head. The initial movement of the diaphragm is the result of expansion of the residual gas contained in the closed volume. Once the re-expansion pressure becomes less than the inlet gas pressure, the inlet check valve opens and the gas at the given suction pressure level enters the cavity and continues to force the diaphragm against the hydraulic fluid. Before the hydraulic piston reaches bottom dead center, the diaphragm group comes into contact with the cavity in the hydraulic head. Remembering that the piston displacement is slightly greater than the cavity displacement, the hydraulic piston continues downward toward bottom dead center. At this point, a pressure differential occurs which permits oil from the sump of the compressor base to enter the hydraulic system. The amount of fluid entering the hydraulic system at this time is equivalent to the amount of fluid over pumped at the completion of the compression cycle less some nominal leakage past piston rings. When the hydraulic piston reaches bottom dead center, the hydraulic system is completely full. Since the diaphragm group is now in its bottom most position, a full gas cavity is assured; and at this point, the cycle is completed.

COMPONENT FUNCTIONS

The Hydraulic Overpump Valve:

The hydraulic overpump valve serves two purposes in the diaphragm compressor operating cycle. First, the volumetric efficiency of the compressor depends on the diaphragm group achieving full displacement. The hydraulic overpump valve, with its setting above the normal discharge pressure, allows the hydraulic system to push the diaphragm group into contact with the upper head. Secondly, the hydraulic overpump valve also limits the maximum pressure which can be developed by the compressor. Although the overpump valve has this secondary function, under no circumstances shall the hydraulic overpump valve be used for primary overpressure protection. It is the users responsibility to provide proper overpressure protection by installing a relief device in the discharge line.

The Hydraulic Injector Assembly:

The hydraulic injector assembly is used on all diaphragm compressors except for the 2000 series. It is designed to inject a measured amount of fluid into the hydraulic system during the suction stroke. The amount of fluid injected ensures that the hydraulic system contains the necessary volume to displace the diaphragm group from bottom dead center to top dead center.

Motion is imparted to the spring-loaded plunger by a cam which is mounted on a shaft. The shaft is an extension of the reciprocating frame crankshaft. The purpose of the spring is to load the plunger so that it remains in contact with the lobe of the cam. Note that there is no suction check valve in the injection pump. A small hole is located in the cylinder in which the plunger rides. The hole is fully exposed when the plunger is retracted and closed off when the plunger moves forward. It can be seen that the point when injections starts determines the amount of hydraulic fluid pumped on each stroke. Likewise, the relationship between the plunger and the oil inlet hole determines the amount of fluid injected. For example, if the cylinder is backed out (loosened), the oil inlet hole is exposed for a greater portion of the plunger stroke. Consequently, the amount of oil injected by the pump into the system is reduced. Conversely, as the cylinder is backed in (tightened), the oil inlet hole is exposed for a very limited portion of the plunger stroke, therefore, increasing the amount of oil injected by the assembly.

Triple Diaphragm Construction:

Triple diaphragm construction is a standard feature on all PPI diaphragm compressors. This construction prevents gas contamination and gas leakage in the event a diaphragm, or diaphragm seal failure occurs. Three separate diaphragms comprise the diaphragm group. Outside of the diaphragm group is a groove, an elastomeric seal and a connection port. The purpose of the seal is to retain the effluent leak in the head assembly and channel it to the collection port.

The process gas diaphragm and hydraulic diaphragm are flat and smooth; the middle diaphragm is produced with either a single slot or multiple scribed grooves extending from the outside diameter of the diaphragm toward the middle of the diaphragm. The purpose of the slot or scribed grooves is to provide a leak path past the seal area of the diaphragm group through which gas or hydraulic fluid may flow and be detected.

Leak Detection System:

The leak detection system is used in conjunction with the triple diaphragm construction and is available as an option on all PPI compressors. The pressure gauge will give local visual indication that a leak has occurred. The pressure switch may be wired for either shutdown or alarm functions. A vent valve is provided so that the system may be manually let down prior to disassembly. A spring loaded check valve is employed to protect the system in the event there is over pressurization. It is extremely important to pipe the check valve vent connection and manual vent valve connection to a safe location away from personnel and the operating area.

There are certain operational characteristics of which the users should be aware. If the diaphragm compressor on which the leak detection system is installed is operating with an atmospheric or sub-atmospheric suction pressure, a vacuum must be drawn in the leak detection system. This will remove air which may be trapped between the diaphragm group. If the air is not removed, it will expand and separate the diaphragm group during the suction stroke causing a flow rate reduction.

If the compressor is operating at suction pressures above atmospheric suction, it is not necessary to pull a vacuum on the system. However, during normal operation the heat generated by compression of the gas will be transferred to the residual air in the leak detection system. The pressure gauge on the leak detection system will show a slight increase. If this condition is present, bleed the system to 0 psig using the manual vent valve. Slight pressure rises could continue until the system reaches a temperature equilibrium, at which time additional venting will not be required.

Section III

STORAGE

SHORT-TERM AND LONG-TERM STORAGE

Proper storage of the PPI diaphragm compressor is mandatory for successful operation. Failure to comply with the procedures may cause considerable damage to the reciprocating frame and motor bearings.

SHORT-TERM STORAGE

If the unit is stored for a period of 90 days or less, the following procedures must be performed:

Upon receipt of the diaphragm compressor, the crate must be opened and the protective barrier of polyethylene sheet must be removed. Reassemble the crate and place a waterproof and fireproof tarpaulin over the entire crate allowing for air circulation.

The crate should be opened every 30 days and the flywheel and motor turned over manually for a few revolutions. Care should be taken not to allow the flywheel or motor to come to rest in the same position as when rotation started.

LONG-TERM STORAGE

If the unit is stored for a period greater than 90 days, the following procedures must be performed:

Upon receipt of the equipment, perform steps outlined above.

The flywheel and motor must be rotated every 30 days as instructed above.

Before equipment start-up, be certain to **drain the hydraulic system** and **refill** with the fluid specified on the compressor specification sheet.

Section IV

INSTALLATION OF PPI DIAPHRAGM COMPRESSORS

PHYSICAL LOCATION

The diaphragm compressor should be installed on a sound foundation with sufficient space on all sides for maintenance. The area should be well lighted and ventilated. On units where the physical size and/or weight of the compressor heads or other components make manual handling impractical, provision for a lifting device should be made. A means of hanging a chain hoist directly above the heads of each stage is preferred. Otherwise, enough space should be left around the unit to allow for the erection of an "A" frame or for the use of some other type mobile crane.

FOUNDATION

The diaphragm compressor is a reciprocating machine and, as such, a certain amount of unbalanced forces are inherent in the machine. Consequently, it should be well anchored to a solid foundation.

Single and two stage 2000 and 4000 series - These units may be bolted directly to the floor provided it is of solid construction. In each case, the baseplate must be leveled on shims and wedges with provisions for about 3/4" of grout between the base and the foundation. Tighten all foundation bolts with even tension and without distorting the baseplate.

Single and two stage 5000, 7000, and 9000 series - These units must have a special foundation poured. These units must be grouted in to facilitate leveling and to allow for irregularities in the foundation. The instructions for a typical installation are included in this section.

SUCTION FILTER

Internal cleanliness is of the utmost importance in obtaining satisfactory life of diaphragms and other process contacting components. The filter should be rated at 20 micron or better and should be sized to minimize pressure drop. If the process filter is not supplied with the unit, it is the responsibility of the user to supply the filter per the above description.

GAS PIPING

Piping Size - Minimal pressure drop in both the suction and discharge piping is necessary for proper operation of a diaphragm compressor. The piping to and from the unit should be at least as large as the corresponding connections on the unit. Piping should be installed so as to minimize restrictions.

Those items making up the system should be hydrostatically tested to 1.5 times the maximum design pressure of the compressor. All components should be thoroughly cleaned for final piping into the system to assure that maximum cleanliness is maintained.

OVER-PRESSURE PROTECTION

An over-pressure protection device must be installed after each stage of compression to protect both the process system and the compressor. In a two stage compressor, this will be after the first stage, in the Interstage piping line and after the second stage, in the discharge piping line. Such a device must be located between the compressor port and the first possible obstruction such as a valve.

Due to the normal pulsation effects present in any reciprocating compressor discharge line, it is advisable to set the relieving pressure as far above the actual operating pressure as is safely possible. Most devices will function well if set approximately 15% above the maximum operating pressure. In no cases should the relief device be set above the following limits:

a) Above10 % greater than the maximum allowable discharge rating of the compressor stage, stamped on the nameplate.
b) Above the lowest maximum allowable pressure rating of the process piping system or components.

Any over-pressure protection device must be installed with an outlet vent pipe having an area at least equal to the relief orifice of the device. The exhaust of the device must be safely vented in a line without restrictions to a safe location.

In some cases, these over-pressure protection devices may already be supplied by PPI and installed in the compressor system. In cases where they are not supplied, it is the responsibility of the user to select and install such devices to protect the compressor and piping system.

LEAK DETECTION SYSTEM

This system must be wired to shut down the unit or activate an alarm in case of a diaphragm or seal failure. The check valve and manual blow down valve on this system must be safely vented. Refer to the Leak Detection section of this manual for a description of a typical leak detection system.

ELECTRICAL CONTROLS

When remote compressor control is used, it is advisable to install a set of local control buttons near the unit for ease of operation and maintenance.

For units wired by PPI, see wiring diagrams immediately after the operating instructions in this manual.

COMPRESSOR BASE FOUNDATION 5000,7000 & 9000 SERIES

Cement Fixtures

Concrete Foundation - A good mixture of concrete for the foundation consists of:

Cement - 1 part
Sand (Clean & Sharp) - 2 parts
Crushed Stone - 4 parts

Where crushed stone is not available, gravel may be substituted. Use a high strength concrete mixture. Make sure the gravel is clean and contains no loam or clay. If time is an important factor in starting the compressor, quick drying cement may be used.

Grout

A non-shrinking type of pre-mixed grout is strongly recommended for grouting the compressor frame to the foundation. In the event that non-shrinking grout is not available, prepare a mixture of two parts clean sharp sand to one part cement, thoroughly mixed with water so that it will just flow freely. Do not use any more water than necessary to avoid excessive shrinkage.

Pouring Foundations

After a check on the location and height of all foundation bolts, the foundation may be poured. Pour concrete per foundation drawing and leave the top surface rough to assure a good bond later for the grout. After pouring the foundation, cover it with burlap and wet it down twice a day until the forms are removed at the end of the third or fourth day.

There should be a total elapsed time of twenty-one days between the pouring of the foundation block and the starting of the compressor when using mixtures above. It is desired to reduce this time through the use of quick drying cement, the cement manufacturer should be consulted as to the possible saving.

Setting the Baseplate

Before putting the baseplate on the foundation, clean the top surfaces of the foundation, breaking off any loose pieces of concrete.

Roughen the foundation with a star chisel and thoroughly clean it. Then thoroughly wet the top so that it will not absorb moisture from the grouting too quickly. Remove the waste from around the foundation bolts.

Prepare enough steel wedges to allow one being placed near each foundation bolt. The wedges must be thick enough to allow approximately 3/4" of grout between the bottom of the bedplate and the top of the foundation when the unit is in its final level position.

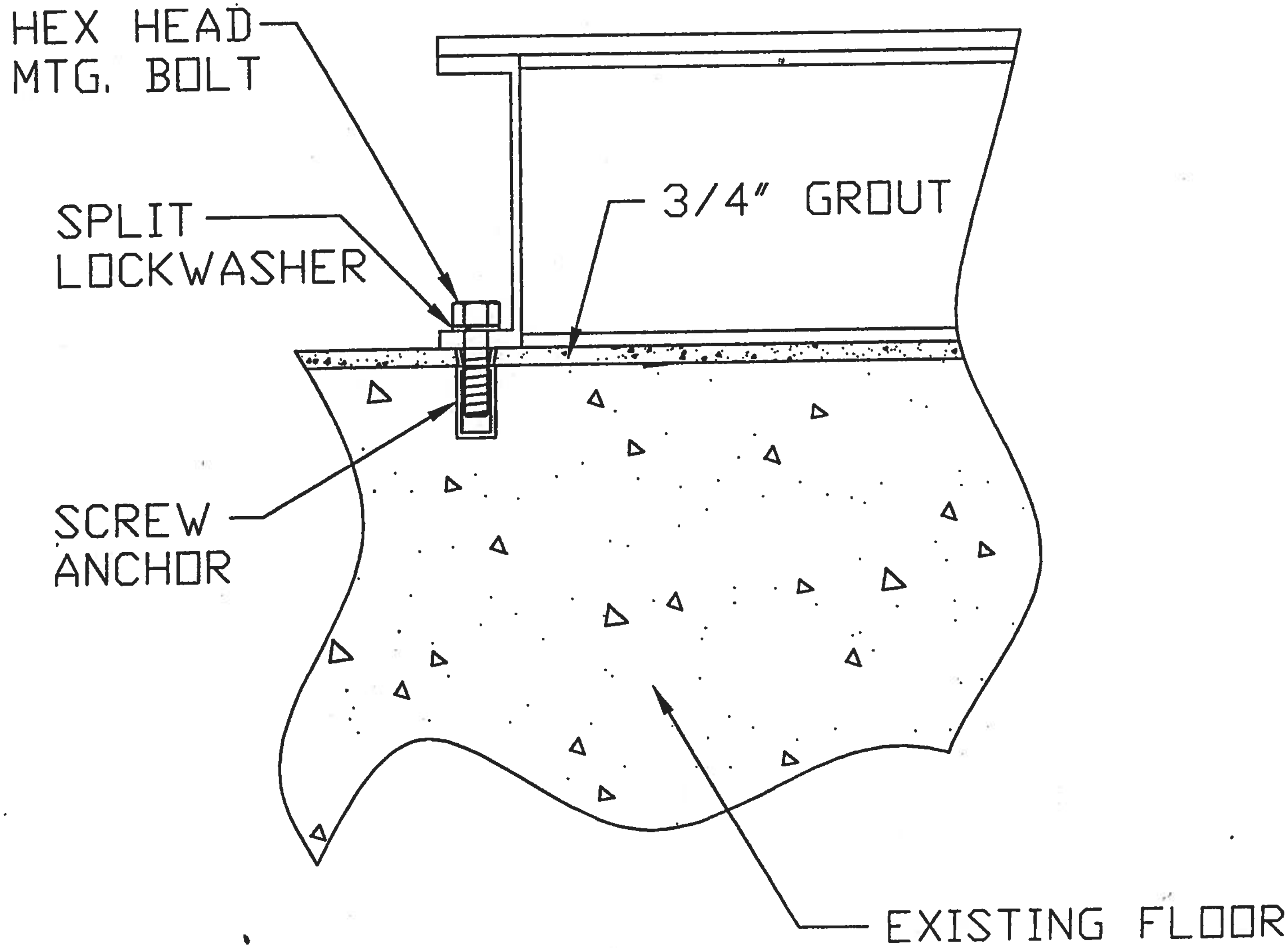
Aligning the Unit

The wedges should be placed to bring the bottom of the baseplate about 1/4" below the final setting. Drive in the wedges, a little at a time and in rotation until the bedplate is up to the desired height and level in both directions. When the unit is level, place washers over the foundations bolts and tighten them down a little at a time in rotation. At the same time, check with the level to make sure the baseplate does not shift on the wedges.

Grouting

After a final check on level and alignment, the unit must be grouted to the foundation. Build a temporary dam of boards around the top of the foundation, about 2" or 3" higher than the bottom of the frame. The grout will be carried up under the baseplate to the full height of the dam. Mark the location of the wedges so they can be removed after the grout has started to set. Prepare a sufficient amount of grout. (See paragraph on grout for mixture.) Before starting to pour, wet the top of the foundations thoroughly, but avoid leaving puddles. Blow any water out of the foundation bolt holes with an air hose. Puddle the grout continuously as it is poured to remove any air pockets, being sure to work the grout into the holes around the foundation bolts.

BASEPLATE (2000 & 4000 SERIES)
SINGLE or TWO STAGE



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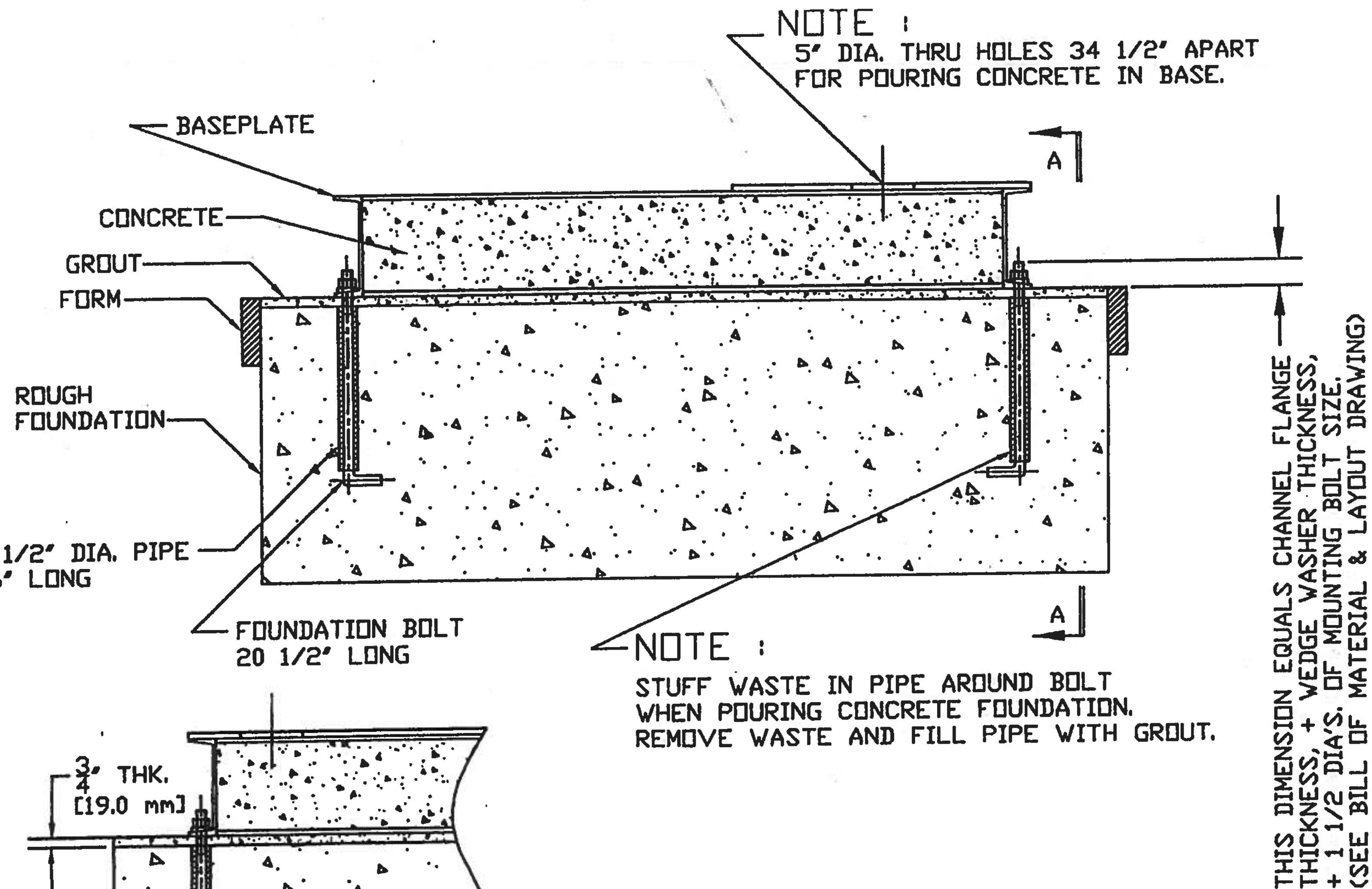
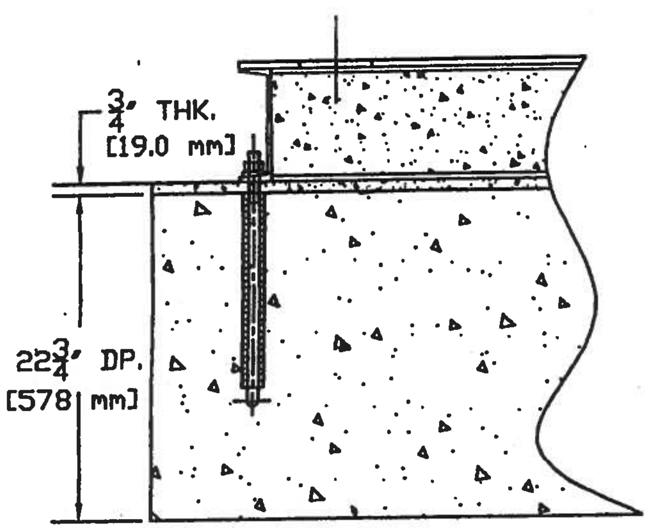




VIEW "A - A"

BASEPLATE (5000, 7000, 9000 SERIES)

SINGLE or TWO STAGE

As soon as the grout has started to set, remove the forms, cut off grout flush with bottom edge of the baseplate, trowel smooth and point up the foundation. After initial set of grout (not less than 24 hours) pull out adjusting wedges and patch. After the grout has thoroughly set (three or four days), check the foundation bolts to see that they are tight.

Baseplate, Concrete to Eliminate Drumming

After 3/4" pad of grout has hardened, build a temporary dam at ends of the baseplate, Fill with concrete using 4" diameter holes in top plate of baseplate. Puddle the concrete continuously as it is poured to remove any air pockets.

DO NOT OPERATE THE COMPRESSOR UNTIL THE FOUNDATION HAS THOROUGHLY HARDENED.

After the grout has thoroughly hardened, connect the intake, discharge cooling water drain piping. Make sure there is no strain on the pipe flanges. Properly support the piping, also provide for expansion of piping.

Finishing Foundation

After the concrete work is finished, the foundation should be painted with a good water-proof and oil proof cement paint. The baseplate to foundation seal must be absolutely tight to prevent oil from creeping under the baseplate.

It is recommended that if the Customer does not have experience in foundation preparation, an outside Consultant should be contacted. It is extremely important that the foundation is poured properly and the unit leveled to give a trouble and vibration-free operation of the compressor.

V- Belt Installation

Instructions for the installation and maintenance of the "V"- Belt Drive are as follows.

Belt Sheave

General - The standard unit is furnished with a single extended crankshaft, and a V-belt sheave. The belt sheave is constructed with a tapered, bushing type hub and is heavy enough to supply the necessary flywheel effect. In addition the sheave is statically balanced with small balance weights located around the inside of the sheave rim (see Fig.1).

To Install:
IMPORTANT: DO NOT USE LUBRICANTS IN THIS INSTALLATION!

1. Inspect the tapered bore of the sheave and the tapered surface of the bushing. Any paint, dirt, oil, or grease MUST be removed.

2. Select the type of mounting (See Fig. 1 or 2) that best suits your application.

3. **STANDARD MOUNTING:**
Install shaft key. (Note: If key was furnished with bushing, you must use that key.) Install bushing on clean shaft, flange end first. If bushing will not freely slide on the shaft, insert a screwdriver or similar object into the flange sawcut to act as a wedge to open the bushing's bore. **Caution: Excessive wedging will split the bushing.** If using the setscrew, tighten it just enough t prevent the bushing from sliding on the shaft. **Caution: Do not over-tighten setscrew!** Slide sheave into position on bushing aligning the drilled holes in the sheave with the tapped holes in the bushing flange. (Note: Install M thru bushings so that the two tapped holes in the sheave are located as far away as possible from the bushing's sawcut.) Loosely thread the capscrews with lockwashers into the assembly. **DO NOT USE LUBRICANT ON THE CAPSCREWS!**

4. Using a torque wrench, tighten all capscrews evenly and progressively in rotation to the torque value in Table. There must be a gap between the bushing flange and sheave hub when installation is complete. **DO NOT OVER-TORQUE! DO NOT ATTEMPT TO CLOSE GAP BETWEEN BUSHING FLANGE AND SHEAVE HUB!**

To Remove:
1. Relieve drive tension by shortening the center distance between driver and driven sheaves.

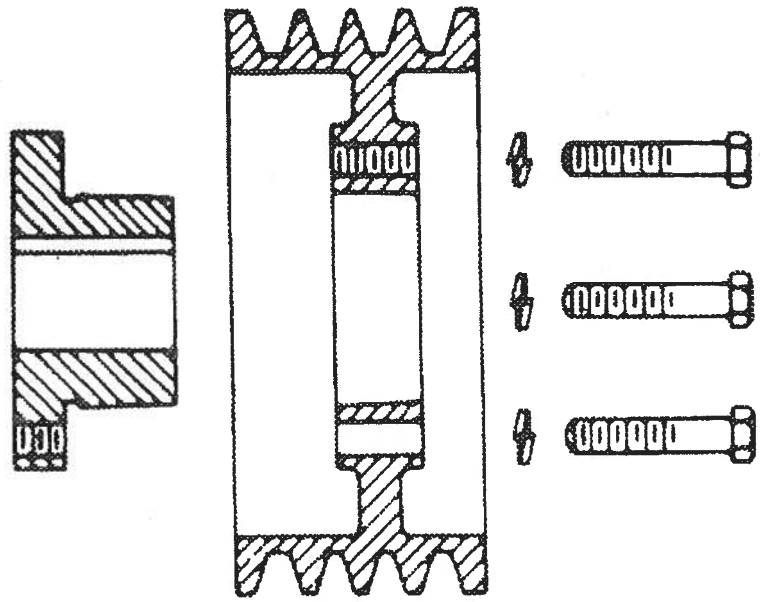
2. Lift off belts.

3. Loosen and remove cap screws. If the bushings have keyway setscrews, loosen them.

4. As shown below, insert cap screws in tapped removal holes and progressively tighten each one until mating part is loose on bushing. (Exception: If mating part is installed with cap screw heads next to motor, with insufficient room to insert screws in tapped holes, loosen cap screws and use wedge between bushing flange and mating part.)

5. Remove mating part from bushing and, if necessary, bushing from shaft.

Closely observe the instructions issued by the motor manufacturer for the motor driver to insure that the driver will perform satisfactorily. The standard direction of rotation is counterclockwise when looking at the compressor belt wheel, as indicated by the "arrow" on the oil pump casing or frame of the compressor. Refer to the foundation plan if rotation is not as indicated above.



TORQUE VALUES

(USE A TORQUE WRENCH)

Tapered Bushing Size	**Cap Screw Size and Pitch**	**Torque Ft.Lbs (N-m)**
SH–SDS–SD	1/4 – 20	9 (12.2)
SK	5/16 – 18	15 (20.3)
SF	3/8 – 16	30 (40.7)
E	1/2 – 13	60 (81.4)
F	9/16 – 12	110 (149.1)
J	5/8 – 11	135 (183)
M	3/4 – 10	225 (305)
N	7/8 – 9	300 (406.8)

CAUTION: The tightening force on the screws is multiplied many times by the wedging action of the tapered surface. If extreme tightening force is applied, or if a lubricant is used, bursting pressures will be created in the hub of the mating part.

Motor Installation

General - Induction motors ordinarily used are comparatively easy to install. An adjustable base or set of slide rails must be provided under the motor to permit adjustment of the position of the motor for proper V-belt tension. The base must be properly leveled and grouted into the foundation in such a position that the motor sheave lines up with the compressor sheave and the shafts are parallel It is also important that the base be located correctly with respect to distance from the compressor to insure maximum movement of the motor on the base for belt take-up.

NOTE: Motor location with respect to the base is such as to allow sufficient movement to slide the motor forward to put on the belts and to slide the motor away from the compressor to allow belt take-up.

Suitable screws are provided in the base or slide rails for adjustment of motor position, and care should be taken to insure that the grouting of the base does not interfere with the movement of the adjusting screws.

<u>V-Belts</u>

Installation - When installing a multiple V-belt drive a check should first be made that the motor and compressor sheaves are properly aligned and that the shafts are parallel. MOVE the motor toward the compressor as far as necessary to install belts. Then put the belts on the sheave.

NOTE: Do not pry belts over sheave (pulley) grooves, as this will injure belts and greatly reduce belt life.

Adjustment - After the sheaves are properly installed and aligned the V-belts should be installed and adjusted as follows:

1. Measure the belt span (refer to Figure 3).
2. Using a spring scale, apply force to any one belt. This should be done at midpoint in the belt span.
3. Measure the force required to deflect the belt 1/64 inch (0.40mm) for every inch (25mm) or span length.

> **Example:** If the span length is 32 inches (813mm) then the deflection should be 1/64 (0.40mm) multiplied by 32 (813mm/25mm)or 1/2 inch (13mm).

4. Refer to the chart in Figure 4 for the correct "Force Required" if the belts are properly tensioned.

Prior to the initial break-in period, the belts should be adjusted to the upper range of valves listed in Figure 3. During this break-in period the belts will stretch somewhat as they seat themselves in the sheave grooves. After the first four hours of "run-in" the belts should be rechecked and if necessary, the tension should be readjusted to that value. This should again be checked after twenty-four hours to make sure they are still within this range.

Maintenance - Protect the V-belts against temperatures above 130°F (54 °C). Avoid tight fitting guards or other abstractions which prevent free circulation of air.

Three elements especially hard on V-belts are: grit, oil and sunlight. Belts should be kept clean, free of oil and protected from sunlight as mush as possible. Mineral oil is especially destructive, as it will penetrate deep into the belt and cause separation of the cover from the carcass. Oil is the greatest enemy of any rubber product because it causes swelling and rapid disintegration.

Do not use any belt dressing, resins or other adhesive substances of the running surfaces of the belts. Such materials may temporarily improve traction between the belts and the sheave grooves, but the belts will slip more than before the application.

If it is necessary to renew the V-belts, install a complete new set. Otherwise, the new unstretched belts, being shorter than the old one, will have to carry most of the load until their initial stretch has taken place. This excessive uneven load will shorten the life of the new belts.

Keep any of the old belts that appear to be in serviceable condition for future emergency use.

Proper Fit - The V-belt should saddle in the sheave groove so that the top surface rides above the highest point of the sheave. Stresses are then distributed properly throughout the belt section and good contact is assured. A low-ring belt may "bottom" on the sheave groove, relieving the wedging action on the sides. This causes slipping and burring. If a belt rides to high, it loses its contact area.

Belt Storage - Regardless of how much length variation results during storage period of V-belts, the belts will even out if properly adjusted during initial run-in. They will remain a matched set for the balance of their service life. If machinery is to be idle for any sizable period of time, V-belts should be removed from sheaves and stored in a cool, dry, dark place, preferably uncoiled, and hung over pegs on a wall or rack. If left on equipment, V-belts acquire a permanent "set" which
greatly increases possibility of failure.

Belts not in use should be stored in a cool, dark, dry place. If belts become water soaked, or are piled on a damp floor, undue shrinkage may occur.

Belt Guards - Belt guards are recommended and are furnished when specified. Proper ventilation will contribute to longer belt life: However, for weatherproof installation it may not always be possible to provide optimum ventilation.

BELT SECTION	FORCE REQ'D LBS.	
	INITIAL	AFTER BREAKIN
3V	8-10	5-7
B	10-12	6-8
5V	16-18	9-13

NOTE : DEFLECTION = 1/64' X BELT SPAN IN INCHES. BELT SPAN IS MEASURED FROM POINT OF TANGENCY.

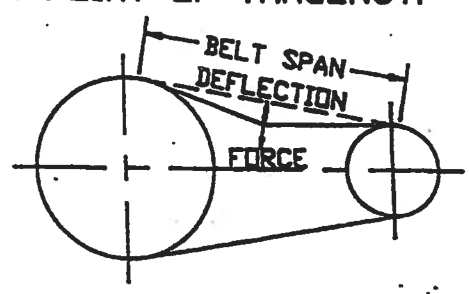


Figure 3. Checking V-Belt Tension by Deflection Force

Section V

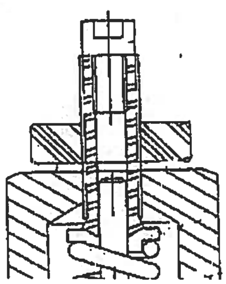
CAUTION NOTES

These notes provide the customer information on practices detrimental to the diaphragm unit. Maximum life of component parts will be realized if the caution notes are observed.

Hydraulic Over-pump Valve Setting

The correct setting of the hydraulic over-pump valve is critical for the proper operation of the compressor. It must be set according to the procedures outlined in the operation instructions. In the event of a loss of gas flow capacity, consult the TROUBLE SHOOTING section XII.

Do not increase the over-pump valve set point to increase gas flow capacity. If loss of capacity due to wear of the over-pump valve trim, do not increase the set point to compensate. Repair or replace the over-pump valve. Excessive hydraulic pressure may result in serious damage to the equipment as well as injury to the operating personnel.



Lock Collar

Do not loosen the lock collar that is clamped to the adjustment screw. When priming the compressor the adjustment screw is turned counterclockwise to reduce the spring pressure. The lock collar follows the adjustment screw. The lock collar assures that the adjustment screw is returned to the original set point after priming the compressor.

The over-pump valve is set at the factory and tagged with the pressure set point. The lock collar is wire sealed at the factory to discourage alteration.

Torques

Over-tightening of the gas check valve back-up nuts or stud nuts in the upper head of the compressor will result in serious damage to the head. Deformation of the cavity will occur causing a definite loss of efficiency and probably failure of the diaphragm. Successive installations of new diaphragms will result only in repetitive failures.
If check valve gaskets are damaged, excessive torque will not effect the seal. Replace gaskets.
Excessive torque of flanged closures nuts will cause bowing of the upper head, resulting in an over-stressed condition and damage to the cavity.

System cleanliness

Solid particles of any kind, even soft materials, cause denting of the diaphragm group. Each dent, no matter how small, becomes a point of high stress concentration when the diaphragm group is flexed. This will eventually result in the diaphragm group failure.
A second hazard contributing to the diaphragm group failure is the slow build-up of solid matter deposited from the process being pumped. This usually occurs at the outer annular areas of the process cavity. Such a condition can result in high bending stresses. If this condition is likely to exist, due to the nature of the process, we suggest periodic cleaning of the surfaces of the diaphragm and cavity with a suitable solvent and/or upstream cleansing of the process being pumped. Moisture must be removed from the process gas. Damage to compressor components can result from condensation build-up.
In all cases, the diaphragm group and the cavity areas (process and hydraulic) must be kept clean and free from solid materials.

Moving Parts

Protective guards are provided for all moving parts. Make sure they are in place before starting the unit. Serious injury will result from contact with moving parts.

CAUTION

OVER-TORQUING OF THE HEAD ASSEMBLY CLOSURE BOLTING MAY RESULT IN DAMAGE TO THE COMPRESSOR.
REFER TO THE ASSEMBLY DRAWINGS FOR PROPER TORQUE VALUES.

CARE MUST BE EXERCISED WHEN WORKING IN THE COMPRESSOR VICINITY SO AS NOT TO TOUCH DISCHARGE PIPING LINES, AS THEY MAY BE EXTREMELY HOT.

Section VI

LUBRICATION

The selection of the proper oil for use in a diaphragm compressor must take into account the fact that the oil has two basic functions. First, the oil must provide adequate lubrication of the crankcase running gear throughout all application and environmental conditions. Secondly, the oil must pulse the diaphragm group in the high pressure portion of the compressor.

PPI has considered both of these cases in specifying the hydraulic oil to be used in your application. This oil is designated on the Compressor Specification Sheet in the front of this manual.

If other oil is to be used, do not substitute without taking into consideration the following requirements:
The oil should have agents added for good anti-corrosion characteristics.
The oil should have superior oxidation stability. The oil should have at least 1500 hours test life in the turbine oil stability test per ASTM D943.

It is important that the oil have anti-foaming agents. A diaphragm compressor cannot operate properly with oil that is entrained with air.
The oil should have the same viscosity as the oil specified by PPI and should have a similar viscosity index.
The table below will aid in cross-referencing PPI specified oils to other manufacturers:

Typical PPI Specification	**Manufacturer**	**ISO Design.**	**Viscosity at 100 F**	**Eqv. SAE Design.**	**Alternate Manufacture**	**Notes**
Tellus 10	Shell	ISO 10 grade	60 SUS	N/A	BP Energol - HLC 10 Dryden Spindle oil 10	
Paradene AW 68	Drydene	ISO 68 grade	319 SUS	SAE 20W	BP Energol - HLC 68 Shell Tellus 68	
Paradene AW 100	Drydene	ISO 100 grade	550 SUS	SAE 30W	BP Energol - HLC 100 Shell Turbo 100	
Paradene AW 150	Drydene	ISO 150 grade	755 SUS	SAE 40 W	BP Energol - HLC 150 Shell Turbo 150	
Halocarbon 27S Chlorofluoro-carbon synthetic oil	Halocarbon Products Corp.	N/A	27 Cst	N/A	None	Oil used in special applications involving reactive gases
Halocarbon 56S Chlorofluoro-carbon synthetic oil	Halocarbon Products Corp.	N/A	56 Cst	N/A	None	Oil used in special applications involving reactive gases

All substitute oils must have the viscosity properties specified and contain anti-foam and anti-corrosion additives. If there is any doubt to the suitability of the oil, please contact the factory.

It is best to operate the compressor in a heated room. If this is not possible, it may become necessary to compensate for seasonal changes by using a heavier grade in the summer months and a lighter 50 grade in the winter months. Some applications will require a crankcase heater to bring the oil to a proper temperature prior to operation of the compressor. If in doubt, please consult the factory.

It is recommended that the oil, oil filter, or filters , be replaced after the initial 40 hours of operation. Thereafter, the oil filters should be replaced after each 4000 hours of operation, or at least once per year.

Section VII

START-UP PROCEDURES

INTRODUCTION AND SAFETY NOTES

This section will discuss the standard start-up procedures for PPI Diaphragm Compressors. For the purpose of this manual we have classified the start-up procedures into two categories: First we discuss initial start-up or start-up after a disassembly of the heads has been performed. Secondly, we will discuss the routine start-up which would occur after the unit was shutdown under normal circumstances.

INITIAL START-UP

General Comments

Safely interrupt all electrical power to the Compressor. Check the level of the hydraulic fluid in the compressor to be sure it is at the proper level. If additional hydraulic fluid is required, make the addition with the fluid specified in the Lubrication Section of the manual.

Resume electrical power to the unit and jog the motor to check the direction of rotation. Rotation must be in the direction indicated on the unit. Turn on the cooling water to the compressor and maintain a cooling water flow rate as required by the compressor specification page. Be certain that all protective guards are in place.

Some procedures in this section recommend that the overpump valve be opened upon initial start-up. Note: this procedure should never be performed when there process pressure in the compressor cavity. This could create a dangerous situation that is detrimental to the machine and possibly hazardous to operating personnel.

PPI diaphragm compressors are shipped with the hydraulic over-pump valve properly set. No adjustment is required before operation. However, if the overpump valve has been repaired or replaced, refer to the Hydraulic Overpump Valve section of this manual.

Compressors with Positive Pressure Injection Pump Systems

Open the hydraulic over-pump valve or valves by turning the adjustment screw counter-clockwise to relieve the spring pressure and thus reduce the pressure setting. **Note: use a hex key (Allen wrench) to turn the adjustment screw. Do not loosen the lock-collar on the adjustment screw.** Start the compressor. Observe the sight glass on the discharge line from the hydraulic over-pump valve. The flow as observed should be clear and not foamy. If the fluid stream is foamy, then air is still entrained in the hydraulic system and the unit should be permitted to operate until the stream is clear. When clear, close the hydraulic over-pump valve or valves. Allow the machine to prime. Priming is complete when a clear over-pump is seen in the sight glass. The compressor is now ready for application of suction pressure.

ROUTINE START-UP

Applicable to Compressors with all Hydraulic Systems

Under normal circumstances, the hydraulic system will remain primed if the process pressure is vented from the compressor when shutdown. It should not be necessary to prime the compressor as discussed in the preceding section

Start the flow of cooling water to the rate specified on the Compressor Specification Page.

Start the compressor and apply suction pressure. Be certain that the pressure does not exceed the rating stamped on the nameplate and as listed on the Compressor Specification page.

Observe the hydraulic fluid flow at the sight gas piped into the discharge port of the hydraulic overpump valve. During the first few minutes of a restart, a foamy condition could exist. Continue to operate the unit until the entrained air is expelled from the hydraulic system. If the foaming does not disappear, shut the compressor down and reprime in accordance with initial start-up.

Section VIII

THE LEAK DETECTION SYSTEM

TRIPLE DIAPHRAGM CONSTRUCTION

Why specify a Diaphragm Compressor ?

PPI pioneered and perfected this unique method of preventing contamination and leakage in the event of a diaphragm or diaphragm seal failure. Unlike conventional in-line detectors, which indicate the actual presence of oil in the compressed gas, the triple diaphragm system instantly detects both diaphragm and diaphragm seal failures. It can be used to offer a warning or automatically shut-down the compressor. This system has been successfully used in hundreds of compressors over the past 30 years. It has virtually eliminated contamination and the associated expensive clean-up operations.

DESIGN FEATURES IN THE HEAD ASSEMBLY

A sandwich of three separate diaphragms is employed with special seals and one or more leak detection port openings. The outer two diaphragms of the sandwich are conveniently flat and smooth. The middle diaphragm has either a cut slot or scribed grooves running from within the seal area to the outer edge of the diaphragm. The purpose of the slot or scribed grooves is to provide a path past the clamped area of the diaphragms through which gas or hydraulic fluid may flow and be easily detected in case of diaphragm failure.

USING THE LEAK DETECTION SYSTEM

The standard PPI leak detection system consists of a pressure switch, a pressure gauge, a relief valve, and a manual vent valve. The pressure switch is normally set at 15 psig increasing.
The standard pressure gauge is 0-30 psig. A 25 psig relief valve protects these components.

The pressure switch can be wired into the motor control circuit to shut down the compressor when the pressure in the leak detection system reaches 15 psig.
Alternatively, the pressure switch can be wired into an annunciator or DCS system to send an alarm when the pressure in the leak detection system reaches 15 psig. This will allow operators to perform a controlled shutdown of the compressor system.

These methods will detect diaphragm or diaphragm seal failures on gas side and oil side.

UNITS OPERATING ON LOW SUCTION PRESSURE

When the suction pressure to the unit is atmospheric or less, it is best to create a vacuum in the leak detection system. If this is not done, air trapped between the diaphragms will expand and separate them during the suction stroke, causing loss of capacity.

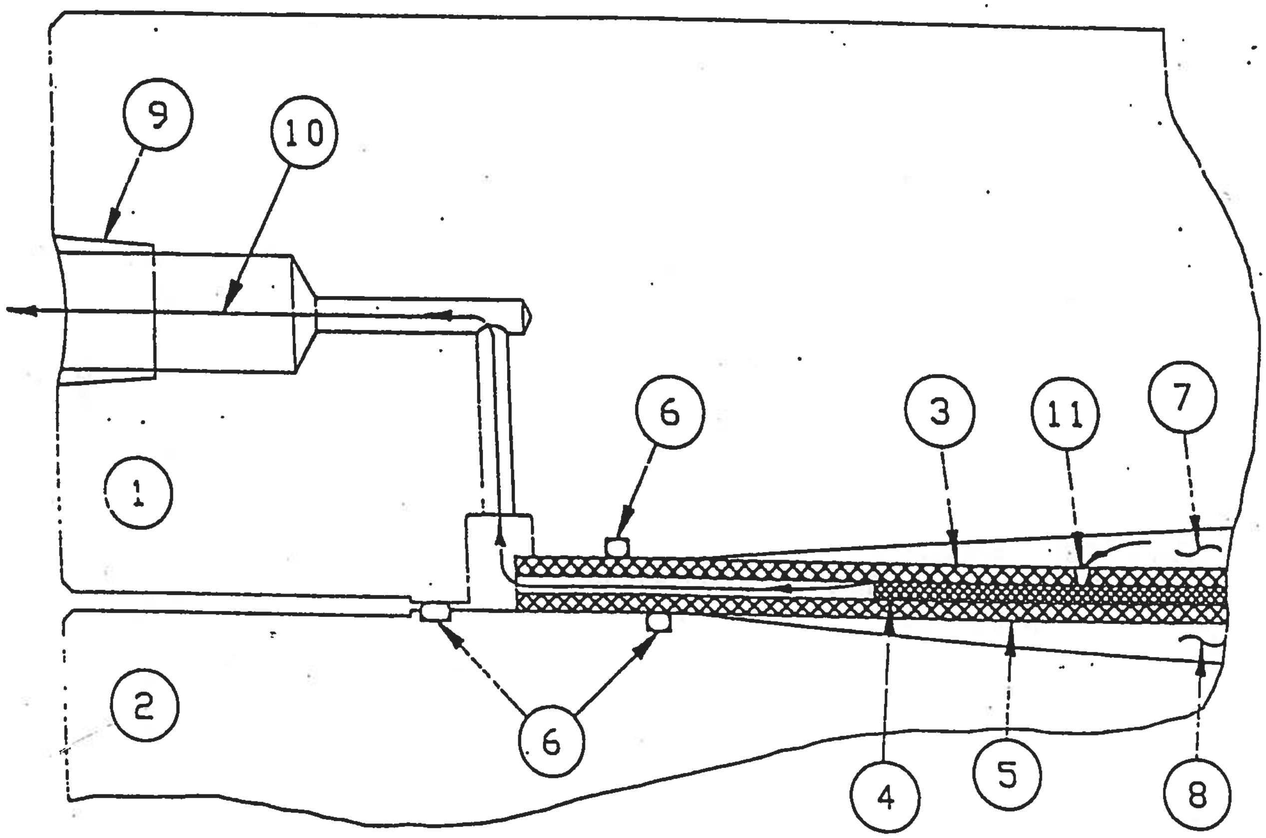


Fig.1. Triple Diaphragm Construction for Bolted Heads. The parts shown are: 1- Process Head; 2- Oil Head; 3- Process Diaphragm; 4- Middle Diaphragm; 5- Hydraulic Diaphragm; 6- "O"Ring Seals; 7- Process Gas or Liquid; 8- Hydraulic Fluid; 9- Leak Detection Port; 10- To Leak Detection System; 11- Diaphragm Failure.

Section IX

THE OIL INJECTOR ASSEMBLY

General Directions

The 2000 Series Compressor does not use an injector assembly. Oil feed to the head assembly is supplied by a small gear pump at the end of the compressor crankshaft. This oil feed occurs when the compressor reaches the bottom of the suction stroke and the hydraulic pressure in the head assembly is reduced to a level that allows the oil to enter. The oil feed rate is set at the factory and must not be altered unless specifically directed by PPI.

The 4000, 5000, 7000, and 9000 Series Compressors use an oil injector assembly which injects a measured amount of oil into the hydraulic system at the proper time with reference to the compression or pumping cycle.

The oil injector assembly is in effect, a two stage pump. A small gear pump at the end of the compressor crankshaft pumps oil from the crankcase up into the body of the plunger portion of the pump. Any excess flow returns to the crankcase. There is a plunger for each stage of the main unit.

The stroke of the plunger is constant, there is no adjustment. The plunger is spring loaded against an eccentric cam which is coupled directly to the crankshaft.

The suction check valve of the injector assembly is contained within the injector plunger. The discharge check valve is a separate, hex body valve installed at the outlet of the injector assembly assembly.

The flow capacity of the injector assembly is a function of the compressor speed and the stroke of the driving eccentric. There is no adjustment.

Disassembly and Re-assembly

To remove the injector assembly, disconnect the hydraulic tubing from the discharge check valve at the outlet of the pump. Remove the internal snap ring that retains the injector sleeve in the housing. Grasp the injector assembly and carefully withdraw the injector assembly assembly from the housing.

Replace the springs and o-rings as needed. The plunger with internal suction check valve is not serviceable. Replace the assembly if necessary. The discharge check valve is not serviceable. Replace the assembly if necessary.

Install the injector assembly in reverse order using a new spring and snap ring.

Section X

THE HYDRAULIC OVER-PUMP VALVE

The hydraulic over-pump valve provides for the maximum volumetric efficiency of the compressor. Since it is set at a level higher than the design discharge pressure rating, the hydraulic pressure always exceeds the process discharge pressure, therefore the diaphragm group will completely sweep the process cavity. This insures maximum process displacement.

The hydraulic valve also limits the maximum pressure which can be generated by the compressor. However, it must not be used as a primary overpressure protection device.

This valve is also used in the initial start-up of a compressor to bleed the air from the hydraulic system. See Caution Notes.

CAUTION NOTES

FAILURE TO COMPLY WITH THE FOLLOWING REQUIREMENTS MAY RESULT IN DAMAGE TO EQUIPMENT AND INJURY TO PERSONNEL.

1. UNDER NO CIRCUMSTANCE SHALL THE HYDRAULIC OVERPUMP VALVE(S) BE SET HIGHER THAN THE SETTING SPECIFIED ON THE COMPRESSOR SPECIFICATION SHEET AND ON THE EQUIPMENT NAMEPLATE.

2. THE HYDRAULIC OVERPUMP VALVE(S) IS NOT TO BE USED FOR PRIMARY OVERPRESSURE PROTECTION. IT IS THE USER'S RESPONSIBILITY TO PROVIDE PROPER OVERPRESSURE PROTECTION, E.G. A PROCESS RELIEF VALVE OR RUPTURE ASSEMBLY.

3. DO NOT USE THE HYDRAULIC OVERPUMP VALVE(S) AS A MEANS TO REGULATE PROCESS FLOW AND/OR DISCHARGE PRESSURE. DAMAGE TO THE OVERPUMP VALVE TRIM, COMPRESSOR HEADS, AND COMPRESSOR RECIPROCATING FRAME MAY RESULT. IF THE COMPRESSOR FLOW CAPACITY IS GREATER THAN THAT REQUIRED BY THE USER, THE USER MUST PROVIDE A FLOW AND/OR PRESSURE-REGULATING DEVICE.

Hydraulic Overpump Valve Setting

The Hydraulic Overpump Valve, like any mechanical component, will wear over a period of time. The valve opens and closes during each revolution of the compressor which is operating at speeds in excess of 300 RPM. For example, if it is assumed that a compressor is operating at 350 RPM, 24 hours a day, for one year, the number of opening and closing cycles will be approximately 184 million In addition to the high cyclic rate of operation, the seating surfaces of the valve are exposed to high pressure differentials which will eventually lead to wear. The start of valve malfunctions can be detected by changes in gas flow rate and reduced discharge pressures. The valve must then be disassembled and rebuilt.

PPI recommends obtaining factory set and sealed overpump valves. If maintenance is required overpump valves can be returned to the factory to be repaired, set, and certified.

Hydraulic Over-pump Valve Setting (cont.)

Hydraulic over-pump valves which have been rebuilt or replaced must be adjusted so that the setting is equal to the value specified on the Compressor Specification Sheet. This can be done by using a hydraulic hand pump capable of developing pressures equal to, or greater than, the required overpump valve setting. The reservoir of the pump must be filled with the fluid used in the compressor's hydraulic system. From the outlet port of the pump install a short nipple and a tee. From one branch of the tee, pipe in a pressure gauge having a range of 50% greater than the required valve setting. From the remaining branch of the tee, pipe to the hydraulic overpump valve. Be certain that the pressure rating of the piping components are equal to or greater than the required relief valve setting. Next, adjust the valve so that the adjusting screw just contacts the spring. This will be evident by increased resistance as the adjusting screw is tightened. Slowly apply pressure to the system.. At some point, the pressure will relieve which can be noted by observing the pressure gauge. This is the initial cracking pressure Turn in the adjusting nut and continue to slowly pressurize the valve while observing the cracking pressure attained on the pressure gauge, Continue to adjust the valve until the cracking pressure is equal to the hydraulic overpump valve setting value specified on the Compressor Specification Sheet. The cracking pressure by definition is the peak pressure developed within the system. Pressure will decrease from the cracking pressure to a reseating pressure during the setting procedure. The cracking pressure is the critical pressure level. At this time turn the lock collar clockwise until it contacts the over-pump valve body. Lock the position of the collar on the adjustment screw with the set screw on the nut.

Relieve the pressure within the system to zero psig. Back out the adjustment screw counterclockwise until it reaches its mechanical stop. Reset the valve by turning the adjusting screw clockwise until the lock collar bottoms out on the valve body. If the cracking pressure is equal to the specified hydraulic over-pump valve setting, the valve has been set correctly.

Install the overpump valve on the compressor and connect the vent line which includes the sight glass to discharge port of the valve.

CAUTION:
NEVER EXCEED THE OVERPUMP VALVE SETTING SHOWN ON THE COMPRESSOR SPECIFICATION PAGE. DO NOT ATTEMPT TO PERFORM ANY MAINTENANCE TO THE OVERPUMP VALVE WHILE IT IS INSTALLED ON THE COMPRESSOR AS SERIOUS DAMAGE TO THE EQUIPMENT OR INJURY TO PERSONNEL WILL RESULT.

Overpump Valve Inspection and Repair

The standard overpump valves furnished on PPI diaphragm compressors are the A12840 valve rated for pressures to 3000 psig, and the B15000 valve rated for pressures to 55000 psig. Prior to performing maintenance on the relief valve as outlined herein, check the unit bill of materials for the relief valve furnished. The assembly drawing for the installed valve will be found in the compressor instruction manual.

Overpump Valve A-12840

1. Remove the over-pump valve from the hydraulic piping. Loosen the set screw in the lock collar (Item 2) and remove it and the thread seal (Item 10) from the adjusting screw (Item 1). Loosen the adjusting screw to relieve spring pressure.
2. Grip the body vertically in a vise with the inlet connection facing upward. Remove the seat/poppet assembly (Item 6), and the o-ring (Item 7).
3. Carefully invert the valve body to remove the stem, the spring and the spring steps. Examine the individual parts and replace those that appear worn or damaged.
4. Carefully inspect all sealing surfaces of the seat/poppet assembly. Any minor nicks or scratches may be removed by lapping with "OO" compound. Any severe deformations will require replacement of the seat/poppet assembly.
5. To reassemble the valve, install a new o-ring (Item 7) over the threads of the seat/poppet assembly. Next, place (1) spring step (Item 3) over the stem (Item 5) followed by the spring (Item 4) and the remaining spring step. Place these components into the seat/poppet assembly (Item 6).
6. Thread the valve body (Item 9) onto the seat/poppet assembly. As this is done make certain that the top of the stem (Item 5) is inserted into the bore of the adjusting screw (Item 1. If this is not done, the stem may be severely damaged.

Follow the operating instructions for resetting the valve. Replace the overpump valve in the hydraulic piping system. Under no circumstance should the compressor be operated unless the overpump valve is re-set to the specified pressure.

Hydraulic Overpump Valve B15000

1. Remove the over-pump valve from the hydraulic piping. Loosen the set screw in the lock collar (Item 9) and remove it, and the thread seal (Item 13), from the adjusting screw (Item 8). Loosen the adjusting screw to relieve spring pressure.
2. Grip the body vertically in a vise with the inlet connection facing upward. Remove the end plug (Item 7) with the seat nut (Item 1). Carefully invert the valve body to remove the spring, and spring cap with ball (Items 3, 4, 5), and the stem and spacer (Items 11, 12).
3. Place the end plug (Item 7) in a vise and remove the seat nut and seat (Items 1, 2).
4. Carefully examine the seat, seat nut, and ball. Surfaces can be lapped or polished to remove minor scratches. Severe deformation requires replacement of both the seat, ball, and spring cap
5. To reassemble, place the end plug (Item 7) in a vise and install seat and seat nut (Items 1, 2). Tighten the seal nut to 40 ft. lbs.
6. Grip the body vertically in a vise with the open end facing upward. Insert the stem (Item 11) into the bore of the adjusting screw (Item 8). Place the spring, spacer, and spring cap with ball (Items 3, 4, 5, 12) onto the stem.
7. Insert end plug, seat and seat nut assembly into the body until the spring cap bore slides over the nose of the seat. Tighten the end plug into the valve body. Install the thread seal and lock nut (Items 9, 13) on to the adjusting screw.

Follow the operating instructions for resetting the valve. Replace the overpump valve in the hydraulic piping system. Under no circumstance should the compressor be operated unless the overpump valve is re-set to the specified pressure.

Section XI

ASSEMBLY AND DISASSEMBLY

INTRODUCTION AND SAFETY NOTES

This section will discuss the disassembly and re-assembly of components making up the diaphragm compressor. As previously stated, clean gas is vital to the operation of a diaphragm compressor. Likewise, when maintenance is performed, it must be carried out in a clean environment. Many users of diaphragm compressors perform disassembly and re-assembly functions away from the operating area to avoid possible intrusion of dirt into the head assembly, process check valves, and other critical parts of the compressor. As a minimum, free floating particles from overhead piping, cranes should be prevented from entering exposed, internal parts of the compressor.

Before any disassembly is begun, personnel performing the task must be thoroughly familiar with the equipment. Drawings and bills of material contained in the manual must be carefully reviewed and relationship of parts understood. Prior to disassembly, personnel must do the following:

1. Disconnect all electric power, both primary drive power and control power.

2. Interrupt all pneumatic control pressure to the compressor or compressor accessories so that equipment can not accidentally be activated.

3. Tag all control stations advising operations that maintenance is being performed.

4. Safely and carefully vent all process and hydraulic pressure.

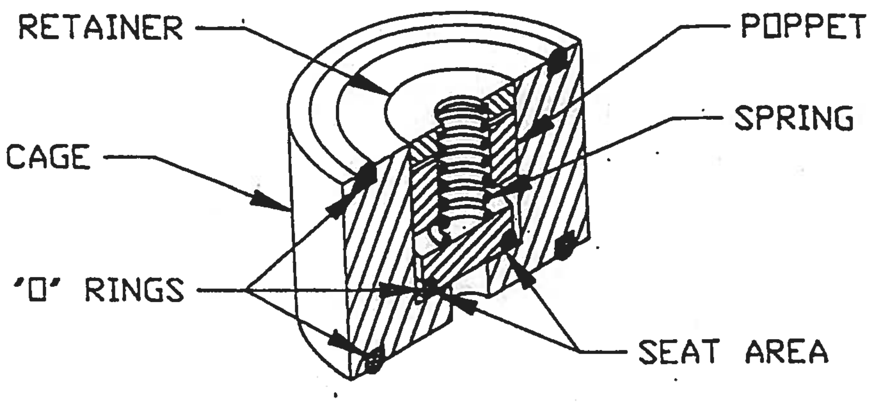
COMPONENT DISASSEMBLY

Process Check Valves

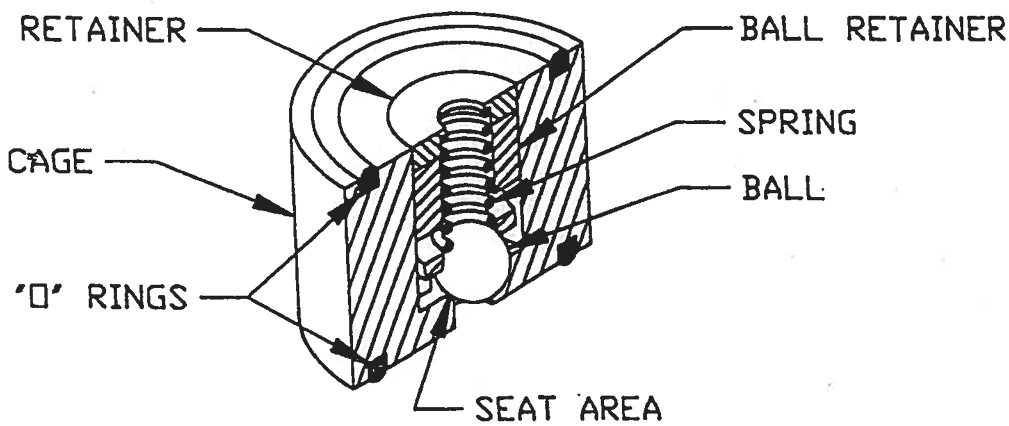
Please note that these instructions represent only the basic information and parts identification, please refer to the appropriate design drawing elsewhere in this manual. The check valves are readily accessible for inspection, repair, or replacement and can be removed without disassembly of the compressor head.

The check valves are retained in the head assembly by either a back up nut or flange. This can be determined by reviewing the compressor head assembly drawing. Be certain that all process pressure has been removed.

TYPICAL PROCESS CHECK VALVE CONFIGURATIONS



CAPSULE POPPET CHECK VALVE



CAPSULE BALL CHECK VALVE

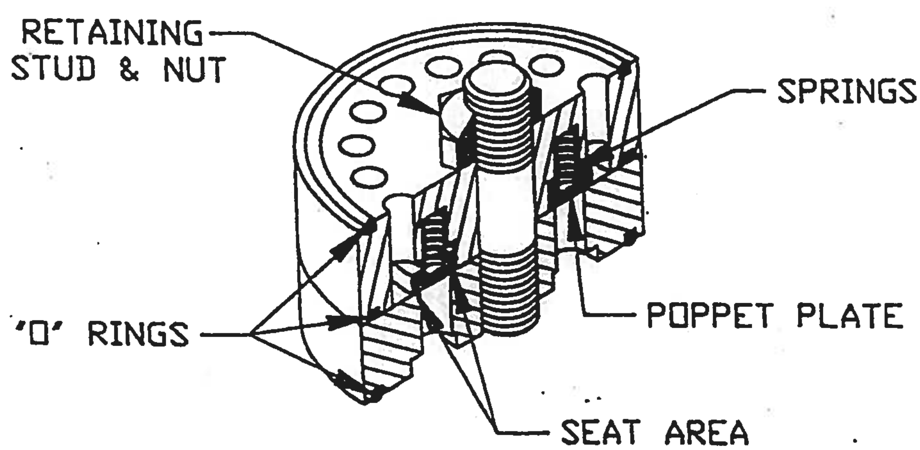


PLATE STYLE CHECK VALVE

Disconnect the process piping, remove the back up nuts or flange and insert a suction cup type tool until it contacts the capsule check valve assembly. Remove the check valve capsules. Some sort of retainer holds the internals within the check valve cage. Remove or unscrew the retainer from the cage. This must be done slowly and carefully so that small parts are not randomly ejected. Remove the internals of the check valve. Examine the cage seat for wear or any marks or indentations which could affect sealing. Any such marks should be polished out so that surfaces are uniform and finished to 16 RMS or better.

For capsule ball check valves, inspect the ball sealing surfaces. If there is any question as to the condition of the ball, such as scratches, score lines, etc., replace it with a ball of the same diameter and material as specified in the bill of material. To assure proper seating, we recommend that the ball be coated with a fine lapping compound (grit of 600) and worked against the seating area in the cage.

Capsule poppet check valves are designed with two options depending on pressure: first, a metal poppet with an "O" ring; second, a high performance plastic with no "O" ring. For the former, O" ring should be inspect for extrusion, particulate matter embedded in the "O" ring and elevation of the "O" ring above the poppet face. We suggest the "O" ring be replaced under any circumstances.

Poppets of high performance plastics are to have the sealing surface inspected (the surface contacting the seat area of the cage). Again, if any surface imperfections are observed, the face of the poppet should be polished. Note that the polishing must be flat and perpendicular to the poppet centerline. Gaskets used to seal the cage to the head and back up nuts (or flanges) should be replaced before re-assembly.

PROCESS HEAD AND DIAPHRAGM SET REMOVAL

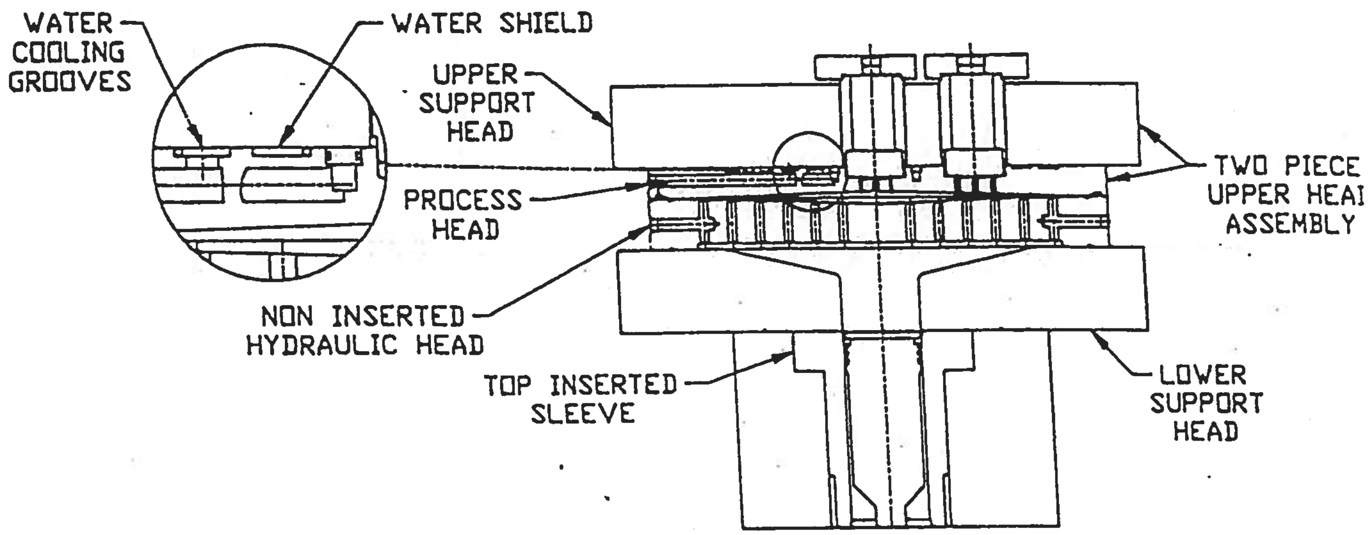
Bolted head closure

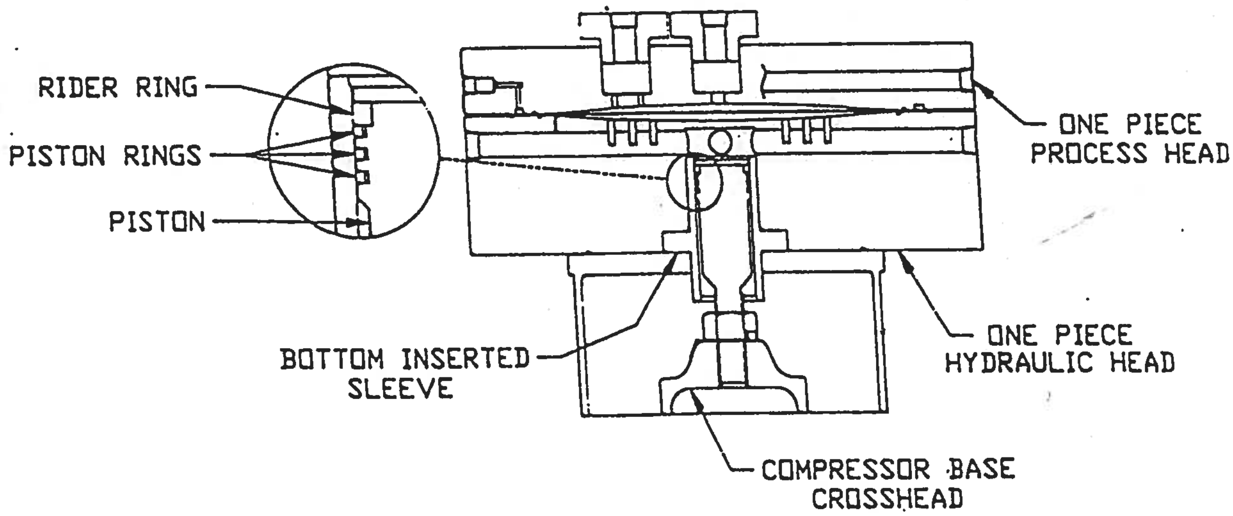
All head assemblies have been stamped at the factory with a pattern for loosening the head stud and nut sets. This sequence must be strictly adhered to. Break loose each nut using the pattern number stamped on the head as a sequence guide. After each nut has been loosened, remove them in the same sequence. If at any time, a nut will not loosen, retorque the bolts to the prescribed torque level. Then, gradually, back them off after the one troublesome nut breaks loose. Remove the process head and place it in a clean area with the cavity side facing upward.

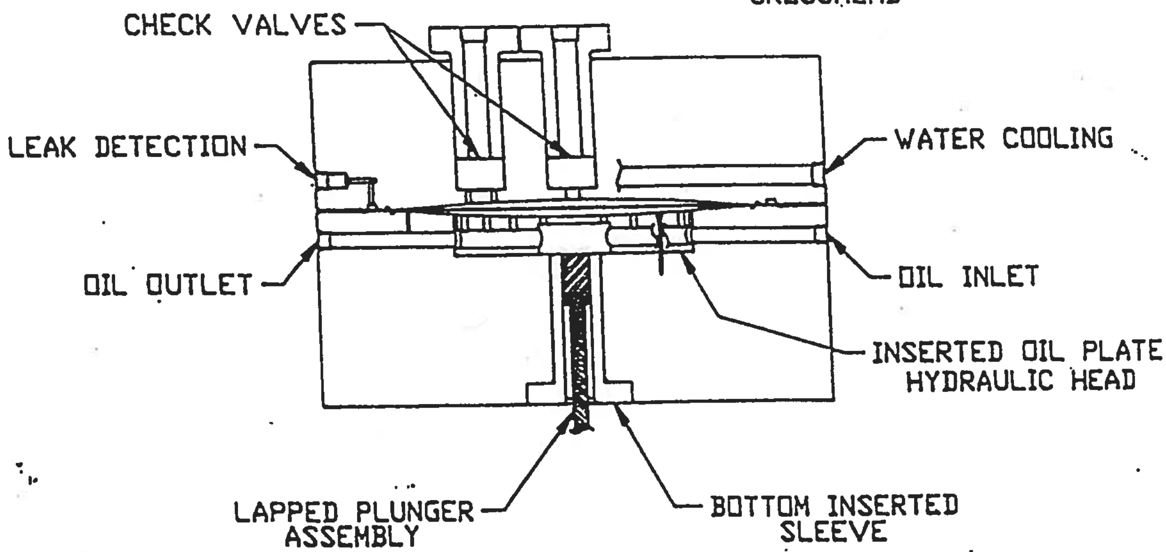
At this time, the diaphragm group can be removed. The diaphragm set is retained by one of two methods: first, a series of socket head cap screws: or second, by a series of roll pins. Remove the diaphragm set and inspect it for any breakage. Inspect the process "O" ring seals, leak detection seals, and oil seals. It is recommended that these seals be replaced even though they may appear to be in satisfactory and usable condition.

Certain head assemblies are of a composite type using a cavity plate and upper support head. The composite head should only be disassembled if the water seal should leak. Loosen and remove the nut holding the cavity plate to the upper support head. Remove the upper support head, water shield, and water seal "O" rings. Place the cavity plate with the cavity side up in a clean area and proceed to clean both the water and gas side. At this time, replace the water shield and water seal "O" rings.

TYPICAL HEAD ASSEMBLYS AND NOMENCLATURE







NOTE:

DRAWINGS SHOW SOME TYPICAL CONFIGURATIONS AND SHOULD BE USED FOR REFERENCE ONLY, ACTUAL COMPRESSOR HEAD ASSEMBLY CONFIGURATION IS SHOWN ON DRAWINGS IN REAR OF MANUAL.

HYDRAULIC SYSTEM DISASSEMBLY

Bolted head closure

The hydraulic system, as defined by this section, consists of the oil head, piston sleeve, piston and piston rings. These components should only be disassembled in the event the piston rings fail or exhibit excessive leakage or there is a seal failure between the sleeve and the lower support head. Unfortunately, there is no way to readily determine which of these components failed in service aside from visual inspection of the parts.

The hydraulic head is of an inserted, non-inserted, or one piece design. The details of your compressor will be shown on the assembly drawings furnished elsewhere in this manual.

If this compressor model uses a lapped fit plunger and the plunger requires replacement, it will be necessary to return the upper head to PPI so that the bore and plunger diameters can be carefully matched.

If the model has an inserted oil plate, loosen and remove the socket head cap screws and remove the inserted oil plate. If the model is a non-inserted design, place lifting lugs in the tapped holes provided on the side of the head, Remove the head with the cavity side up and place it in a clean area. For either design, "O" rings are used to seal components together. They should be replaced at this time.

The piston sleeve is retained in the head assembly by several methods. In all cases, the flywheel is to be rotated until the piston is at bottom, dead-center. For those models having sleeves inserted through the top of lower support head, remove the sleeve by pulling directly up. Once the sleeves have been removed, loosen and remove the bolts holding the lower support head to the reciprocating base cylinder. Remove the lower support head and place it in a clean area.

Piston and piston ring removal is accomplished by manually rotating the flywheel until the piston is at top, dead-center. The piston rings are now accessible for disassembly. Loosen and remove the bolt or bolts on the top of the piston which will permit the piston rings to be removed for inspection and/or replacement. If it is necessary to remove the pistons for replacement or repair, loosen and remove the socket head cap screws on the piston head adapter. Once they are removed, the piston and the piston hold-down plate can be withdrawn for inspection

REASSEMBLY AND INSPECTION OF COMPONENTS

The process and hydraulic systems should now be carefully inspected prior to re-assembly. If a diaphragm failed in service, it is very important to note the location of the failure and type of failure. In the majority of cases, the diaphragm failure is a direct result of foreign , solid particles entering the head.

Once the point of failure has been determined, inspect the process head or cavity plate for any indentations which may have caused the metal to rise above the surface. These surfaces should be polished using 400 grit paper backed by a wood block. Discoloration on the process head or cavity plate should be polished off using 400 grit paper.

If a process "O" ring has failed, note the type of failure. For example, extrusion or break. If the "O" ring has extruded, carefully inspect the area outside of the "O" ring groove. It is possible that extrusion material, which has been squeezed between the process head or cavity plate and the diaphragm group could indent the cavity plate or upper head. If this has occurred, carefully polish the area and consult the factory for further instructions. CAUTION: Excessive metal removal in the "O" ring seal area, inward toward the center of the cavity, could cause a change in contour which may result in high stresses and reduced diaphragm life. Excessive polishing or metal working must be avoided. If machining operations are necessary, consult PPI.

While "O" ring seals may appear to be in satisfactory condition, we must recommend that they be replaced upon reassemble. "O" rings, even in hydraulic service, have a tendency to assume a "set position" and may not seal when re-pressurized. Particular attention should be given to the process "O" rings, hydraulic head "O" rings, sleeve "O" rings (where applicable),and the leak detection system "O" ring.

Piston sleeves and piston rings must be carefully inspected prior to reassemble. Piston sleeves with glazed surfaces or surfaces with longitudinal scratches must be reworked. The limitations of sleeve rework are normally 0.0005". Refinishing must be limited to honing and not manual polishing. Once the sleeve has been inspected and reworked as noted herein, the piston rings should be checked for uniformity of cross section. A variation of cross sectional width greater than 0.001 indicates wear has taken place and the piston ring or rings should be replace. Note that conventional piston rings are not suitable replacement parts. The piston ring design has been developed by PPI for over twenty years, and replacement parts must be obtained from PPI in order to ensure continuous, trouble-free operations.

Cleanliness is extremely important and all parts must be thoroughly cleaned and free of foreign matter prior to reassemble.

PISTON AND PISTON RING ASSEMBLY

Rotate the flywheel until the piston is at top, dead-center. Place the piston rings on the piston. Stagger the joints equally around the piston. For example, if there are (3) rings the joints should be 120 degrees apart. Assemble the rider ring and its retaining bolts and torque them to the specified level.

Manually rotate the flywheel until the piston is at bottom, dead-center. As noted in the disassembly instruction, there are several piston sleeves and support head designs for PPI diaphragm compressors. In all cases, it is necessary to lightly coat the entire bore of the sleeve with the hydraulic fluid specified.

For the proper fluid, refer to the compressor specification sheet. As previously discussed, be certain that the seal has been replaced prior to reassemble.

HYDRAULIC HEAD REASSEMBLY

Models using an inserted oil plate require that the oil plate be placed into the lower support head and the socket head cap screws inserted and torqued to the specified level.. It is extremely important that these socket head cap screws be properly anchored. We recommend the use of a thread locking compound such as lock-tight, to prevent these screws from becoming loose during operation and causing possible damage to the compressor. Models making use of non-inserted oil heads should have all hydraulic seals inspected and replaced prior to assembly. Place the "O" rings in the grooves provided. Lower the oil head onto the lower support head. When the oil head comes into contact with the lower support head, it should not be lifted because the hydraulic seal may dislodge form the groove.

REASSEMBLY OF THE DIAPHRAGM GROUP AND PROCESS HEADS

Place the diaphragm set on the oil head. The set is to be oriented by pins in the oil head. If socket head cap screws are used, align the diaphragm group and torque the socket head cap screw to the specified level shown on the unit assembly drawing.

Models making use of a composite head assembly have a water shield and water shield seal. As stated in the previous section, these parts should be inspected and replaced as necessary. Assemble the seals into the proper grooves and place the water shield on top. Lower the upper support head onto the cavity plate and attach the upper support head with the stud and nut sets. Torque the stud and nut sets to the specified level.

The reassembly steps for the composite and non-composite process heads are identical. Once the process seal has been replaced and inserted into the groove, lower the upper head onto the diaphragm group. When the upper head assembly comes into contact with the diaphragm group, it should not be lifted again as the process seal may dislodge from the groove.

Insert the stud and nut sets through the heads and hand-tighten all of the nuts. Using the numbers stamped on the process head, tighten the nuts in that numerical sequence, first, to a level of 25% of maximum torque, then 50% of maximum torque, then 75% of maximum torque, and finally, to the final torque valve. Recheck all nuts.

CAUTION: BE CERTAIN TO FOLLOW THE PROPER SEQUENCE FOR EACH LEVEL OF TORQUE. DO NOT OVER-TORQUE. SERIOUS DAMAGE TO THE EQUIPMENT OR INJURY TO PERSONNEL MAY RESULT.

REASSEMBLY OF PROCESS CHECK VALVES

Insert the check valve capsules into the proper ports and thread the back-up nuts into place and torque them to their specified level. If flange back-ups are used, torque the flange bolts to the specified level.

The next step is extremely important. On units with back-up flanges, assemble the "Belleville" washers duplicating the orientation shown on the equipment drawings contained in this operating manual. Tighten in the order stamped on the process check valve body the stud and nut sets to 50% of the specified valve, Increase the torque to 75%, and finally, to 100% of the value called for on the equipment drawings.

CAUTION: BE SURE TO FOLLOW THE PROPER SEQUENCE FOR EACH TORQUE LEVEL. DO NOT OVER-TORQUE. SERIOUS DAMAGE TO THE EQUIPMENT OR INJURY TO PERSONNEL MAY RESULT.

PREPERATION FOR RESTART

Replace all piping to the head assembly, including process piping, cooling water piping, and hydraulic piping. Be certain that all maintenance tools and components are accounted for and that the flywheel guard has been replaced. Refer to the instruction manual section, entitled, "Start-up Instructions and Procedure" for restarting the equipment.

TROUBLESHOOTING AND MAINTENANCE GUIDE

PROBLEM	POSSIBLE CAUSE	SOLUTION
Loss of process flow or pressure	Piping leakage	Tighten connections replace worn gaskets, re-polish damaged gasket surfaces.
	Incorrect process component functions.	Revise component design
	Hydraulic over-pump valve open	Close Valve
	Clogged Suction Filter	Clean filter assembly. Wash the element by back-flushing in solvent or replace element
	Improper over-pump valve setting, or worn or damaged over-pump valve trim	Check the over-pump valve per instructions.
	Process check valve malfunction.	Disassemble and inspect check valves. Replace worn or damaged parts.
No Over-pumping	Low oil level	Check oil level in base or reservoir. Refill if necessary. Re-prime per operating instructions.
	Clogged oil filter.	Clean or replace.
	Clogged oil sump screen	Clean or replace.
	Leaking oil lines	Tighten or replace as required.
	Worn piston or packing rings	Disassemble, inspect, and replace if necessary.
	Oil suction check valve leaking.	Disassemble: inspect poppet "O" ring and seat. Replace as required
	Malfunction of base or injection pump	Remove oil suction line and run unit to check oil pump output.
	Leaking past piston sleeve "O" ring.	Disassemble, inspect and replace if necessary.
Hydraulic Hammering (Cavitation)	Applying gas pressure before heads are properly primed (Check same causes as for **"no over-pumping"**)	Re-prime per operating instructions.
Shut down by Leak Detection System	Broken diaphragm or leaking head seals.	Remove heads and replace diaphragms and seals.
Higher than normal discharge gas temperature	Insufficient water supply to heads or to oil or gas coolers.	Turn on water supply. Check for cooling system restrictions and eliminate.
Discharge gas too hot.	Discharge check valve leaking gas back to suction. Suction pressure too low. Suction temperature too high.	Inspect check valves. Replace damaged seals and/or parts. Increase suction pressure. Add pre-cooler to piping.

LOSS OF PROCESS PRESSURE OR FLOW

A. Hydraulic over-pump is present

	POSSIBLE CAUSE	POSSIBLE SOLUTION	CHECKED
1	Hydraulic over-pump valve open.	Close valve	
2	Improper hydraulic over-pump valve setting or worn or damaged relief valve trim	Check over-pump valve setting. Reset if necessary. Inspect and replace if necessary.	
3	Clogged suction filter.	Clean or replace as necessary.	
4	Process Piping Leaking.	Soap bubble check; tighten connections; Replace worn or damaged gaskets and seals.	
5	Process Bypass or Unloading Valve open.	Close Valve.	
6	Process Bypass or Unloading Valve leaking.	Inspect, repair or replace, as necessary.	
7	Process Check Valve leaking.	Disassemble and inspect. Repair or replace, as necessary.	

B. Loss of hydraulic over-pump

	POSSIBLE CAUSE	POSSIBLE SOLUTION	CHECKED
1	Low oil level.	Check oil level; refill if necessary; Re-prime compressor per instruction manual.	
2	Clogged oil filter or sump screen. (Low oil pressure)	Clean or replace, as necessary	
3	Leaking oil lines.	Tighten or replace as required.	
4	Oil Suction Check Valve Leaking.	Disassemble. Inspect seat, "O" ring, and poppet. Repair or replace, as necessary.	
5	Worn piston rings or damaged sleeve "O" ring.	Pressure check hydraulic system (static). If internal leak is evident - disassemble, inspect and replace piston rings and sleeve "O" ring.	

Section XIII - Routine Maintenance

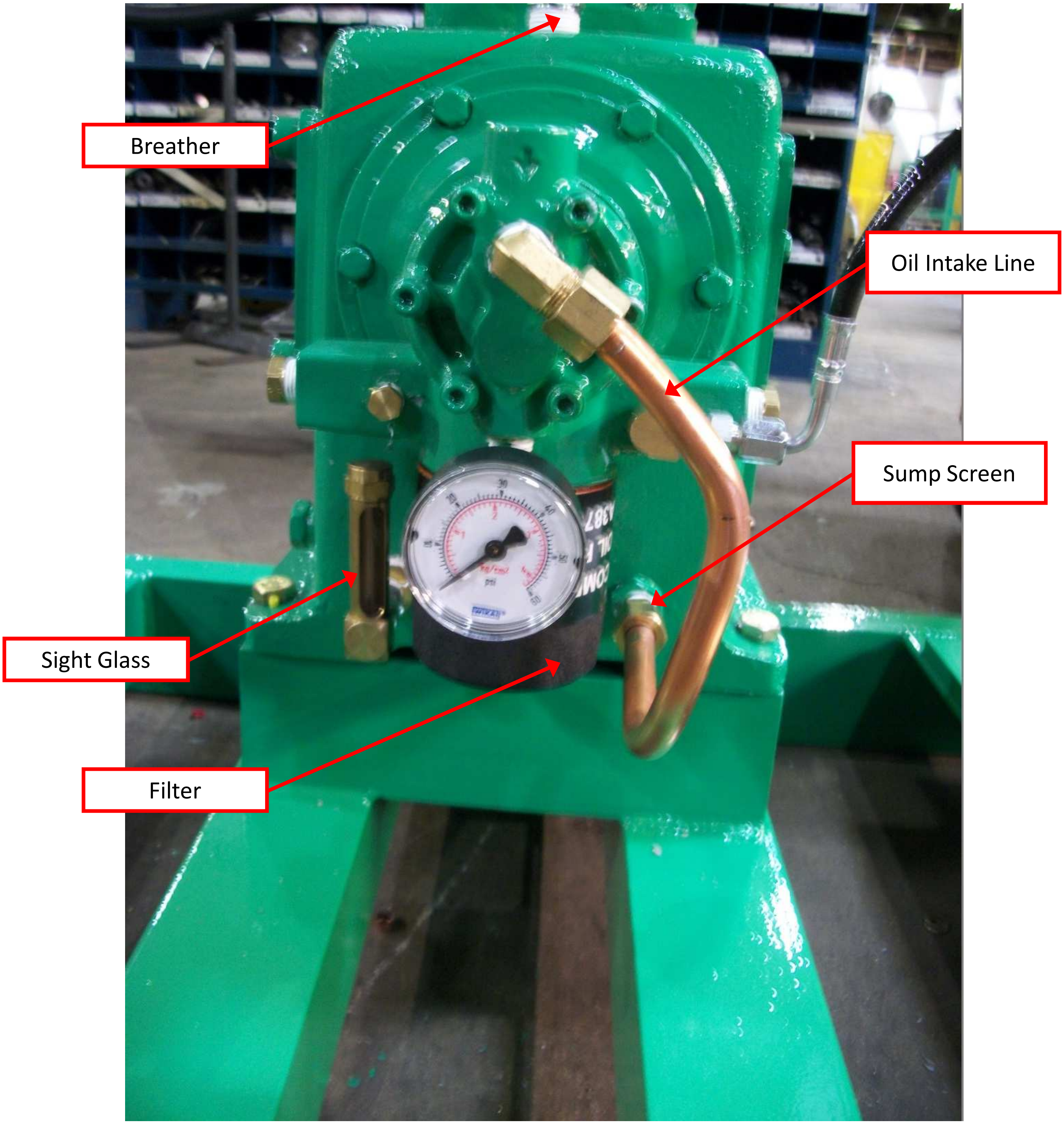
System	Maintenance Item	Daily	2000 hours or 3 months	4000 hours or 6 months	8000 hours or 12 months
Head Assembly	check head bolt torque		X		
	check compressor valve retainer torque		X		
	replace diaphragms				X[3]
	replace process, hydraulic and leak detection o-rings				X[3]
Leak Detection	check gas tightness of system		X		
	confirm pressure switch set point			X	
Cooling	confirm coolant flow	X			
	confirm operation of coolant flow switch(es)				X[2]
	confirm coolant temperature switch set points				X[2]
	check system for coolant leaks		X		
Drive	guards in place and secure	X			
	drive belt wear			X	
	drive belt tension				X
Hydraulic	confirm overpump valve set point				X
	examine and clean oil inlet check valve				X

System	Maintenance Item	Daily	2000 hours or 3 months	4000 hours or 6 months	8000 hours or 12 months
Lubrication	check oil level	X			
	check oil pressure	X			
	confirm oil pressure switch set point			X	
	drain and replace operating oil				X[1]
	replace oil filter				X[1]
	clean oil sump strainer				X
	check crankcase oil heater operation				X[2]
	confirm oil temperature switch set point				X[2]
Process	clean/replace process inlet filter element			X	
	examine and clean compressor valves			X	
	confirm process system pressure switch(es) set points				X[2]
	confirm process system temperature switch(es) set points				X[2]
	confirm process safety valve set point				X[2]
	check process piping for leaks		X		

Notes:
1. Examine condition of operating oil after first 50 hours of operation. Replace if necessary
2. If compressor is so equipped.
3. Replace when there is a diaphragm or o-ring failure.

APEKS Diaphragm Compressor Oil Change Instructions

1. Ensure compressor is properly locked-out to prevent accidental starting during the oil change.
2. Place an oil pan below the oil pump intake line.
3. Loosen the compression fittings connecting the oil intake line to the compressor sump and oil pump.
4. Remove oil intake line and allow oil to drain into the pan.
5. Remove sump-mesh screen to allow oil to drain out completely from sump.
6. Clean sump screen of any debris.
7. If the sump screen has accumulated dirt or debris, remove the access plate on the right side of the compressor in order to clean out any debris remaining in the base
8. Use a light coating of silicone RTV when replacing the access plate.
9. Remove and replace oil filter, applying a light coating of oil to the filter seal.
10. Apply fresh TFE tape and reinstall the sump screen and oil intake line.
11. Remove breather at the top of the crankcase.
12. Place a funnel in the breather port. Use of a strainer or mesh cloth is recommended to prevent debris from entering the crankcase.
13. Refill compressor with new oil, follow the recommendation in the IOM (also on the compressor nameplate) for the quantity and grade of oil.
14. Fill the oil to approximately ½ way up the sight glass. Note: the qty. of oil given includes the oil required to fill the compressor head(s), so the level on the gauge may initially be greater than ½ way up the sight glass.
15. Reapply TFE tape and re-install the breather.
16. To aid the oil pump to build pressure, oil may also be added to the pump housing by removing the ¼”NPT plug located on the top of the housing. Once the pump housing is full, tape and re-install the plug.
17. The compressor is now ready to be restarted, following the instructions in the IOM.
18. Oil pressure should be generated within 30 seconds of the compressor starting.
19. If oil pressure does not build within 30 seconds, repeat steps 6 & 16.
20. The oil level may drop as the head is filled during the priming cycle at start-up. The compressor can be operated with oil level between the ¼- ¾ of the sight glass.
21. Symptoms of low oil level include low or no oil pressure.



Representative Hydraulic Arrangement

Motor Sheave

General – the standard unit is furnished with a single extended crankshaft and a V-belt sheave. The belt sheave is constructed with a tapered, bushing type hub and is heavy enough to supply the necessary flywheel effect. The sheave is statically balanced with small balance weights located around the inside of the sheave rim.

To Install:

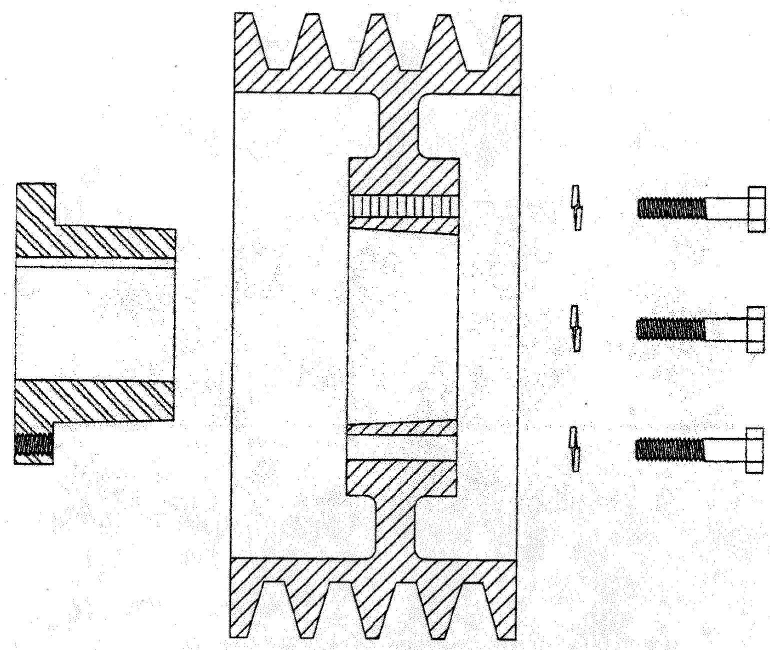
1. Inspect the tapered bore of the sheave and the tapered surface of the bushing. Any paint, dirt, oil, or grease MUST be removed.
2. **Standard Mounting:**
   Install shaft key. If key was furnished with bushing, you must use that key.
   Install bushing on clean shaft, flange end first. If bushing will not freely slide on the shaft, insert a screwdriver or similar object into the flange saw-cut to act as a wedge to open the bushing's bore.
   Caution: Excessive wedging will split the bushing.
   If using the setscrew, tighten it enough to prevent the bushing from sliding on the shaft.
   Caution: Do not over-tighten setscrew!
   Slide sheave into position on bushing, aligning the drilled holes in the sheave with the tapped holes in the bushing flange.
   Note: Install **M** thru bushings so that two tapped holes in the sheave are located as far away as possible from the bushing's sawcut. Loosely thread the cap screws with lockwashers into the assembly.
3. **DO NOT USE LUBRICANT ON THE CAPSCREWS!** Using a torque wrench, tighten all cap screws evenly and in rotation to the torque value in 'Torque Values' Table. There must be a gap between the bushing flange and sheave hub when installation is completed.

DO NOT OVER-TORQUE!
DO NOT ATTEMPT TO CLOSE GAP BETWEEN BUSHING FLANGE AND SHEAVE HUB!

To Remove:

1. Relieve drive tension by shortening the center distance between driver and driven sheaves.
2. Lift off belts.
3. Loosen and remove cap screws. If the bushings have keyway set screws, loosen them.
4. As shown below, insert cap screws in tapped removal holes and tighten each one until mating part is loose on the bushing. *Exception:*
   If mating part is installed with cap screw heads next to motor, with insufficient room to insert screws in tapped holes, loosen cap screws and use wedge between bushing flange and mating part.
5. Remove mating part from bushing and, if necessary, bushing from shaft.

Closely observe the instructions issued by the motor manufacturer for the motor driver, to insure that the driver will perform satisfactorily. The standard direction of rotation is counterclockwise when looking at the compressor belt wheel, as indicated by the "arrow" on the oil pump casing or frame of the compressor. Refer to the foundation plan if rotation is not as indicated above.



STANDARD MOUNTING ASSEMBLY

TORQUE VALUES **(USE A CALIBRATED TORQUE WRENCH)**		
Tapered Bushing Size	Cap Screw Size and Pitch	Torque Ft. Lbs (N-M)
SH-SDS-SD	1/4 - 20	9 (12.2)
SK	5/16 – 18	15 (20.3)
SF	3/8 – 16	30 (40.7)
E	1/2- 13	60 (81.4)
F	9/16 - 12	110 (149.1)
J	5/8 – 11	135 (183)
M	3/4 - 10	225 (305)
N	7/8 – 9	300 (406.8)

CAUTION: The tightening force on the screws is multiplied many times by the wedging action of the tapered surface. If extreme tightening force is applied, or if a lubricant is used, bursting pressures will be created in the hub of the mating part.

Motor Installation

General – ordinarily, Induction motors are used and easy to install. An adjustable base or set of slide rails must be provided under the motor to permit adjustment of the position of the motor.

V- Belt tension:

The base must be properly leveled and grouted into the foundation so that the motor sheave lines up with the compressor sheave and the shaft are parallel. It is important that the base be located correctly with respect to distance from the compressor, to insure maximum movement of the motor on the base for belt take-up.

NOTE:

The motor location in reference to the base must allow sufficient movement in order to slide the motor forward and to put on the belts and to slide the motor away from the compressor to allow belt take-up.

Suitable screws are provided in the base or slide rails for adjustment of motor position. Care should be taken to insure that the grouting of the base does not interfere with the movement of the adjusting screws.

V Belts:

Installation – When installing a multiple V-belt drive, first check that the motor and compressor sheaves are properly aligned and that the shafts are parallel. Move the motor toward the compressor as far as necessary to install belts and then put the belts on the sheave.

NOTE: Do not pry belts over sheave (pulley) grooves, as this will greatly reduce belt life.

Adjustment – After the sheaves are properly installed and aligned, the V-belts should be installed and adjusted as follows:

1. Measure the belt span (refer to fig. 3)
2. Using a spring scale, apply force to any one belt. Do this at midpoint in the belt span.
3. Measure the force required to deflect the belt 1/64" (0.40mm) for every inch (25mm) or span length.

Example: If the span length is 32 inches (813mm) then the deflection should be 1/64 (0.40mm) multiplied by 32 (813mm/25mm) or 1/2 inch (13mm)

Refer to the chart in Fig. 4 for the correct "Force required" and if the belts are properly tensioned.

Prior to the initial break-in period, adjust belts to the upper range of values listed in Fig.3. The belts will stretch somewhat as they seat themselves in the sheave grooves. After the first four hours of "run-in" the belts should be rechecked and, if necessary, the tension should be readjusted to that value. This should again be checked after twenty-four hours to assure they are still within this range.

Maintenance – protect the V-belts against temperatures above 130°(54℉). Avoid tight fittin g guards or other obstructions, which prevent free circulation of air.

Three elements harmful to the V-belt are: grit, oil and sunlight. Belts should be kept clean, free of oil and protected from sunlight, as much as possible. Mineral oil is especially destructive, as it penetrates deep into the belt and causes separation of the cover from the carcass. Oil is the greatest enemy of rubber products, because it causes swelling and rapid disintegration.

Do not use any belt dressing, resins or other adhesive substances on the running surfaces of the belts. Such materials may temporarily improve traction between belts and the sheave grooves, but the belts will slip more than before the application.

If it is necessary to replace the V-belt, install a complete new set, otherwise the new unscratched belt, being shorter than the old belt,

will carry most of the load until their initial stretch has taken place. This excessive uneven load will shorten the life of the belt.

Keep any of the old belts that appear in serviceable condition for future emergency use.

Proper Fit – The V-belt should saddle in the sheave groove so that the top surface rides above the highest point of the sheave. This eliminates stress, which is distributed throughout the belt section and good contact is assured. A low-ring belt may "bottom" on the sheave groove, relieving the wedging action on the sides. This causes slipping and burring. If a belt rides to high, it loses its contact area.

Belt Storage- Regardless of how much length variation results during the storage period, the belts will even out if properly adjusted during initial run-in. They will remain a match set for the balance of their service life. If machinery is idle for a long period of time, V-belts should be removed from sheaves and stored Belts not in use should be stored in a cool, dark, dry place. If belts become water soaked or are piled on a damp floor, undue shrinkage may occur.

Belt Guards – Belt guards are recommended and are furnished when specified. Proper ventilation will contribute to longer belt life. For waterproof installation it may not always be possible to provide optimum ventilation.

Checking V-belt Tension by Deflection Force Required LBS		
BELT SECTION	**INITIAL**	**AFTER BREAK-IN**
3V	8-10	5-7
B	10-12	6-8
5V	16-18	9-13

Note: Deflection = 1/64" x belt span in inches.

Belt span is measured from point of tangency