



OPERATION / SERVICE / PARTS MANUAL

6T-855-62B/2000

BOM 10186

**325 PSIG SUCTION TO 2000 PSIG DISCHARGE
2700 SCFM CAPACITY TWO STAGE OPERATION
325 PSIG SUCTION TO 900 PSIG DISCHARGE
3600 SCFM CAPACITY SINGLE STAGE OPERATION
CAT C18 630 BHP DRIVE ENGINE
FISHER AUTOMATIC UNLOAD / AUTOLOAD
FUEL BULKHEAD CONNECTIONS
WILL FIT IN 20' SHIPPING CONTAINER
4" 300# FLANGE SUCTION CONNECTION
3" 1500# FLANGE DISCHARGE CONNECTION
AOP BALL VALVES FOR SINGLE STAGE SWITCHING
ASME CODED COOLERS WITH LOUVERS**

OPERATION, MAINTENANCE & PARTS MANUAL

GENERAL SAFETY

How to Work Safely With Your Compressor

Before You Start the Compressor

- Check fluid levels and for possible leaks
- Use adequate hose and couplings with safety locks or pins
- Remove all tools and/or loose items from engine compartment
- Relieve any pressure in separator tank by opening drain

Use of Compressed Air

- Air from this machine is not fit for human consumption – **do not use air for breathing for food processing**
- Never operate in an enclosed area
- Never use compressed air to clean your clothes; and never direct it at another person – **IT CAN KILL**
- Wear eye protection
- Install velocity check valve (“OSHA” valve) upstream of hose

Other Safety Precautions

- Do not touch hot surfaces or moving parts – such as exhaust or fans
- Do not adjust or restrict relief valves
- Do not disconnect or alter shutdown sensors or switches
- Do not clean machine with gasoline or volatile fluids
- Do not refuel while machine is running; shut down and allow to cool before refueling
- Do not jump-start with cable connections directly on battery. Connect ground last, away from battery or frame

Servicing

- Before servicing compressor, relieve separator pressure and allow to cool
- Disconnect battery if mechanical work is to be performed
- Wipe up any spills resulting from servicing

Lifting Procedure

Designated personnel shall do lifting or hoisting. The load capacity rating shall be clearly marked on hoist. Do not exceed load rating. Inspection and testing for cracks or defects in hoist system shall be performed on a regular basis. Before lifting, alert personnel in immediate areas. Do not stand under unit while it is being moved from one area to another on a hoist. Do not stand under unit to do service work.

GENERAL SAFETY (continued)

Read Manufacturer's Service Manual Before Operating Compressor

Failure to heed any of the above warnings or misuse of the compressor even though not previously mentioned herein may result in severe injury or death, property damage, and mechanical failure, for which neither Hurricane Compressors (Grimmer Industries) nor the Compressed Air and Gas Institute can be held responsible.

If an operator cannot read or understand the manufacturer's safety and operating instructions, we strongly suggest the employer read (translate) and explain this information to the operator.

This document was produced by the Compressed Air and Gas Institute to assist in the safety operation of portable air compressors.

Important Safety Instructions

Look for these signs, which point out potential hazards to the safety of you and others. Read and understand thoroughly. Heed warnings and follow instructions. If you do not understand, inform your supervisor.



Indicates the presence of a hazard, which **WILL** cause **severe** injury, death or property damage, if ignored.



Indicates the presence of a hazard, which **CAN** cause **severe** injury, death or property damage, if ignored.



Indicates the presence of a hazard, which **WILL** or **CAN** cause injury, death or property damage, if ignored.



Indicates important setup, operating or maintenance information.

California Proposition 65 Warning – Diesel engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects, and other reproductive harm.

Warnings: This machine produces loud noises with the service valve vented. Extended exposure to loud noise can cause hearing loss. Always wear hearing protection when service valve is vented.

Warning: High-pressure air can cause severe injury or death. Relieve pressure before recovering filter plugs, caps, fittings or covers.

Danger: Air pressure can remain trapped in air supply line, which can result in serious injury or death. Always carefully vent air supply line at vent valve before performing any service.

GENERAL SAFETY (continued)

Warning: Do not remove the pressure cap from a **HOT** radiator. Allow radiator to cool before removing pressure cap.

Danger: Disconnected air hoses whip. They can cause severe injury, death or property damage. Always use cable restraints.

Warning: Never run unit with guards, covers or screens removed. Keep hands, hair, clothing, tools, air gun tips, etc. away from moving parts.

Hazardous Substance Precaution

The following substances are used in the manufacture of this machine and may be hazardous to health if used incorrectly.

Substance	Precaution
Antifreeze	Avoid ingestion, skin contact and breathing fumes
Compressor Lubricating Oil	Avoid ingestion, skin contact and breathing fumes
Engine Lubricating Oil	Avoid ingestion, skin contact and breathing fumes
Preservative Grease	Avoid ingestion, skin contact and breathing fumes
Rust Preventative	Avoid ingestion, skin contact and breathing fumes
Diesel Fuel	Avoid ingestion, skin contact and breathing fumes
Battery Electrolyte	Avoid ingestion, skin contact and breathing fumes

The following substances may be produced during the operation of this machine and may be hazardous to health.

Substance	Precaution
Engine Exhaust Fumes	Avoid breathing
Engine Exhaust Fumes	Avoid build-up of fumes in confined spaces

BOOSTER

CAPACITY @ 325 PSIG SUCTION @ 2000 PSIG DISCHARGE @ 1800 RPM	2700 SCFM TWO STAGE MODE
CAPACITY @ 325 PSIG SUCTION @ 900 PSIG DISCHARGE @ 1800 RPM	3600 SCFM SINGLE STAGE MODE
SEE CAPACITY SHEET IN OPERATION SECTION FOR MORE DETAIL	
MAXIMUM DISCHARGE PRESSURE	2000 PSIG TWO STAGE MODE
MAXIMUM DISCHARGE PRESSURE	900 PSIG SINGLE STAGE MODE
OPERATING SPEED	1200 RPM - 1800 RPM
MAXIMUM OVERALL COMPRESSION RATIO FROM SUCTION PRESSURE	5.93:1 TWO STAGE MODE
MAXIMUM OVERALL COMPRESSION RATIO FROM SUCTION PRESSURE	2.69:1 SINGLE STAGE MODE

ENGINE

MODEL	CATERPILLAR C18
RATING	630 BHP @ 1800 RPM INDUSTRIAL-C INTERMITTENT CURVE
FUEL	DIESEL
ELECTRICAL SYSTEM	24 VDC

UNIT MEASUREMENTS

OVERALL LENGTH	17'-10" (214")
OVERALL WIDTH	7'-5" (89")
HEIGHT TOP OF FRAME	7'-5" (88.5")
OVERALL HEIGHT	7'-8" (92.5")
(OVERALL HEIGHT INCLUDES AIR CLEANER BONNET)	

WEIGHT

DRY	17160 POUNDS
WET	17500 POUNDS

FLUID CAPACITIES

PUMPER LUBRICATING OIL	10 GALLONS (INCLUDES FILTER)
ENGINE LUBRICATING OIL	10 GALLONS (INCLUDES FILTER)
COOLANT SYSTEM	23 GALLONS
FUEL TANK	NONE, BULKHEAD CONNECTIONS

PUMPER

STROKE	6.00"
1 ST STAGE DIAMETER	3.00" x 3 CYLINDERS
2 ND STAGE DIAMETER	2.00" x 3 CYLINDERS

SAFETY RELIEF VALVE SETTINGS

SUCTION	450 PSIG
1 ST STAGE	1000 PSIG
2 ND STAGE	2500 PSIG

SET PRESSURES

SCRUBBER TANK BACK PRESSURE REGULATOR	400 PSIG
FISHER VALVE UNLOAD REGULATOR	30 PSIG
DISCHARGE PRESSURE SWITCH	2000 PSIG MAXIMUM, OR DESIRED UNLOAD PRESSURE, OR MAXIMUM OVERALL COMPRESSION RATIO FROM SUCTION AS LISTED ON CAPACITY CHART

SHUT DOWN SET POINTS

SUCTION HIGH GAS TEMPERATURE	160°F
1 ST STAGE HIGH GAS TEMPERATURE	400°F
2 ND STAGE HIGH GAS TEMPERATURE	400°F
LOW PUMPER OIL PRESSURE	20 PSIG

BATTERIES

SIZE	1231MF
CCA @ 32°F	1260
CCA @ 0°F	1100
BATTERY VOLTAGE	12 VDC
CIRCUIT	SERIES
CIRCUIT VOLTAGE	24 VDC
QUANTITY	2

CAPACITY CHART
6T-855-62B/2000
3.00 DIAMETER PISTONS 1ST STAGE
2.00 DIAMETER PISTONS 2ND STAGE
2700 SCFM MAXIMUM CAPACITY
TWO STAGE MODE
325 PSIG MAXIMUM SUCTION
2000 PSIG MAXIMUM DISCHARGE
5.93:1 MAXIMUM OVERALL
COMPRESSION RATIO FROM SUCTION

CAPACITY SCFM AT VARIOUS PRESSURE AND RPM

SUCTION PSIG	DISCHARGE PSIG	1800 RPM	1600 RPM	1400 RPM	1200 RPM
325	2000	2700 SCFM	2400 SCFM	2100 SCFM	1800 SCFM
300	1850	2500 SCFM	2200 SCFM	1950 SCFM	1670 SCFM
275	1700	2300 SCFM	2050 SCFM	1790 SCFM	1540 SCFM
250	1550	2100 SCFM	1870 SCFM	1640 SCFM	1400 SCFM

CAPACITY CHART
6T-855-61B/900
3.00 DIAMETER PISTONS 1ST STAGE
2.00 DIAMETER PISTONS 1ST STAGE
3600 SCFM MAXIMUM CAPACITY
SINGLE STAGE MODE
325 PSIG MAXIMUM SUCTION
900 PSIG MAXIMUM DISCHARGE
2.69:1 MAXIMUM OVERALL
COMPRESSION RATIO FROM SUCTION

CAPACITY SCFM AT VARIOUS PRESSURE AND RPM

SUCTION PSIG	DISCHARGE PSIG	1800 RPM	1600 RPM	1400 RPM	1200 RPM
325	900	3600 SCFM	3200 SCFM	2800 SCFM	2400 SCFM
300	830	3340 SCFM	2960 SCFM	2590 SCFM	2220 SCFM
275	765	3070 SCFM	2730 SCFM	2390 SCFM	2050 SCFM
250	700	2800 SCFM	2490 SCFM	2180 SCFM	1870 SCFM

INSTRUMENT PANEL SHUTDOWN SETPOINTS



DISCHARGE PRESSURE SWITCH

SET AT DESIRED UNLOAD PRESSURE.
2000 PSIG MAXIMUM OR 5.93:1 MAXIMUM
OVERALL COMPRESSION RATIO TWO STAGE MODE.
900 PSIG MAXIMUM OR 2.69:1 MAXIMUM
OVERALL COMPRESSION RATIO SINGLE STAGE MODE.
SEE CAPACITY CHART IN OPERATION SECTION



UNLOAD VALVE REGULATOR

SET AT 30 PSIG

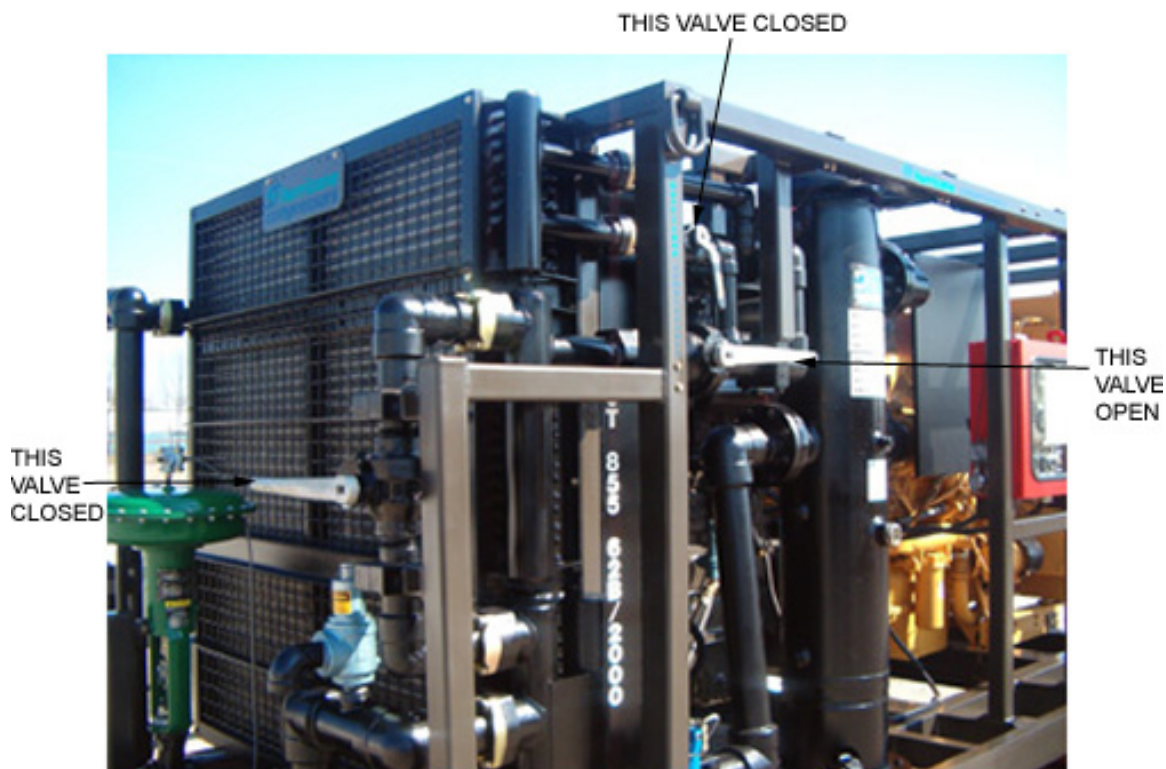


SUCTION SCRUBBER TANK RELIEF VALVE REGULATOR

SET AT
400 PSIG



TWO STAGE OPERATION



**2000 PSIG MAXIMUM DISCHARGE AT 325 PSIG SUCTION,
OR, 5.93:1 MAXIMUM OVERALL COMPRESSION RATIO
FROM SUCTION. SEE CAPACITY CHART IN
'OPERATION' SECTION.**

SINGLE STAGE OPERATION



**900 PSIG MAXIMUM DISCHARGE AT 325 PSIG SUCTION,
OR, 2.69:1 MAXIMUM OVERALL COMPRESSION RATIO
FROM SUCTION. SEE CPACTY CHART IN
'OPERATION' SECTION.**

**Cat Electronic Technician 2006A v1.0
Configuration**

6/25/2007 7:17 AM

C18 IND (WJH02110)

Parameter	Value
Equipment ID	NOT PROGRAMMED
Engine Serial Number	WJH02110
ECM Serial Number	00976152JM
Personality Module Part Number	2840589-00
Personality Module Release Date	OCT06

Description	Value	Unit	TT
C18 IND (WJH02110)			
ECM Identification Parameters			
Equipment ID	NOT PROGRAMMED		0
Engine Serial Number	WJH02110		0
ECM Serial Number	00976152JM		
Personality Module Part Number	2840589-00		
Software Group Release Date	OCT2006		
Selected Engine Rating			
Rating Number	2		0
Rated Power	630 HP at 2100 RPM		
Rated Peak Torque	2042 lb-ft at 1400 RPM		
Top Engine Speed Range	1800 - 2310 RPM		
Test Spec	0K4932 0K6202		
Top Engine Limit	Unavailable	RPM	
Engine Acceleration Rate	50	RPM/s	1
Low Idle Speed	1200	RPM	1
PTO Mode	Ramp Up/Ramp Down		0
High Idle Speed	1900	RPM	1
Intermediate Engine Speed	1200.0	RPM	1
Maximum Engine Torque Limit	2042	lb-ft	0
Customer Password #1	*****		

Customer Password #2	*****		
FLS	0		0
FTS	7		0
Ether Control	Disabled		0
Ether Solenoid Configuration	Not Installed		0
Air Shutoff	Disabled		0
Maintenance Indicator Mode	Off		
PM1 Interval	0	Gal	
Throttle Position Sensor	Not Installed		0
Coolant Level Sensor	Installed		1
Direct Fuel Control Mode	Data Invalid		
Engine Retarder Enable Command	Disabled		
Last Tool to change Customer Parameters			
Last Tool to change System Parameters	NEVER S		
Auxiliary Temperature Sensor Installation Status	Not Installed		
Auxiliary Pressure Sensor Installation Status	Not Installed		
Throttle Input Low Idle Duty Cycle Setpoint	10.0	%	0
Throttle Input High Idle Duty Cycle Setpoint	90.0	%	0
Engine Governor Primary Mode Configuration	Speed Control		
Total Tattletale	12		
Configuration Group 1			
Run Out Control	Off		0
Runout Spd Droop	Off		0

**Cat Electronic Technician 2006A v1.0
Monitoring System Tool**

6/25/2007 7:15 AM

C18 IND (WJH02110)

Parameter	Value
Equipment ID	NOT PROGRAMMED
Engine Serial Number	WJH02110
ECM Serial Number	00976152JM
Personality Module Part Number	2840589-00
Personality Module Release Date	OCT06

Description	State	Trip Point	Delay Time
Low Engine Oil Pressure			
Warn Operator(1)	On	None	8 Sec
Engine Derate(2)	On	None	8 Sec
Engine Shutdown(3)	On	None	4 Sec
High Engine Coolant Temperature			
Warn Operator(1)	On	230 Deg F	10 Sec
Engine Derate(2)	On	232 Deg F	10 Sec
Engine Shutdown(3)	On	232 Deg F	10 Sec
Engine Overspeed			
Warn Operator(1)	On	2500 RPM	1 Sec
Engine Shutdown(3)	On	2700 RPM	1 Sec
High Engine Inlet Air Temperature			
Warn Operator(1)	On	179.6 Deg F	8 Sec
Engine Derate(2)	On	186.8 Deg F	8 Sec
Low Coolant Level			
Warn Operator(1)	On	None	10 Sec
Engine Derate(2)	On	None	10 Sec
Engine Shutdown(3)	On	None	10 Sec
High Fuel Temperature			

Warn Operator(1)	On	194 Deg F	30 Sec
Engine Derate(2)	On	196 Deg F	10 Sec
Engine Shutdown(3)	Off	196 Deg F	10 Sec
High Fuel Pressure			
Warn Operator(1)	On	109.9 PSI	8 Sec
High Auxiliary Temperature			
Warn Operator(1)	Off	221 Deg F	4 Sec
Engine Derate(2)	Off	223 Deg F	4 Sec
Engine Shutdown(3)	Off	225 Deg F	4 Sec
High Auxiliary Pressure			
Warn Operator(1)	Off	218 PSI	4 Sec
Engine Derate(2)	Off	218 PSI	3 Sec
Engine Shutdown(3)	Off	218 PSI	3 Sec

PRIOR TO START UP

- 1) SET THE BOOSTER ON LEVEL GROUND NOT TO EXCEED 5° IN ANY DIRECTION.
- 2) DO NOT SET BOOSTER WITHIN 8 FEET OF OTHER MACHINERY, BUILDINGS, OR ANY OBSTRUCTIONS THAT MAY HAMPER COOLING AIR FLOW TO AND FROM BOOSTER.
- 3) CONFIRM PRESSURE SWITCH AUTO UNLOAD PRESSURE.
- 4) CHECK ENGINE/PUMPER OIL AND COOLANT LEVELS.
- 5) DRAIN FLUID FROM INLET SCRUBBER TANK.
- 6) DRAIN FLUID FROM INTERSTAGE SEPERATOR TANK.
- 7) DRAIN FLUID FROM COOLERS.
- 8) CHECK THAT SUCTION HOSES ARE CLEAR OF DIRT AND DEBRIS.
- 9) DO NOT OPERATE WITHOUT SAFETY CABLES ON AIR HOSES.
- 10) DO NOT OPERATE WITH SAFETY DEVICES BY-PASSED.
- 11) DO NOT ATTEMPT TO START WITH AIR IN SYSTEM.
- 12) WARM UP PRIMARY SCREW COMPRESSORS.

START UP PROCEDURE

- 1) CLOSE INLET SCRUBBER TANK VALVE.
- 2) CLOSE INTERSTAGE SEPERATOR TANK VALVE.
- 3) CLOSE COOLER DRAIN VALVES.
- 4) CONFIRM EMERGENCY STOP BUTTON IS IN EXTENDED POSITION.
- 5) TURN UNLOAD/AUTOLOAD SWITCH TO UNLOAD.
- 6) TURN OFF/RUN/BY-PASS SWITCH TO BY-PASS.
- 7) RESET ANY TRIPPED TATTLE-TALES.
- 8) PUSH START BUTTON AND HOLD IN UNTIL ENGINE FIRES. DO NOT ENGAGE STARTER FOR MORE THAN 15 SECONDS INTERVALS, ALLOWING TIME FOR STARTER TO COOL.
- 9) HOLD OFF/RUN/BY-PASS SWITCH TO BY-PASS POSITION UNTIL PUMPER OIL PRESSURE IS ABOVE 20 PSIG. WHEN PRESSURE OF PUMPER IS ABOVE 20 PSIG, RELEASE SWITCH TO RUN POSITION. IF PUMPER OIL PRESSURE DOES NOT IMMEDIATELY CLIMB, STOP BOOSTER AND INVESTIGATE PROBLEM.
- 10) ENGINE WILL IDLE AT 1200 RPM.
- 11) OPEN BOOSTER DISCHARGE VALVE.
- 12) OPEN BOOSTER SUCTION VAVLE.
- 13) DO NOT LOAD BOOSTER UNTIL COOLANT TEMPERATURE REACHES 1401F.

AUTOMATIC BOOSTER LOADING

- 1) TURN UNLOAD/AUTOLOAD SWITCH TO AUTOLOAD.
- 2) INCREASE / DECREASE ENGINE SPEED FROM 1200 ROM TO 1800 RPM TO MATCH DESIRED CAPACITY.
- 3) BOOSTER WILL BEGIN TO BUILD PRESSURE IF THERE IS SUFFICIENT RESTRICTION DOWN LINE.
- 4) BOOSTER WILL AUTOMATICALLY UNLOAD AND LOAD ACCORDING TO PRESSURE SWITCH SETTING.

MANUAL BOOSTER UNLOAD

- 1) TURN UNLOAD/AUTOLOAD SWITCH TO UNLOAD.
- 2) ENGINE SPEED WILL SLOW TO 1200 RPM.

ROUTINE SHUTDOWN PROCEDURE

- 1) TURN UNLOAD/AUTOLOAD SWITCH TO UNLOAD.
- 2) ENGINE SPEED WILL SLOW TO 1200 RPM.
- 3) ALLOW BOOSTER TO RUN FOR 5 MINUTES TO COOLDOWN.
- 4) TURN OFF/RUN/BY-PASS SWITCH TO OFF.
- 5) OPEN INLET SCRUBBER TANK VALVE.
- 6) OPEN INTERSTAGE SEPERATOR TANK VALVE.
- 7) OPEN COOLER DRAIN VALVES.

EMERGENCY SHUTDOWN PROCEDURE

- 1) PRESS EMERGENCY STOP BUTTON ON SIDE OF INSTRUMENT PANEL.
- 2) OPEN INLET SCRUBBER TANK VALVE.
- 3) OPEN INTERSTAGE SEPERATOR TANK VALVE.
- 4) OPEN COOLER DRAIN VALVES.
- 5) TURN OFF/RUN/BY-PASS SWITCH TO OFF.
- 6) TURN UNLOAD/AUTOLOAD SWITCH TO UNLOAD.

CAPACITY CHART
6T-855-62B/2000
3.00 DIAMETER PISTONS 1ST STAGE
2.00 DIAMETER PISTONS 2ND STAGE
2700 SCFM MAXIMUM CAPACITY
TWO STAGE MODE
325 PSIG MAXIMUM SUCTION
2000 PSIG MAXIMUM DISCHARGE
5.93:1 MAXIMUM OVERALL
COMPRESSION RATIO FROM SUCTION

CAPACITY SCFM AT VARIOUS PRESSURE AND RPM

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275	1700	2300 SCFM	2050 SCFM	1790 SCFM	1540 SCFM
250	1550	2100 SCFM	1870 SCFM	1640 SCFM	1400 SCFM

CAPACITY CHART
6T-855-61B/900
3.00 DIAMETER PISTONS 1ST STAGE
2.00 DIAMETER PISTONS 1ST STAGE
3600 SCFM MAXIMUM CAPACITY
SINGLE STAGE MODE
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900 PSIG MAXIMUM DISCHARGE
2.69:1 MAXIMUM OVERALL
COMPRESSION RATIO FROM SUCTION

CAPACITY SCFM AT VARIOUS PRESSURE AND RPM

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275	765	3070 SCFM	2730 SCFM	2390 SCFM	2050 SCFM
250	700	2800 SCFM	2490 SCFM	2180 SCFM	1870 SCFM

PREVENTATIVE MAINTENANCE SCHEDULE

IF OPERATING IN EXTREME ENVIRONMENTAL CONDITIONS (VERY HOT, COLD, DUSTY, OR WET), THESE TIME PERIODS SHOULD BE REDUCED.

R = REPLACE

C = CHECK (ADJUST OR REPLACE IF NECESSARY)

L = LUBRICATE

HOURLY

- DRAIN INLET SCRUBBER TANK AND INTERSTAGE SEPERATOR TANK (OR AS NEEDED). C
CAUTION - DRAIN INLET SCRUBBER TANK AND INTERSTAGE SEPERATOR TANK MORE OFTEN AS NEEDED WHEN OPERATING DURING HIGH HUMIDITY.
DANGER - FAILURE TO DRAIN INLET SCRUBBER TANK MAY RESULT IN COMPRESSOR VALVE DAMAGE OR HYDRAULIC LOCK.

DAILY

- WALK AROUND INSPECTION C
- PUMPER OIL LEVEL C
- ENGINE OIL LEVEL C
- COOLANT SYSTEM LEVEL C
- AIR FILTER RESTRICTION INDICATOR C
- GAUGES/LIGHTS C
- SHUTDOWN DEVICES C
- FUEL TANK (FILL AT END OF DAY) C

MONTHLY

- FAN BELTS C
- HOSES AND CLAMPS (AIR, OIL, COOLANT) C
- COOLERS AND RADIATOR C
- AUTOMATIC SHUTDOWN SYSTEM (TEST) C
- FASTENERS C

3 MONTHS

- COOLERS AND RADIATOR (CLEAN EXTERIOR) C

250 HOURS

- PUMPER OIL AND FILTER CHANGE L/R
- PUMPER FAN DRIVE L

DRIVE ENGINE

REFER TO CATERPILLAR ENGINE MANUALS FOR ALL CATERPILLAR ENGINE RELATED SERVICE, ADJUSTMENTS, AND SPECIFICATIONS.

PUMPER OIL LEVEL

MAINTAIN BETWEEN FULL AND ADD

PUMPER CRANKCASE LUBRICATION OIL

LUBRICANT VISCOSITY CHART FOR OUTSIDE AMBIENT TEMPERATURES

OIL VISCOSITY	AMBIENT 1F	
	MINIMUM	MAXIMUM
SAE 0W-20	0	50
SAE 0W-30	0	86
SAE 0W-40	0	104
SAE 5W-30	10	86
SAE 5W-40	10	104
SAE 10W-30	20	104
SAE 15W-40	32	122

- SUPPLEMENTAL OIL HEATING IS REQUIRED FOR START UP BELOW 101F
- SELECT OIL VISCOSITY BASED UPON MAXIMUM EXPECTED OPERATING TEMPERATURE. START UP AT LOWER THAN SPECIFIED AMBIENT TEMPERATURE REQUIRES CAUTION. START UP AT VERY LOW AMBIENT TEMPERATURES MAY REQUIRE AUXILIARY OIL HEATERS AND JACKET WATER HEATERS OR OTHER METHODS TO INCREASE CRANKCASE TEMPERATURES.
- TO DETERMINE IF THE OIL IN THE CRANKCASE WILL FLOW IN COLD WEATHER, REMOVE THE OIL DIPSTICK BEFORE STARTING. IF THE OIL WILL FLOW OFF THE DIPSTICK, THE OIL IS FLUID ENOUGH TO CIRCULATE PROPERLY.
- SELECT AN OIL WITH API CH-4 (PREFERRED) OR API CG-4 (PREFERRED) OR API CF-4 CERTIFICATION.
- SYNTHETIC BASE STOCK OILS ARE ACCEPTABLE FOR USE.
- SYNTHETIC BASE STOCK OILS OUTPERFORM NON-SYNTHETIC OILS IN IMPROVED LOW TEMPERATURE VISCOSITY CHARACTERISTICS, ESPECIALLY IN ARCTIC CONDITIONS, AND IMPROVED OXIDATION STABILITY, ESPECIALLY AT HIGH OPERATING TEMPERATURES.

RECOMMENDED CRANKCASE OILS

- MOBIL DELVAC 1300 SUPER 15W-40
- MOBIL DELVAC 1300 SUPER 10W-30
- MOBIL DELVAC 1 SYNTHETIC 5W-40

COOLERS

THE COMPRESSOR SUCTION, INTERSTAGE, AND DISCHARGE AIR COOLS BY MEANS OF FIN AND TUBE TYPE COOLERS, LOCATED AT THE PUMPER END OF THE BOOSTER. THE AIR FLOWING INTERNALLY THROUGH THE TUBE SECTION IS COOLED BY THE AIR STREAM PASSING THROUGH THE FIN SECTION FROM THE FAN. WHEN GREASE, OIL, AND DIRT ACCUMULATE ON THE EXTERIOR SURFACES OF THE COOLERS THEIR EFFICIENCY IS IMPAIRED. IT IS RECOMMENDED THAT THE COOLERS BE CLEANED BY DIRECTING COMPRESSED AIR OPPOSITE FAN FLOW DIRECTION WHICH CONTAINS A NON-FLAMMABLE SAFETY SOLVENT THROUGH THE CORE OF THE COOLER FINS.

BATTERIES

HEAVY-DUTY, DIESEL CRANKING TYPE BATTERIES WERE INSTALLED AT THE FACTORY. KEEP BATTERY POST TO CABLE CONNECTIONS CLEAN, TIGHT, AND LIGHTLY COATED WITH CORROSION PREVENTATIVE. THE ELECTROLYTE LEVEL IN EACH CELL SHOULD COVER THE TIPS OF THE PLATES. IF NECESSARY, TOP-OFF WITH DISTILLED WATER.

INLET SCRUBBER TANK AND INTERSTAGE SEPERATOR TANK DRAIN HOURLY OR AS NEEDED.

CAUTION - DRAIN INLET SCRUBBER TANK AND INTERSTAGE SEPERATOR TANK MORE OFTEN AS NEEDED WHEN OPERATING DURING HIGH HUMIDITY.

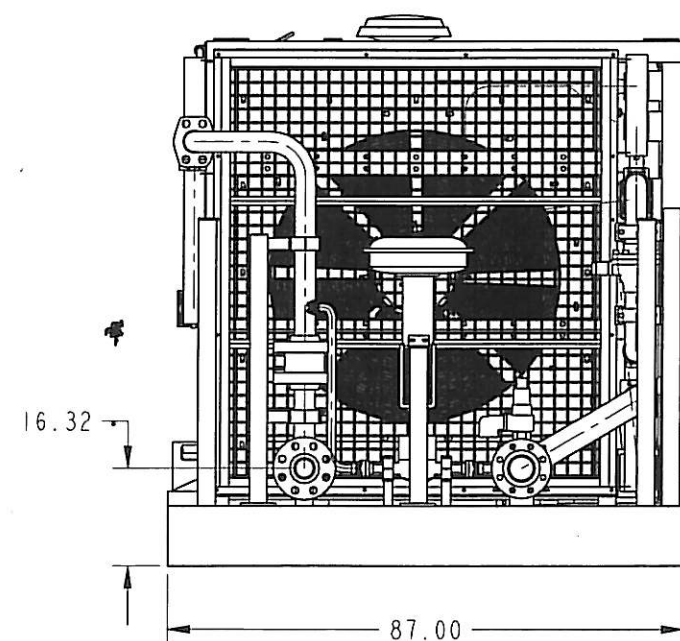
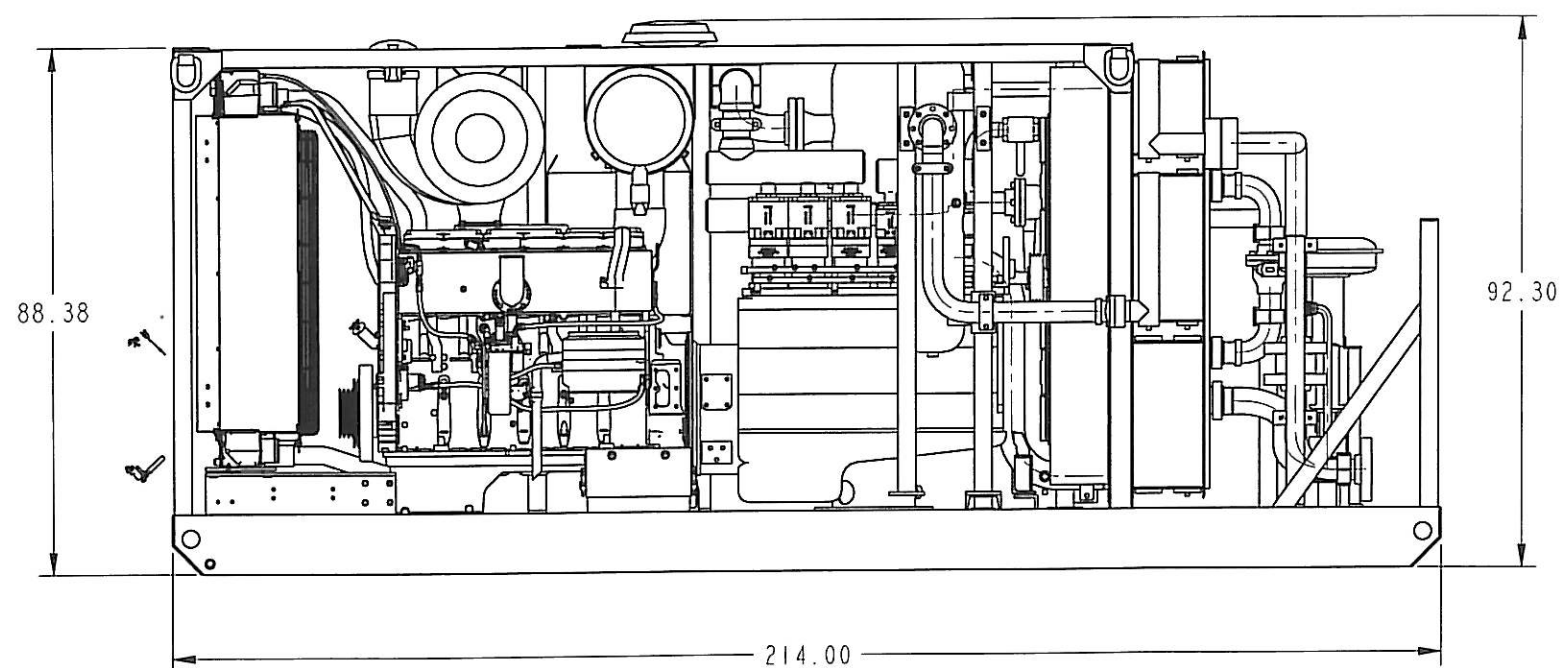
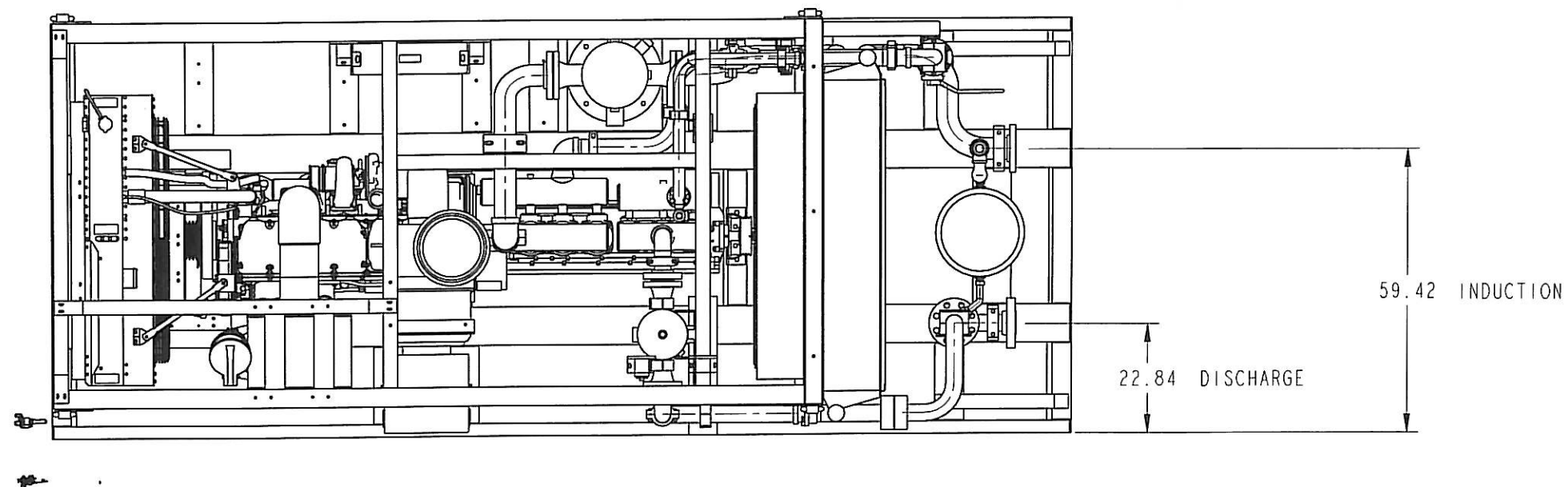
DANGER - FAILURE TO DRAIN INLET SCRUBBER TANK AND INTERSTAGE SEPERATOR MAY RESULT IN COMPRESSOR VALVE DAMAGE OR HYDRAULIC LOCK.

AIR CLEANER

THE DRIVE ENGINE IS EQUIPPED WITH AIR FILTER RESTRICTION INDICATOR. IF THE INDICATOR SHOWS RED THE ELEMENT SHOULD BE REPLACED. THE AIR CLEANER HOUSING AND PIPING SHOULD BE INSPECTED FOR LEAKAGE PATHS OR INLET OBSTRUCTIONS.

10186

C



DO NOT SCALE DRAWING

DRAWING TOLERANCES
UNLESS OTHERWISE SPECIFIED

ALL SHEAR DIMS ± 0.031 in.
ALL FORM DIMS ± 0.062 in.
ALL WELD DIMS ± 0.093 in.
ALL SAW CUT DIMS ± 0.062 in.
ALL ANGLES $\pm 1^\circ$

MATERIAL:

DESCRIPTION:

ASSY

PART NO:

SPECS:



1015 N. Hurricane Rd / Franklin, IN 46131-9501 ph 317-736-3800
for 317-736-3801
jag@hinedirect.net

DRAWN

DLS

APPROVED

DATE

5-1-07

APR. DATE

TITLE

BOOSTER, 6T-855-62B/2000(2700)

REQ'D

SCALE

0.016

SHEET

1 OF 1

PRODUCT

6T-855-62

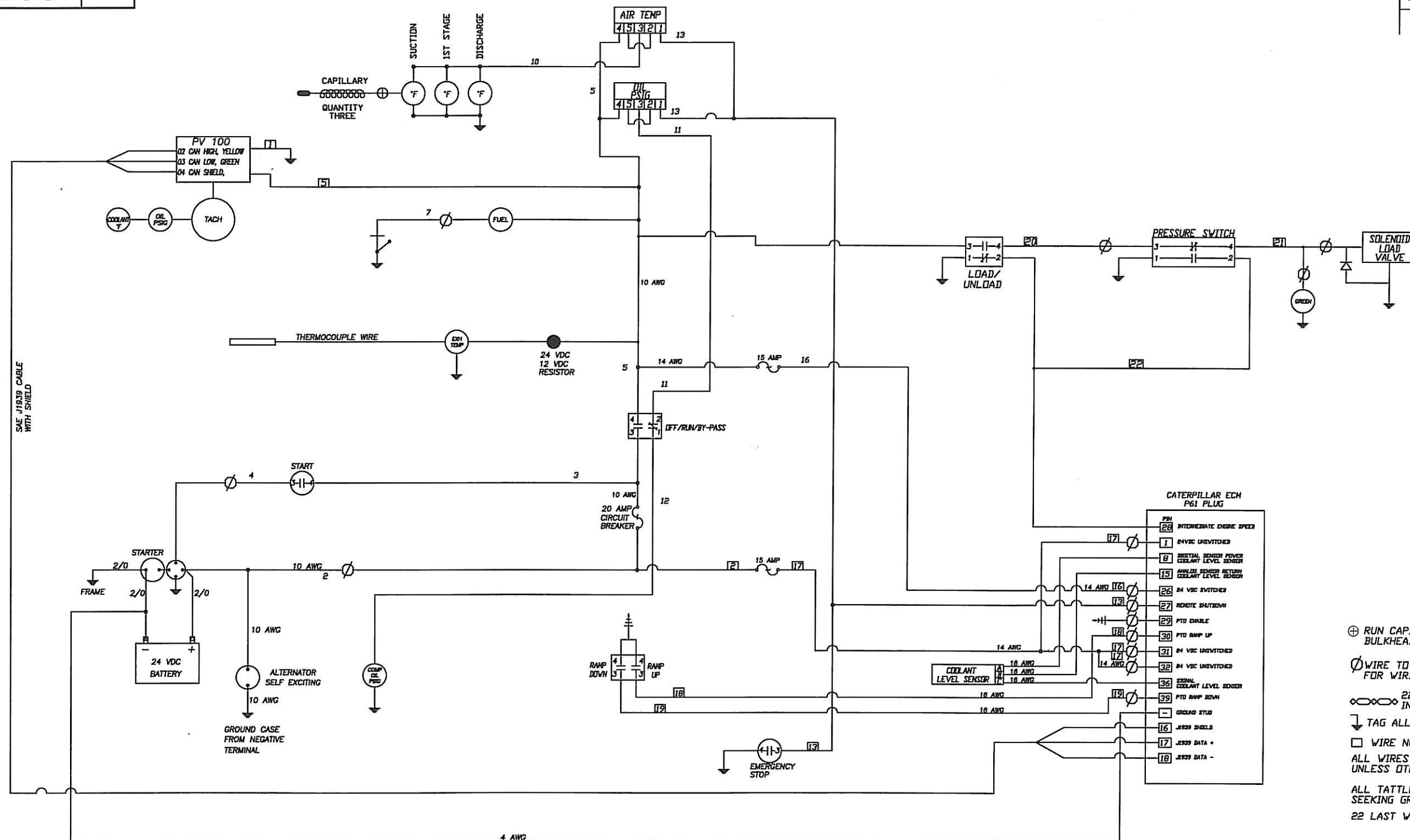
10186

PRO-E

C

B

ECN	LTR.	DATE	NO.	DESCRIPTION	BY:
	-	---	---	---	-



⊕ RUN CAPILLARIES THROUGH
BULKHEAD OUT OF PANEL

Ø WIRE TO TERMINAL BLOCK
FOR WIRING OUTSIDE OF PANEL

⊗ 22 AWG TWISTED PAIR
IN SHIELDED CABLE


↓ TAG ALL GROUND □

□ WIRE NUMBERS

ALL WIRES TO BE 18AWG
UNLESS OTHERWISE SPECIFIED

ALL TATTLE TALES ARE
SEEKING GROUND

22 LAST WIRE NUMBER USED

MATERIAL:	APPROVAL	 1015 N. Hurricane Rd / Franklin, IN 46131-9501 ph 317-736-3800 Fax 317-736-3801 Jeg@hnetdirect.net			
DESCRIPTION:	ENG.	DRAWN PS DATE 05-03-05 INFORMATION UPON THIS DRAWING IS PROPRIETARY AND CONFIDENTIAL. DISCLOSURE BY ANY MEANS IS EXPRESSLY FORBIDDEN WITHOUT WRITTEN APPROVAL.			
	MFG.				
PART NO:		REQ'D		TITLE	
SPECS:		SCALE	NONE	SCHEM, WIRING 6T-855-62B	
		SHEET	1 OF 1	PRODUCT	
		AutoCAD R14		6T-855-62B	21588 B

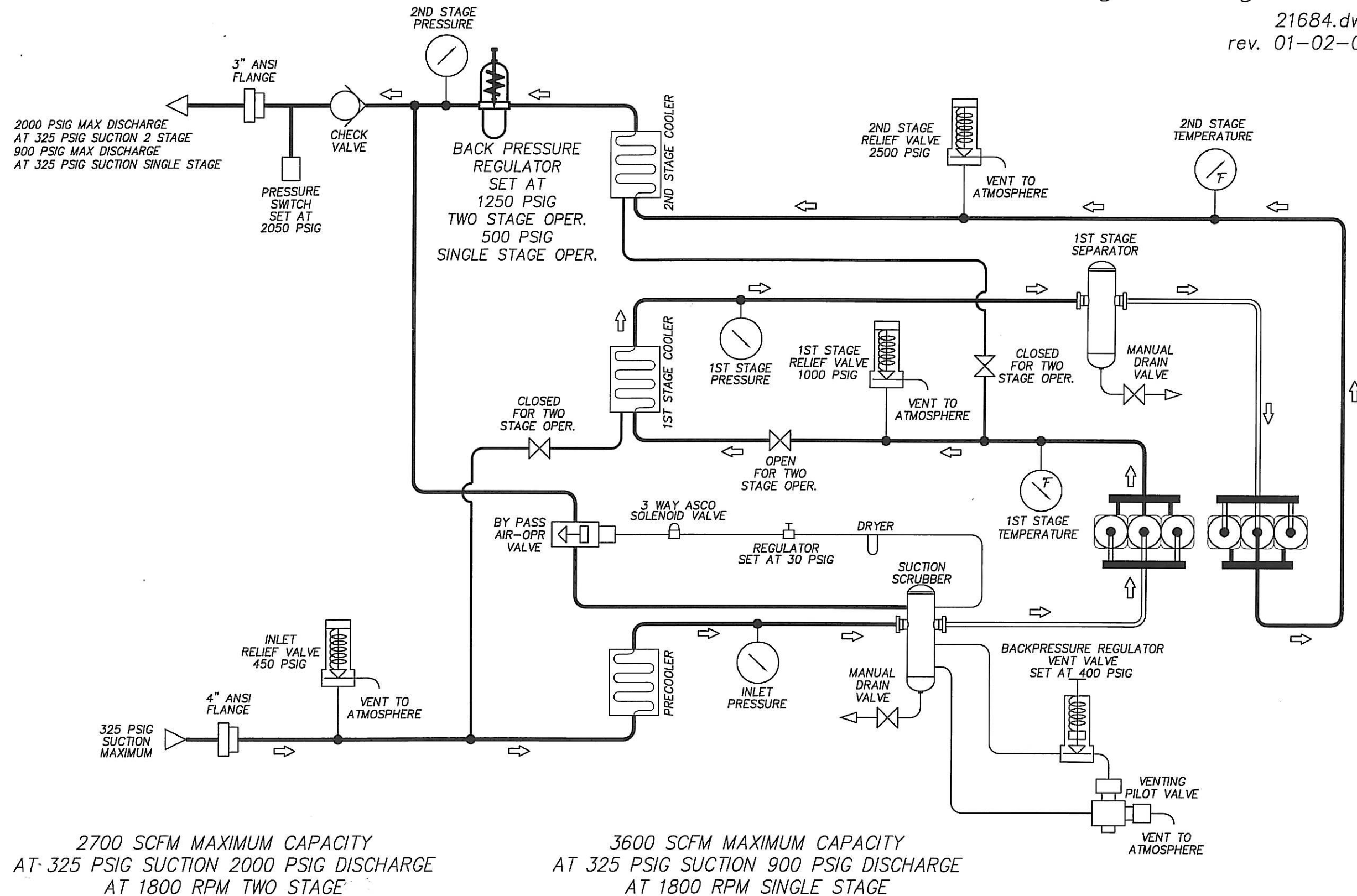


1015 North Hurricane Road / Franklin, Indiana 46131-9501
(317) 736-3800 / fax (317) 736-3801

Model 6T-855-62B/2000

General Plumbing Arrangement

21684.dwg
rev. 01-02-06



Hurricane Illus. Compr. Assy. 6T-855-62B/2000 (2700 SCFM) compressors

1015 North Hurricane Road / Franklin, Indiana 46131-9501
(317) 736-3800 / fax (317) 736-3801

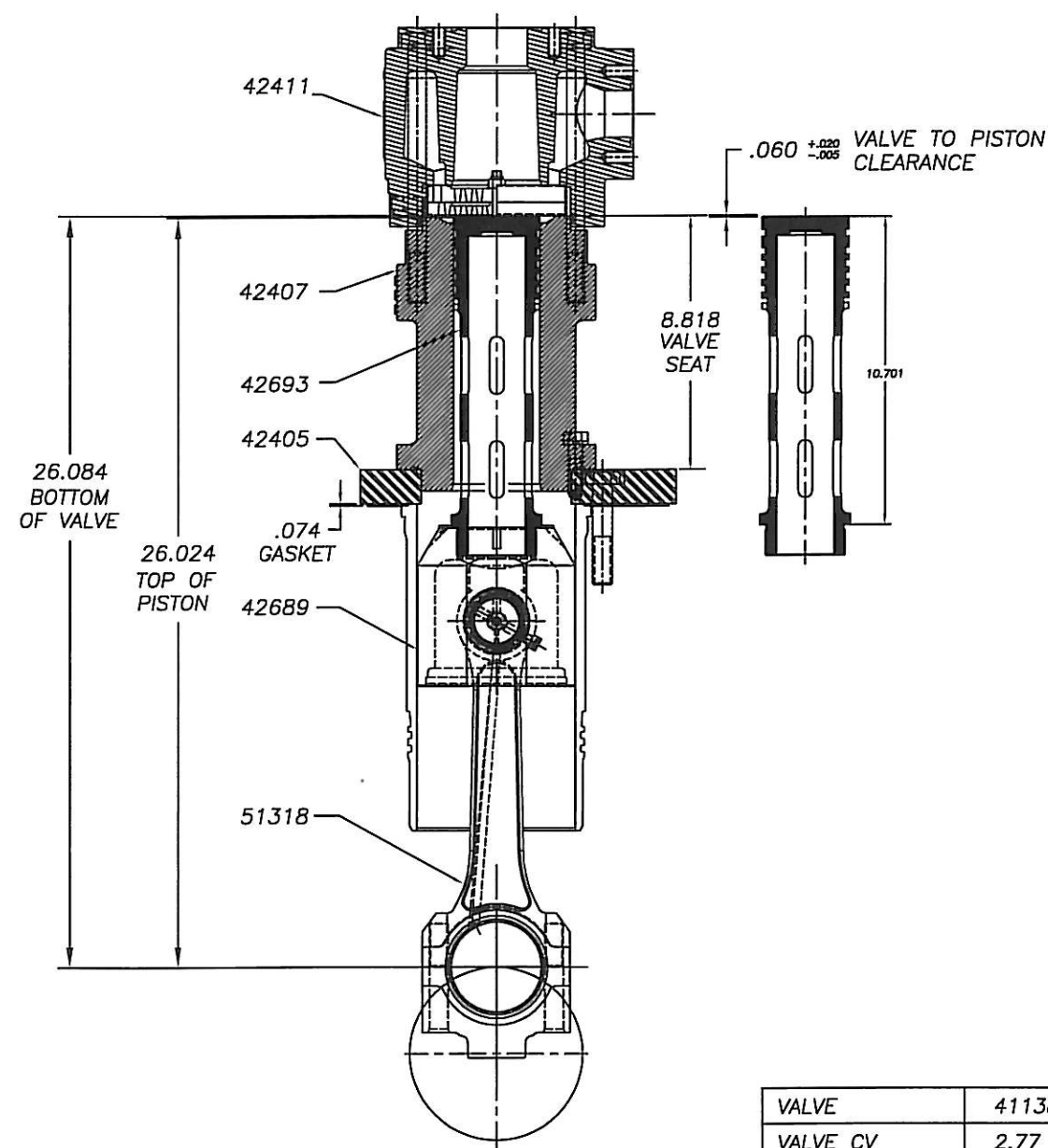
21892.dwg

5/18/07 REV.

Dimensional tolerance stack up

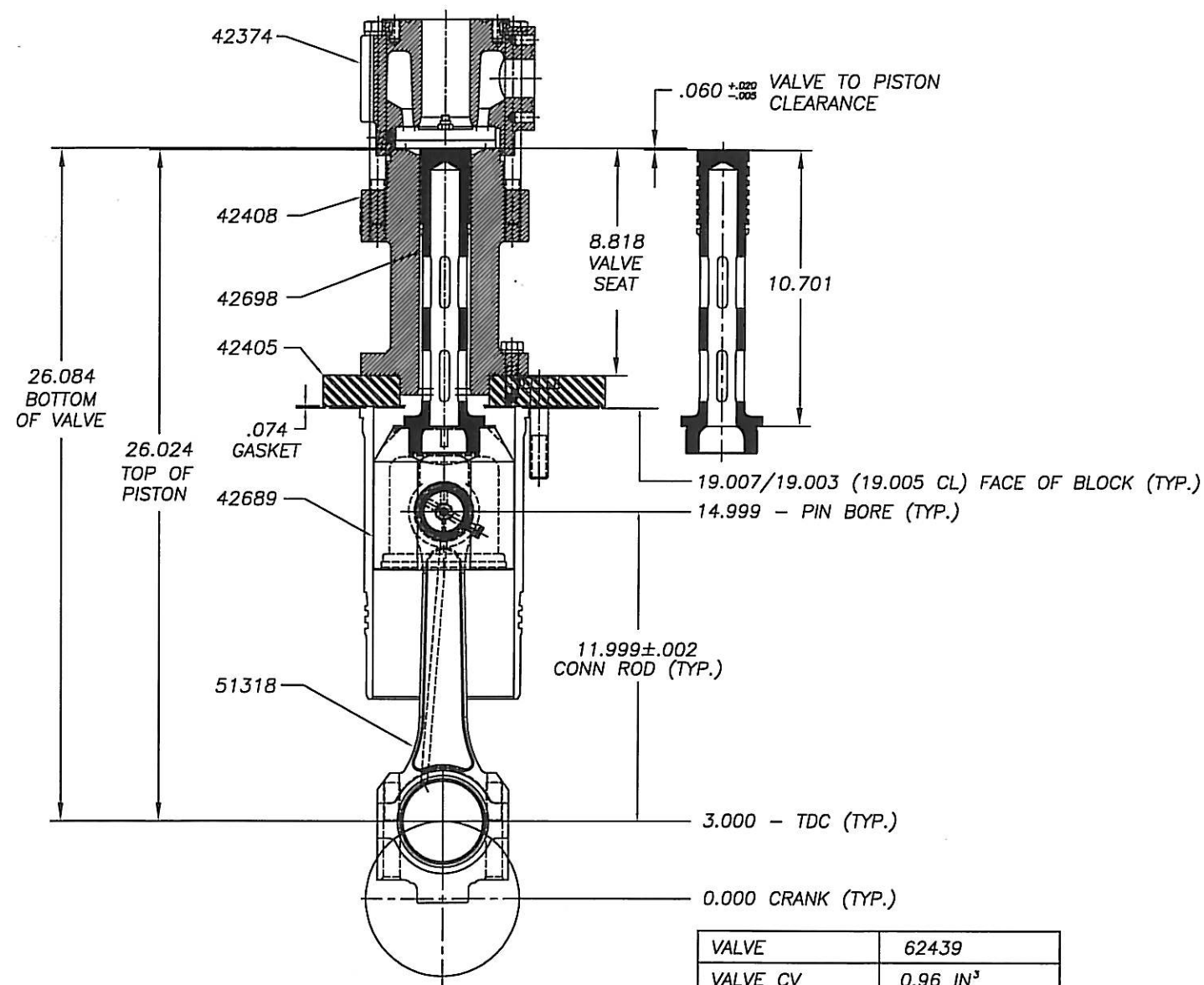
NOTE
ALL HURRICANE COMPRESSORS STACK-UP
TOLERANCES PERTAINING TO PISTON TO VALVE
CLEARANCE TO BE $+.001/-0.001$ FROM NOMINAL

SLEEVE PROTRUSION $.069 \pm .001$
LINER COUNTER BORE DEPTH $.370 \pm .001$



1st. STAGE 3.00"

VALVE	41138
VALVE CV	2.77 IN ³
SWEPT DISP.	42.41 IN ³
TOTAL CV	4.17 IN ³
% CV	9.8%



2nd. STAGE 2.00

VALVE	62439
VALVE CV	0.96 IN ³
SWEPT DISP.	18.85 IN ³
TOTAL CV	1.74 IN ³
% CV	9.2%



1015 North Hurricane Road / Franklin, Indiana 46131-9501
(317) 736-3800 / fax (317) 736-3801

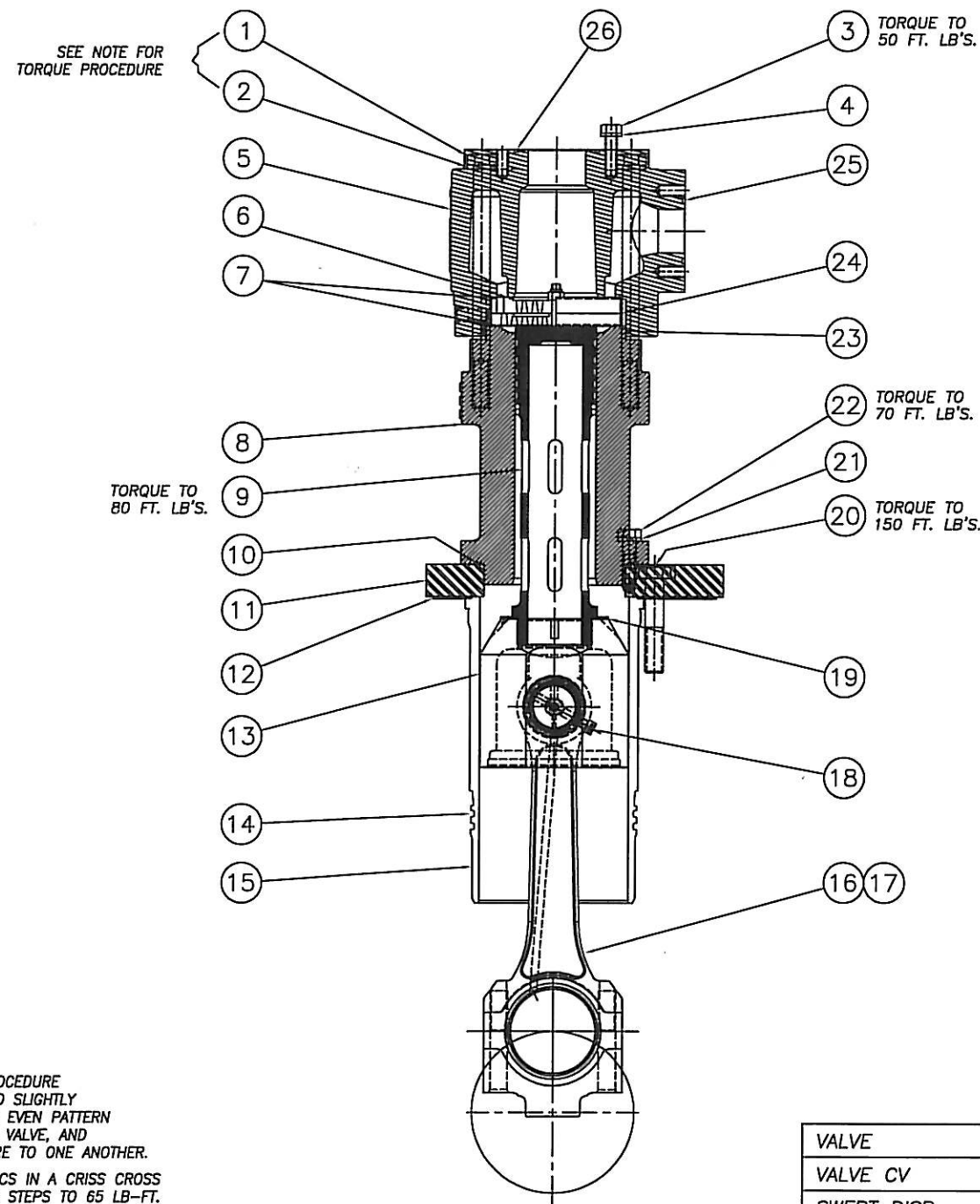
1st. STAGE COMPRESSOR ASSEMBLY 6T-855-62B/2000 (2700 SCFM)

ITEM	PART NO.	DESCRIPTION	QTY.
1	80417	HHCS, 5/8-11 x 9"	4
2	80110	WASHER, SPLIT LOCK 5/8"	4
3	80034	HHCS, 7/16-14 x 1-1/4 GR8	4
4	80108	WASHER, SPLIT LOCK 7/16"	4
5	42411	COMPRESSOR HEAD	1
6	60064	O-RING, 2-042	1
7	61138	O-RING, 2-047	2
8	42407	COMPRESSOR CYLINDER	1
9	42693	COMPRESSOR PISTON	1
10	61869	O-RING, 2-161	1
11	42405	BASE PLATE	1
12	42406	BASE PLATE GASKET	1
13	42689	CROSSHEAD PISTON	1
14	63598-01	LINER SEAL KIT	1
15	63598	LINER	1
16	42414	CONNECTING ROD MOD.	1
17	51318	CONN. ROD & CROSSHEAD ASS'Y.	1
18	80374	SHCS, 5/16-24 x 1" SELF-LOCK	1
19	64960	WASHER, LOCKING PW 14	1
20	80418	HHCS, 11/16-16 x 3-1/2"	14
21	80109	WASHER, SPLIT LOCK 1/2"	4
22	80180	HHCS, 1/2-13 x 1-3/4"	4
23	63689	O-RING, 2-251	1
24	41138	COMPRESSOR VALVE	1
25	63842	O-RING, 2-227	1
26	60056	O-RING, 2-233	1
27	62739	RING, 3.000 COMPR. CI PS TF WID	5
28	41079	RING, 3.000 DIA. 3 PC. OIL	1
29	64099	RET. RING TRUARC N5000-218	4
30	90489	PLUG, 3/8 NPT CSK STEEL	1
31	63617	PIN, WRIST FOR NEEDLE BRG'S.	1
32	64098	BEARING, INA, # NCS-2616	2

NOTE: THREE ASSEMBLY REQUIRED

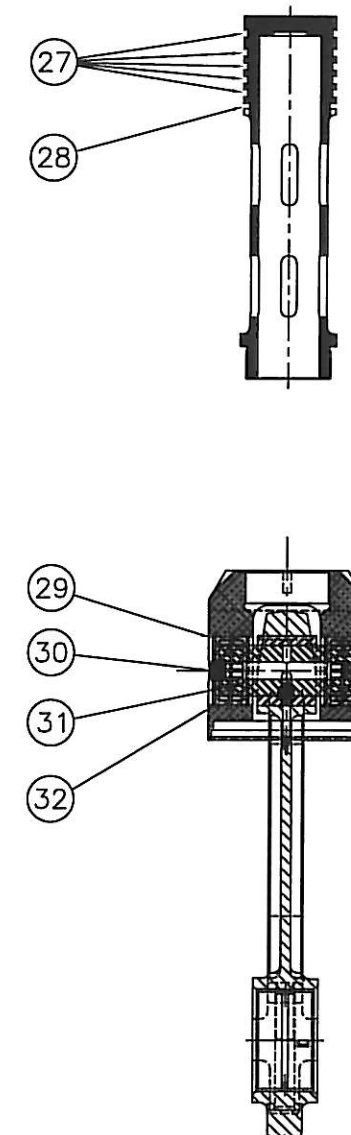
NOTE: 51318 ASSEMBLY INCLUDES ITEMS
13 16 17 18 29 30 31 & 32

NOTE: TORQUE PROCEDURE
1) INSTALL HEAD AND SLIGHTLY
TIGHTEN HHCS IN AN EVEN PATTERN
MAKE CERTAIN HEAD, VALVE, AND
CYLINDER ARE SQUARE TO ONE ANOTHER.
2) TORQUE HEAD HHCS IN A CRISS CROSS
PATTERN IN 3 EQUAL STEPS TO 65 LB-FT.
3) TORQUE HEAD HHCS IN A CRISS
CROSS PATTERN TO 75 FT-LB.
4) MAKE SURE NO HHCS IS
TIGHTER THAN 75 LB-FT.



1st. STAGE 3.00"

VALVE	41138
VALVE CV	2.77 IN ³
SWEPT DISP.	42.41 IN ³
TOTAL CV	4.17 IN ³
% CV	9.8%



21892-01
5/18/07



1015 North Hurricane Road / Franklin, Indiana 46131-9501
(317) 736-3800 / fax (317) 736-3801

2nd. STAGE COMPRESSOR ASSEMBLY 6T-855-62B/2000 (2700 SCFM)

ITEM	PART NO.	DESCRIPTION	QTY.
1	80242	HHCS, 5/8-11 x 7-1/2"	4
2	80110	WASHER, SPLIT LOCK 5/8"	4
3	80034	HHCS, 7/16-14 x 1-1/4 GR8	4
4	80108	WASHER, SPLIT LOCK 7/16"	4
5	42374	COMPRESSOR HEAD	1
6	60051	O-RING, 2-035	1
7	61392	O-RING, 2-043	2
8	42408	COMPRESSOR CYLINDER	1
9	42698	COMPRESSOR PISTON	1
10	60048	O-RING, 2-154	1
11	42405	BASE PLATE	1
12	42406	BASE PLATE GASKET	1
13	42689	CROSSHEAD PISTON	1
14	63598-01	LINER SEAL KIT	1
15	63598	LINER	1
16	42414	CONNECTING ROD MOD.	1
17	51318	CONN. ROD & CROSSHEAD ASS'Y.	1
18	80374	SHCS, 5/16-24 x 1" SELF-LOCK	1
19	64960	WASHER, LOCKING PW 14	1
20	80418	HHCS, 11/16-16 x 3-1/2"	14
21	80109	WASHER, SPLIT LOCK 1/2"	4
22	80180	HHCS, 1/2-13 x 1-3/4"	4
23	63580	O-RING, 2-156	1
24	62439	COMPRESSOR VALVE	1
25	61396	O-RING, 2-225	1
26	60056	O-RING, 2-233	1
27	62420	RING, 2.000 COMPR. CI PS TF WID	6
28	62284	RING, 2.000 DIA. 3 PC. OIL	1
29	64099	RET. RING, TRUARC N5000-218	4
30	90489	PLUG, 3/8 NPT CSK STEEL	1
31	63617	PIN, WRIST FOR NEEDLE BRG'S.	1
32	64098	BEARING, INA # NCS-2616	2

NOTE: THREE ASSEMBLY REQUIRED

NOTE: 51318 ASSEMBLY INCLUDES ITEMS
13 17 18 29 30 31 & 32

SEE NOTE FOR
TORQUE PROCEDURE

TORQUE TO
80 FT. LB'S.

TORQUE TO
50 FT. LB'S.

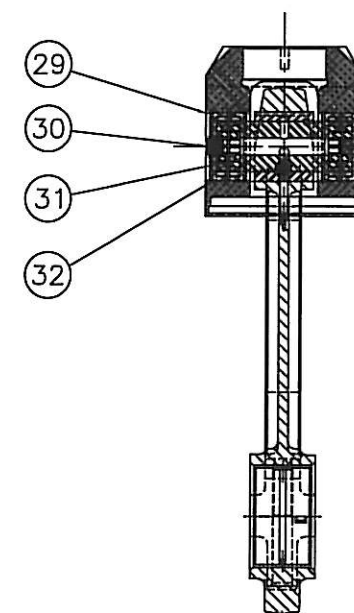
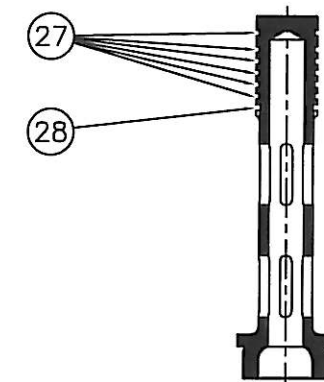
TORQUE TO
70 FT. LB'S.

TORQUE TO
150 FT. LB'S.

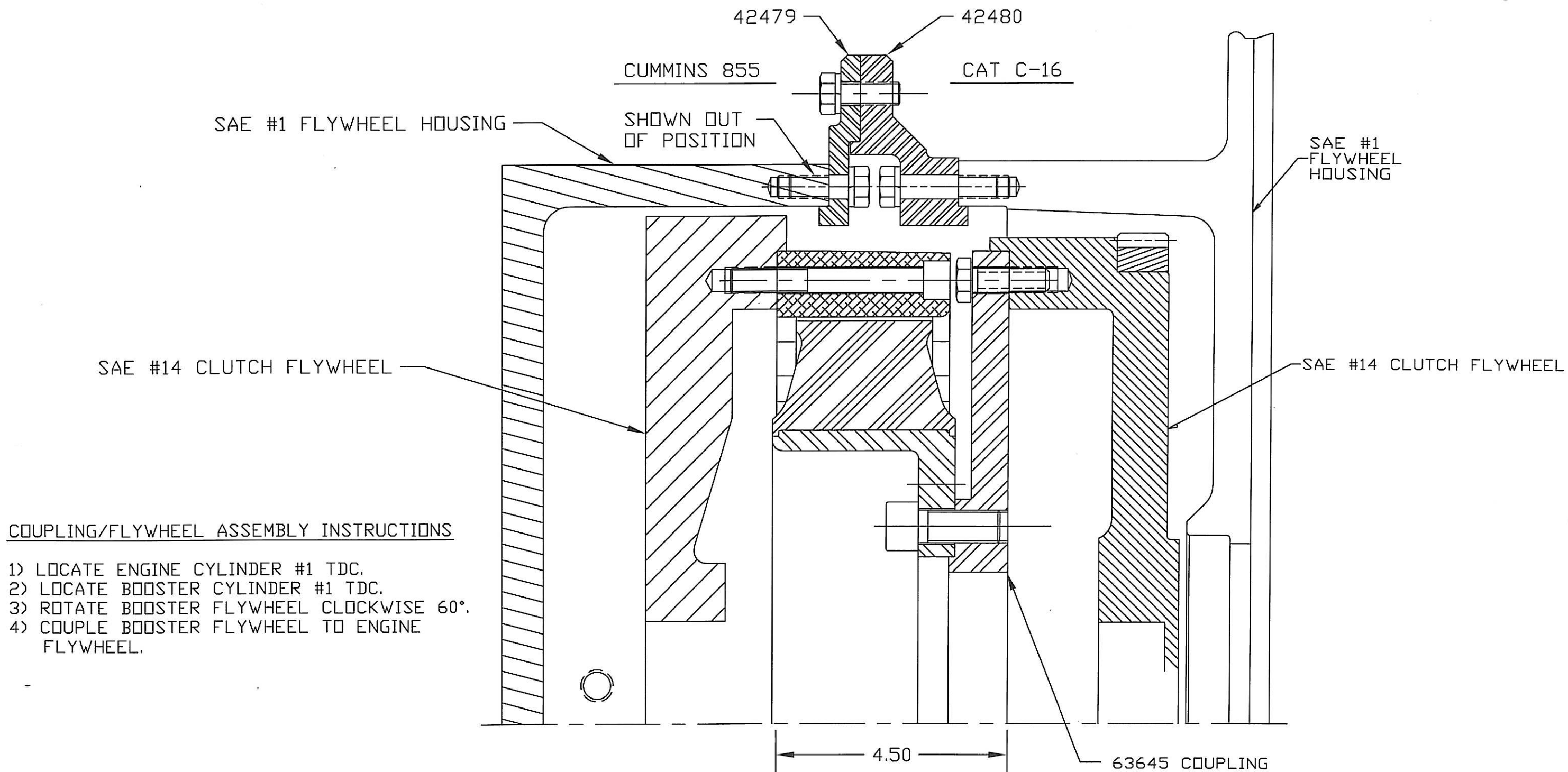
NOTE: TORQUE PROCEDURE
1) INSTALL HEAD AND SLIGHTLY
TIGHTEN HHCS IN AN EVEN PATTERN
MAKE CERTAIN HEAD, VALVE, AND
CYLINDER ARE SQUARE TO ONE ANOTHER.
2) TORQUE HEAD HHCS IN A CRISS CROSS
PATTERN IN 3 EQUAL STEPS TO 65 LB-FT.
3) TORQUE HEAD HHCS IN A CRISS
CROSS PATTERN TO 75 FT-LB.
4) MAKE SURE NO HHCS IS
TIGHTER THAN 75 LB-FT.

2nd. STAGE 2.00

VALVE	62439
VALVE CV	0.96 IN ³
SWEPT DISP.	18.85 IN ³
TOTAL CV	1.74 IN ³
% CV	9.2%



21892-02
5/24/07

COUPLING/FLYWHEEL ASSEMBLY INSTRUCTIONS

- 1) LOCATE ENGINE CYLINDER #1 TDC.
- 2) LOCATE BOOSTER CYLINDER #1 TDC.
- 3) ROTATE BOOSTER FLYWHEEL CLOCKWISE 60°.
- 4) COUPLE BOOSTER FLYWHEEL TO ENGINE FLYWHEEL.

DO NOT SCALE DRAWING

DRAWING TOLERANCES
UNLESS OTHERWISE SPECIFIED

ALL SHEAR DIMS ± 0.031 in.
ALL FORM DIMS ± 0.062 in.
ALL WELD DIMS ± 0.093 in.
ALL SAW CUT DIMS ± 0.062 in.
ALL ANGLES $\pm 1^\circ$

MATERIAL:

DESCRIPTION:

PART NO:

SPECS:

APPROVAL

ENG.

MFG.



hurricane compressors
1015 N. Hurricane Rd / Franklin, IN 46131-9501 ph 317-736-3800
Fax 317-736-3801
Jeg@inetdirect.net

DRAWN PNC
DATE 01-21-05

REQ'D 1
SCALE 1/2

SHEET 1 OF 1
AutoCAD R14

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FORBIDDEN WITHOUT WRITTEN APPROVAL.

TITLE
ILLUS, FLYWHEEL/HSG.

PRODUCT
6T-855-62B

21509 C

INSTRUMENT PANEL FAULT CODES

ENGINE FAULT

THE ENGINE FAULT TATTLETALE WILL POP OUT AND SHUTDOWN THE BOOSTER FOR THE FOLLOWING REASONS:

- 1) LOW PUMPER OIL PRESSURE

AIR TEMP FAULT

THE AIR TEMP FAULT TATTLETALE WILL POP OUT AND SHUTDOWN THE BOOSTER FOR THE FOLLOWING REASONS:

- 1) HIGH SUCTION AIR TEMPERATURE
- 2) HIGH INTERSTAGE AIR TEMPERATURE
- 3) HIGH DISCHARGE AIR TEMPERATURE
- 4) HIGH SCRUBBER TANK LIQUID LEVEL

MURPHY POWERVIEW 100

CATERPILLAR ENGINE FAULTS WILL DISPLAY ON THE MURPHY POWERVIEW 100. REFER TO THE CATERPILLAR MANUAL FOR MORE INFORMATION.



Installation and Operations Manual

Please read the following information before installing. A visual inspection of this product for damage during shipping is recommended before mounting. It is your responsibility to have a qualified person install this unit.

GENERAL INFORMATION

WARNING

BEFORE BEGINNING INSTALLATION OF THIS MURPHY PRODUCT

- ✓ Disconnect all electrical power to the machine.
- ✓ Make sure the machine cannot operate during installation.
- ✓ Follow all safety warnings of the machine manufacturer.
- ✓ Read and follow all installation instructions.



Description

The PowerView is a powerful new display in a line of components manufactured by FWMurphy as part of its J1939 MurphyLink™† Family. The J1939 MurphyLink™ Family of products have been developed to meet the needs for instrumentation and control on electronically controlled engines communicating using the SAE J1939 Controller Area Network (CAN).

The PowerView System is comprised of the PowerView and the Mlink™ PowerView Gages. The PowerView is a multifunction tool that enables equipment operators to view many different engine or transmission parameters and service codes. The system provides a window into modern electronic engines and transmissions. The PowerView includes a graphical backlit LCD screen. It has excellent contrast and viewing from all angles. Back lighting can be controlled via menu or external dimmer potentiometer. The display can show either a single parameter or a quadrant display showing 4 parameters simultaneously. Diagnostic capabilities include fault codes with text translation for the most common fault conditions.

The PowerView has four buttons using self-calibrating charge transfer activation technology, which eliminates the concern for pushbutton wear and failure. In addition operators can navigate the display with ease. Enhanced alarm indication with ultra bright alarm and shutdown LEDs (amber & red). It has a wide operating temperature range of -40 to +85° C (-40 to 185° F), display viewing -40 to +75° C (-40 to 167° F), and increased environmental sealing to +/- 5 PSI (± 34kPa). In addition it features Deutsch DT style connectors molded into the case and fits quickly and easily into existing 2-1/16 in. (52 mm) gage opening with little effort.

Other components in the system are microprocessor-based Mlink™ PowerView Gages for displaying critical engine data broadcast by an electronic engine or transmission's Engine Control Unit (ECU): engine RPM, oil pressure, coolant temperature, system voltage, etc. and a combination audible alarm and relay unit for warning and shutdown annunciation. Up to 32 components may be linked to the PowerView using a simple daisy chain wire connection scheme using RS485. The PowerView and all connected components can be powered by 12 or 24-volt systems.

Display Parameters

The following are some of the engine and transmission parameters displayed by the PowerView in English or Metric units (when applicable, consult engine or transmission manufacturer for SAE J939 supported parameters):

- ❖ Engine RPM
- ❖ Engine Hours
- ❖ Machine Hours
- ❖ System Voltage
- ❖ % Engine Load at the current RPM
- ❖ Coolant Temperature
- ❖ Oil Pressure
- ❖ Fuel Economy
- ❖ Throttle Position
- ❖ Engine Manifold Air Temperature
- ❖ Current Fuel Consumption
- ❖ Transmission Gear Oil Pressure
- ❖ Transmission Gear Oil Temperature
- ❖ Transmission Gear Position
- ❖ Active Service Codes
- ❖ Stored Service Codes from the engine
- ❖ Set Units for display (English or Metric)
- ❖ Engine Configuration Parameters

Warranty

A two-year warranty on materials and workmanship is given with this FWMurphy product. A copy of the warranty may be viewed or printed by going to www.fwmurphy.com/warranty.asp.

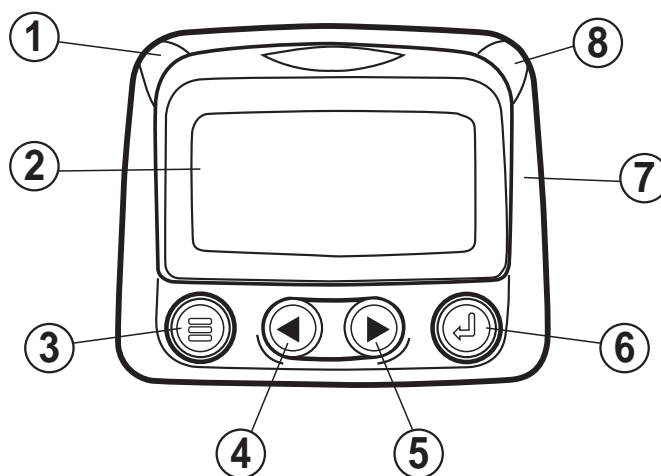
† MurphyLink™ is a registered trademark of FWMurphy. All other trademarks and service marks used in this document are the property of their respective owners.

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Key Pad Functions

- 1. Amber Warning LED**
- 2. Display**
- 3. Menu Key**
- 4. Left Arrow Key**
- 5. Right Arrow Key**
- 6. Enter Key**
- 7. Bezel**
- 8. Red Shutdown/Derate LED**



Keypad Functions

The keypad on the PowerView is a capacitive touch sensing system. There are no mechanical switches to wear or stick, and the technology has been time proven in many applications. It operates in extreme temperatures, with gloves, through ice, snow, mud, grease, etc., and it allows complete sealing of the front of the PowerView. The 'key is pressed' feedback is provided by flashing the screen. The keys on the keypad perform the following functions:



– **Menu Key** - The Menu Key is pressed to either enter or exit the menu screens.



– **Left Arrow** - The Left Arrow Key is pressed to scroll through the screen either moving the parameter selection toward the left or downward.



– **Right Arrow** - The Right Arrow Key is pressed to scroll through the screen either moving the parameter selection toward the right or upward.



– **Enter Key** - The Enter Key (also known as Enter Button) is pressed to select the parameter that is highlighted on the screen.

MECHANICAL INSTALLATION

Specifications

Display: 1.3 x 2.6 in. (33 x 66 mm), 64 x 128 pixels.

Operating Voltage: 8 VDC minimum to 32 VDC max.

Reversed Polarity: Withstands reversed battery terminal polarity indefinitely within operating temperatures.

Operating Temperature: -40 to +85°C (-40 to 185°F).

Display Viewing Temperature: -40 to +75°C (-40 to 167°F).

Storage Temperature: -40 to +85°C (-40 to 185°F).

Environmental Sealing: IP68, +/- 5 PSI (+/- 34.4 kPa).

Power Supply Operating Current: (@ 14 VDC)=
52 mA minimum; 268 mA maximum (LCD heater on).

CAN BUS: SAE J1939 Compliant.

Case: Polycarbonate / Polyester.

Clamp: Polyester (PBT).

Connectors: 6-Pin Deutsch DTO6 Series.

Maximum Panel Thickness: 3/8 in. (9.6 mm).

Mounting Hole: 2.062 inch (52 mm) in diameter.

Auxiliary Communications (Gages):

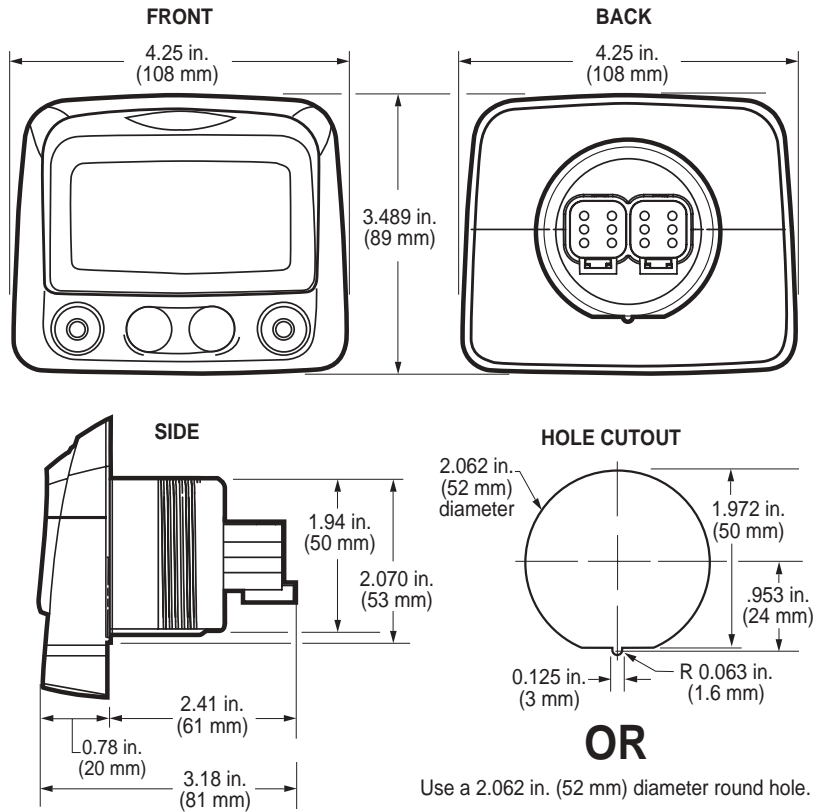
One (1) RS485 port, MODBUS RTU master,
38.4K baud, N, 8, 1 or 2, half duplex.

Potentiometer Input: 1K ohm, 1/4 W

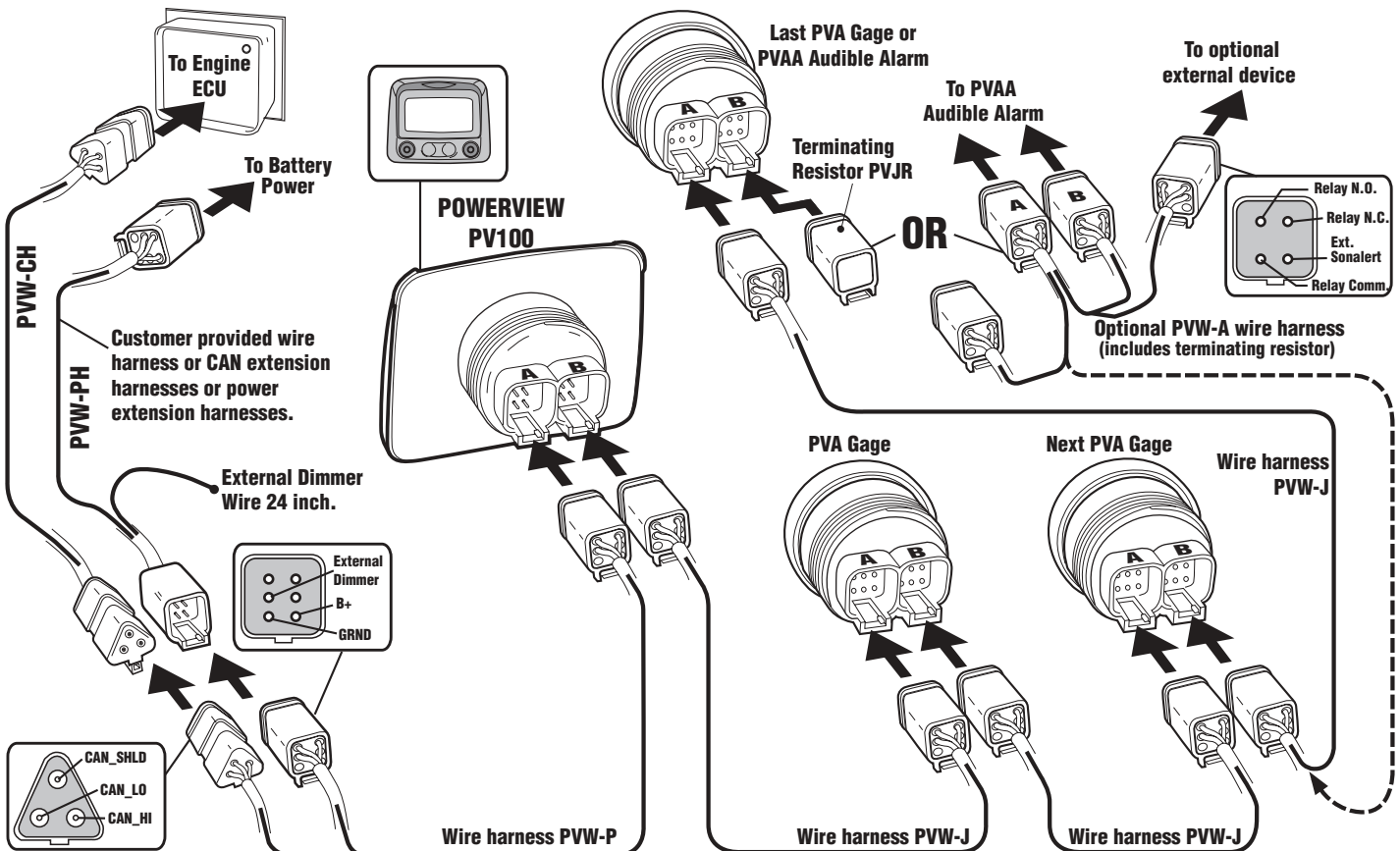
Shipping Weights (all models): 1 lb. (450 g.)

Shipping Dimensions (all models): 6 x 6 x 6 in. (152 x 152 x 152 mm).

Typical Mounting Dimensions

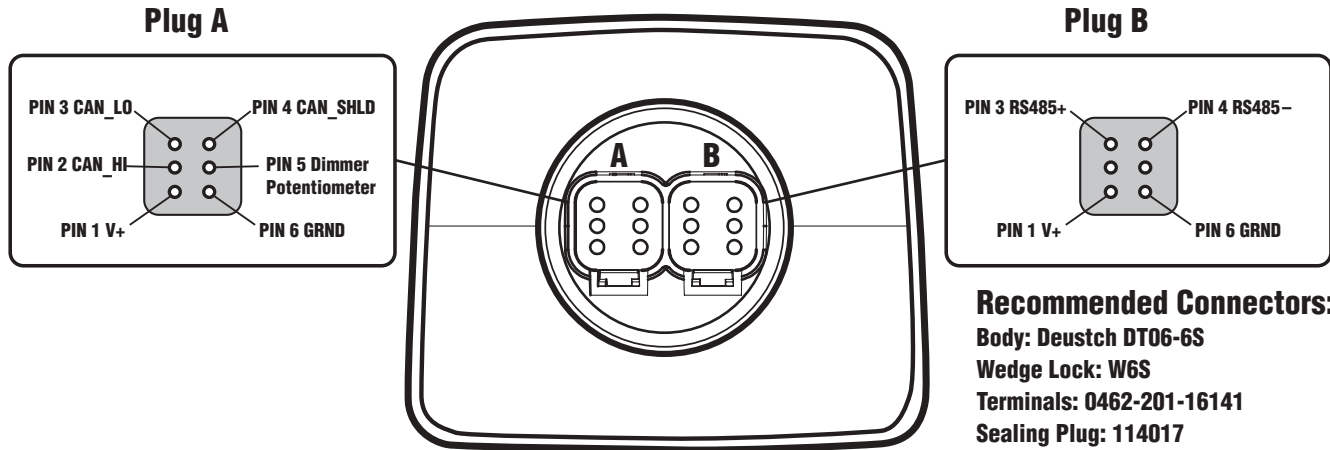


Typical Quick-Connect Diagram



ELECTRICAL INSTALLATION

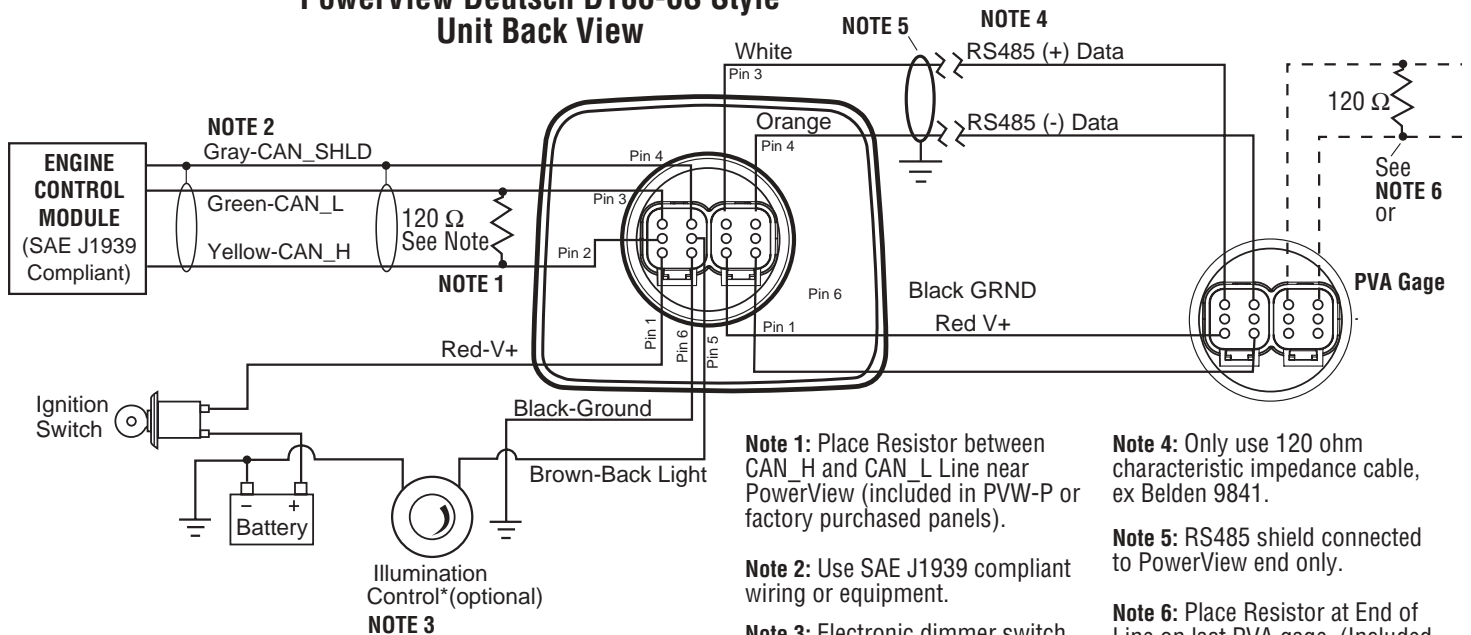
PowerView Unit Back View Deutsch DT06-6S Style Connections



Typical Wiring Diagram

IMPORTANT: To eliminate external interference: RS485(+) and RS485(-) should be twisted pair cable or twist wires together, one twist per inch minimum. CAN_L, CAN_H and CAN Shield should be approved J1939 CAN bus cable (CAN wire for example: RADOX plug and play cable, from Champlain cable). (RS485 wire for example: BELDEN 9841 or 3105A).

PowerView Deutsch DT06-6S Style Unit Back View



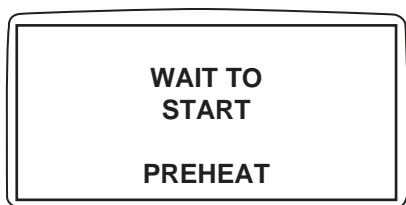
PowerView Menus

First Time Start Up

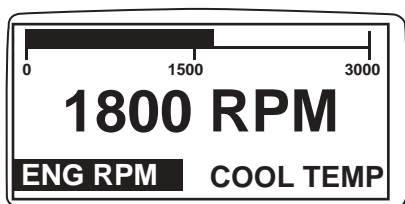
1. When power is first applied to the PowerView, the "Logo Screen" will be displayed.



2. The "Wait to Start" message will be displayed for engines with a pre-startup sequence. Once the "Wait to Start" message is no longer displayed the operator may start the engine. Note: Displays only when SAE J1939 message is supported by engine manufacturer.

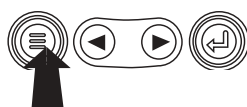
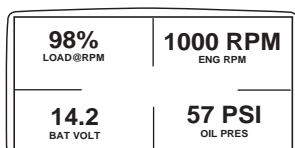
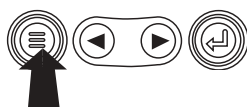
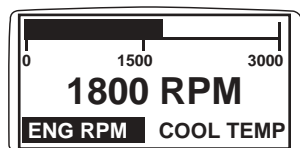


3. Once the engine has started the display will show the single engine parameter display.

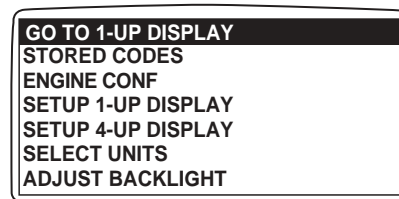


Main Menu Navigation

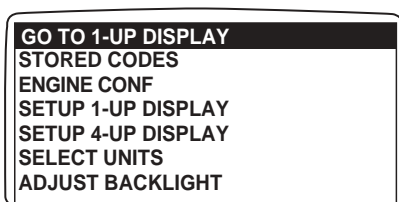
1. Starting at the single or four engine parameter display, depress the "Menu Button".



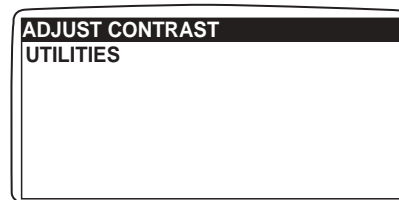
2. The first seven items of the "Main Menu" will be displayed.



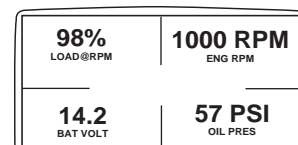
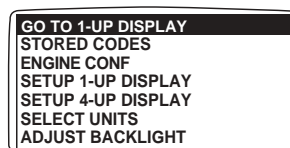
3. Depressing the "Arrow Buttons" will scroll through the menu selections.



4. Pressing the right arrow button will scroll down to reveal the last items of "Main Menu" screen highlighting the next item down.

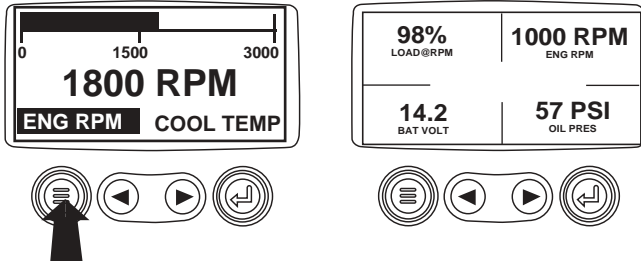


5. Use the arrow buttons to scroll to the desired menu item or press the "Menu Button" to exit the Main menu and return to the engine parameter display.

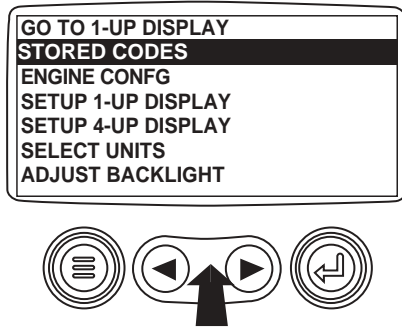


Stored Fault Codes

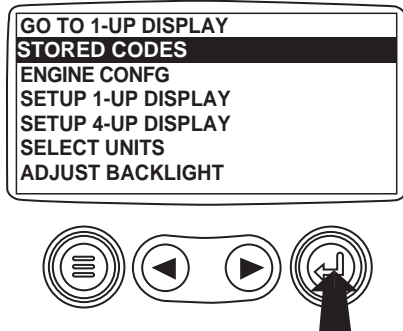
- Starting at the single or four engine parameter display depress the "Menu Button".



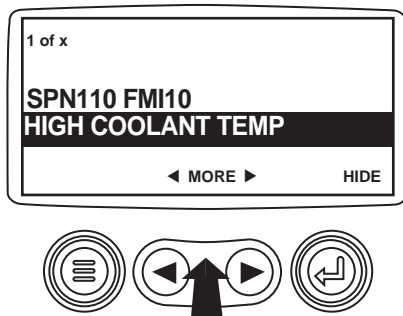
- The main menu will pop up on the display. Use the "Arrow Buttons" to scroll through the menu until the "Stored Fault Codes" is highlighted.



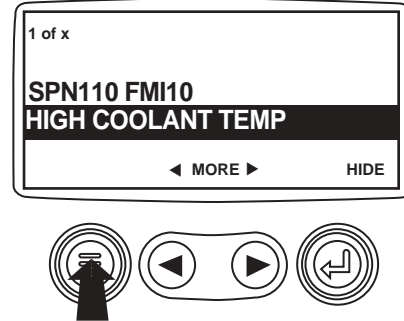
- Once the "Stored Fault Codes" menu item has been highlighted press the "Enter Button" to view the "Stored Fault Codes".



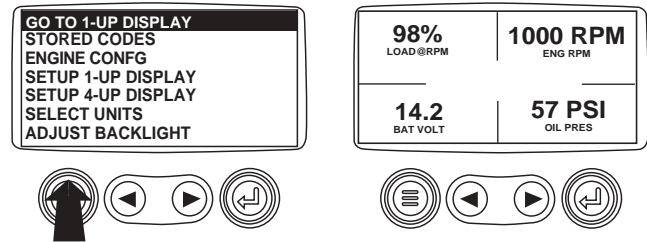
- If the word "MORE" appears above the "Arrow Buttons" there are more stored fault codes that may be viewed. Use the "Arrow Buttons" to scroll to the next Stored Diagnostic Code.



- Press the "Menu Button" to return to the main menu.

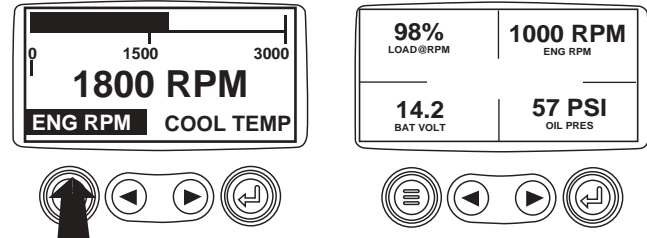


- Press the "Menu Button" to exit the Main menu and return to the engine parameter display.

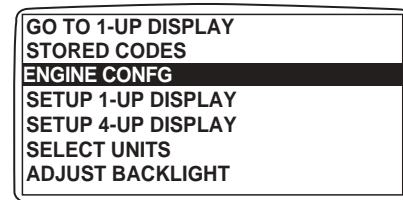


Engine Configuration Data

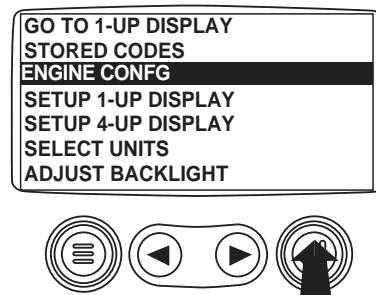
- Starting at the single or four engine parameter display press the "Menu Button".



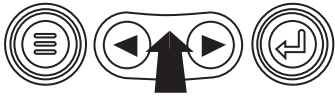
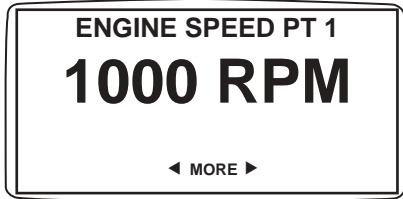
- The main menu will pop up on the display. Use the "Arrow Buttons" to scroll through the menu until the "Engine Configuration" is highlighted.



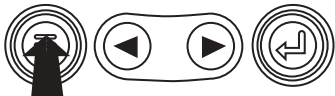
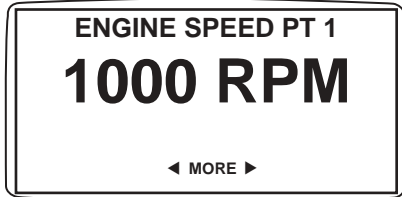
- Once the "Engine Configuration" menu item has been highlighted press the "Enter Button" to view the engine configuration data.



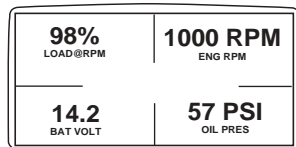
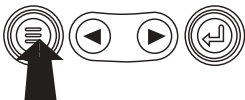
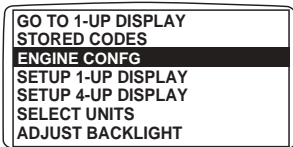
4. Use the "Arrow Buttons" to scroll through the engine configuration data.



5. Press the "Menu Button" to return to the main menu.



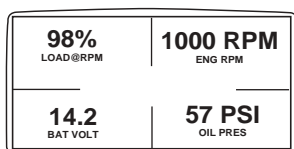
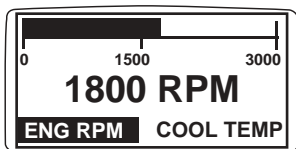
6. Press the "Menu Button" to exit the Main menu and return to the engine parameter display.



Faults and Warnings

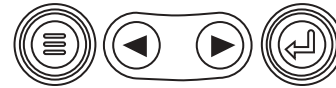
Auxiliary Gage Fault

1. During normal operation the single or four parameter screen will be displayed.

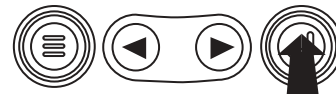


2. The PVA Series of auxiliary gages can be attached to the PowerView. These auxiliary gages communicate with the Modbus master PowerView via a daisy-chained RS-485 port. If at any time during system initialization

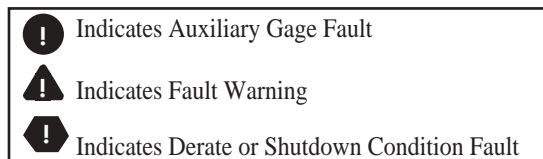
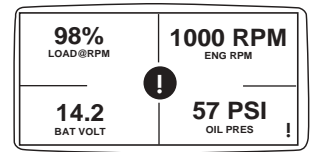
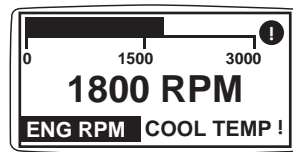
or normal operation an auxiliary gage should fail the single or four parameter screen will be replaced with the "MLink Gage Fault" message.



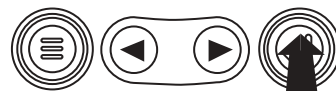
3. To acknowledge and "Hide" the fault and return to the single or four parameter display press the "Enter Button".



4. The display will return to the single or four parameter screen.

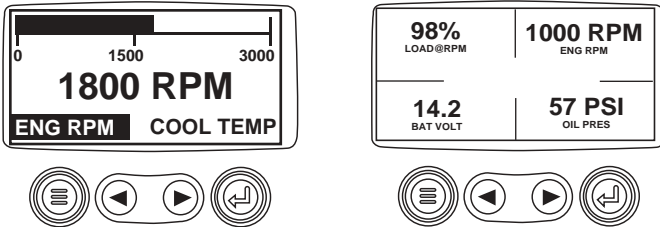


5. Pressing the "Enter Button" will redisplay the hidden fault. Pressing the "Enter Button" once again will hide the fault and return the screen to the single or four parameter display. NOTE: The fault can only be cleared by correcting the cause of the fault condition.

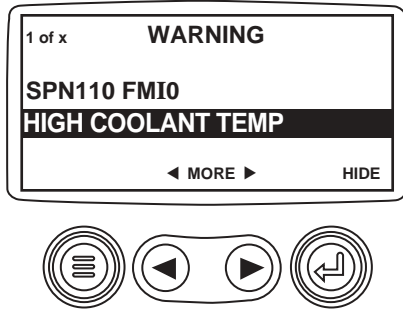


Active Fault Codes

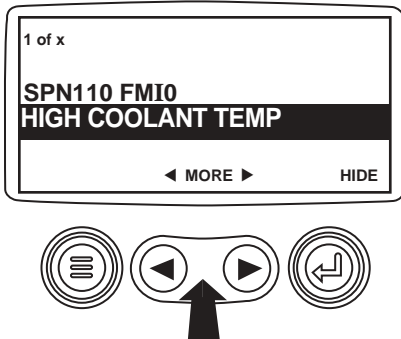
1. During normal operation the single or four parameter screen will be displayed.



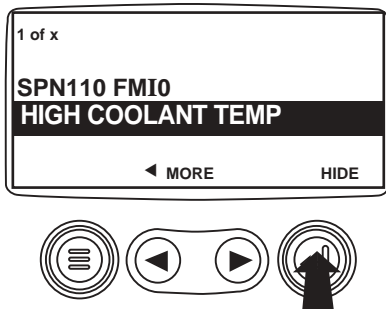
2. When the PowerView receives a fault code from an engine control unit the single or four parameter screen will be replaced with the "Active Fault Codes" message.



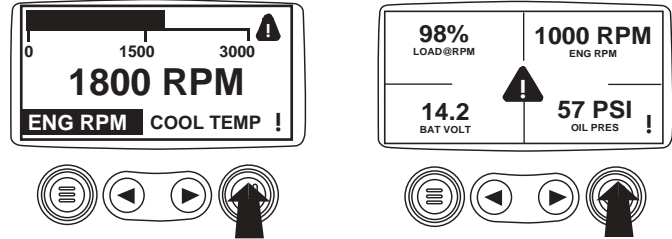
3. If the word "MORE" appears above the "Arrow Buttons" there are more active fault codes that may be viewed. Use the "Arrow Buttons" to scroll to the next "Active Fault Code"



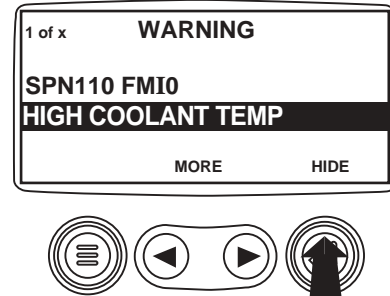
4. To acknowledge and "Hide" the fault and return to the single or four parameter display press the "Enter Button".



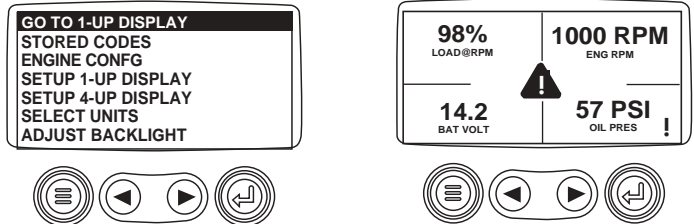
5. The display will return to the single or four parameter display, but the display will contain the "Active Fault" warning icon. Pressing the "Enter Button" will redisplay the hidden fault.



6. Pressing the "Enter Button" once again will hide the fault and return the screen to the single or four parameter display.

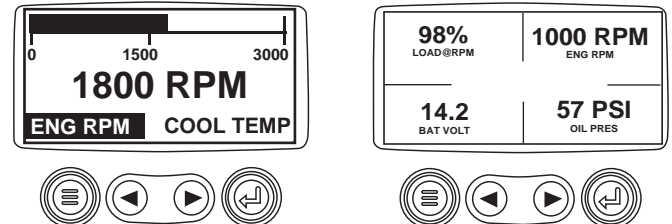


7. The Single or Four parameter screen will display the fault icon until the fault condition is corrected. NOTE: Ignoring active fault codes could result in severe engine damage.

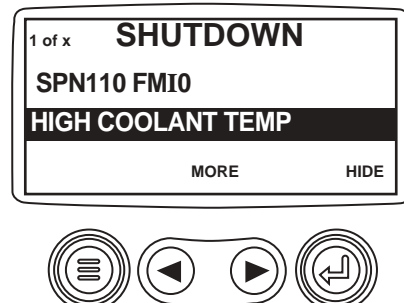


Shutdown Codes

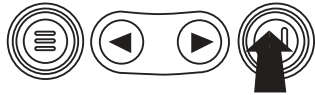
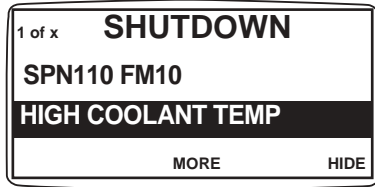
1. During normal operation the single or four parameter screen will be displayed.



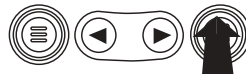
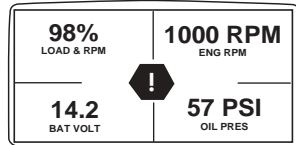
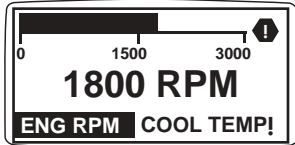
2. When the PowerView receives a severe fault code from an engine control unit the single or four parameter screen will be replaced with the "Shutdown!" message.



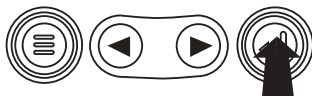
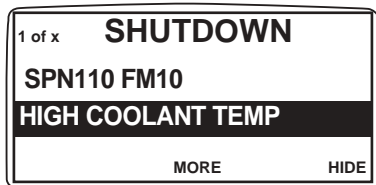
3. To acknowledge and "Hide" the fault and return to the single or four parameter display press the "Enter Button".



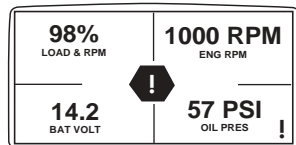
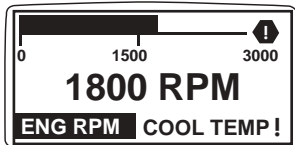
4. The display will return to the single or four parameter display, but the display will contain the "Shut Down" icon. Pressing the "Enter Button" will redisplay the hidden fault.



5. Pressing the "Enter Button" once again will hide the fault and return the screen to the single or four parameter display.

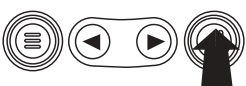
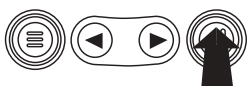
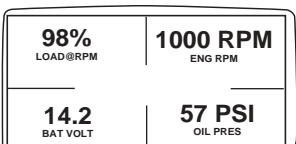
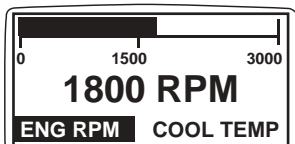


6. The Single or Four parameter screen will display the fault icon until the fault condition is corrected. NOTE: Ignoring active fault codes could result in severe engine damage.

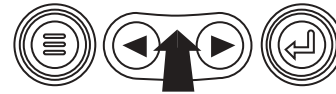
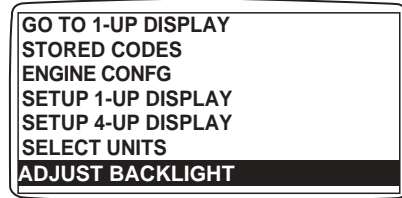


Back Light Adjustment

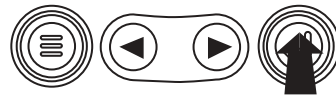
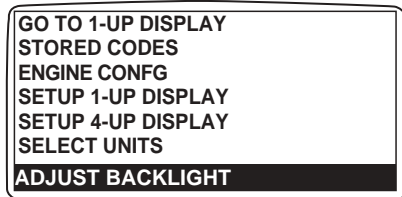
1. Starting at the single or four engine parameter display press the "Menu Button".



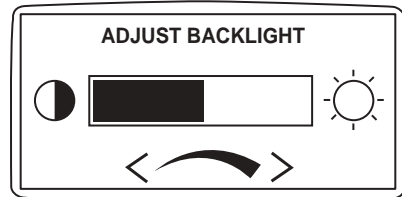
2. The main menu will pop up on the display. Use the "Arrow Buttons" to scroll through the menu until the "Adjust Backlight" is highlighted.



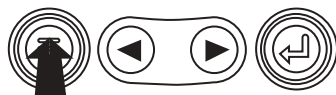
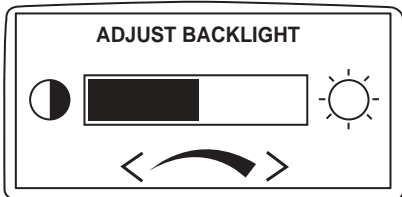
3. Once the "Adjust Backlight" menu item has been highlighted press the "Enter Button" to activate the "Adjust Backlight" function.



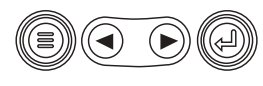
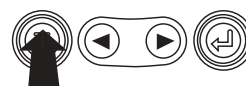
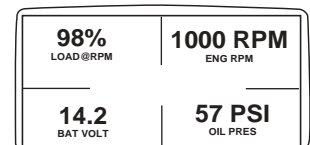
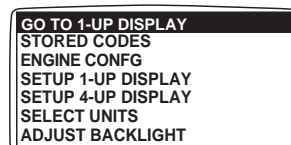
4. Use the "Arrow Buttons" to select the desired backlight intensity.



5. Press the "Menu Button" to return to the main menu.

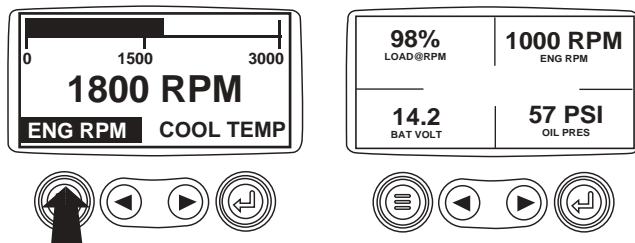


6. Press the "Menu Button" to exit the Main menu and return to the engine parameter display.

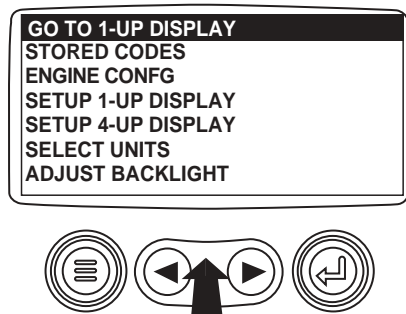


Contrast Adjustment

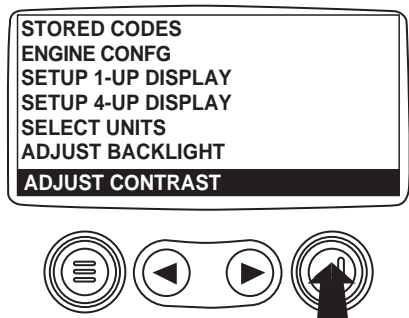
1. Starting at the single or four engine parameter display depress the "Menu Button".



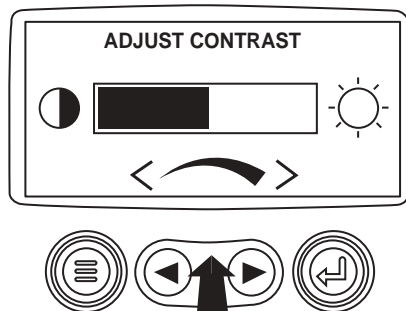
2. The main menu will pop up on the display. Use the "Arrow Buttons" to scroll through the menu until "Adjust Contrast" is highlighted.



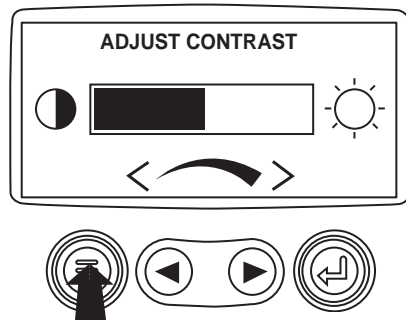
3. Once the "Adjust Contrast" menu item has been highlighted press the "Enter Button" to activate the "Adjust Contrast" function.



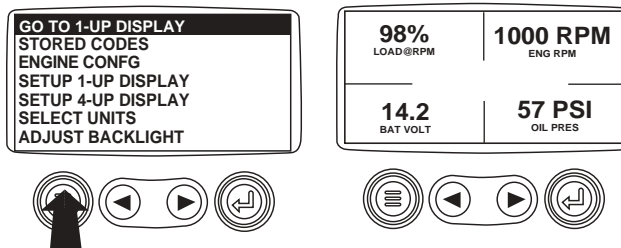
4. Use the "Arrow Buttons" to select the desired contrast intensity.



5. Press the "Menu Button" to return to the main menu.

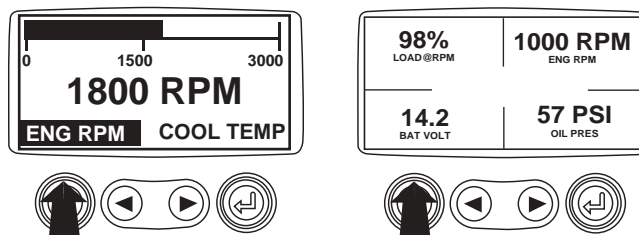


6. Press the "Menu Button" to exit the Main menu and return to the engine parameter display.

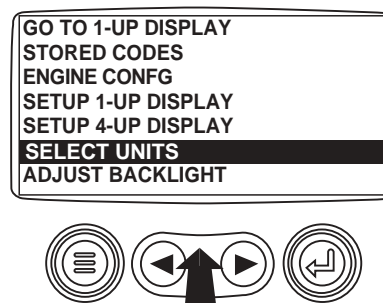


Select Units

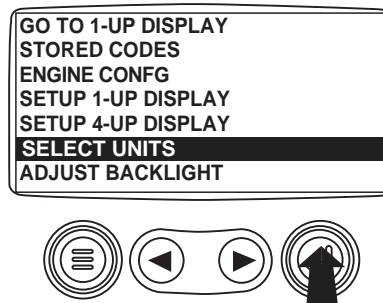
1. Starting at the single or four engine parameter display depress the "Menu Button".



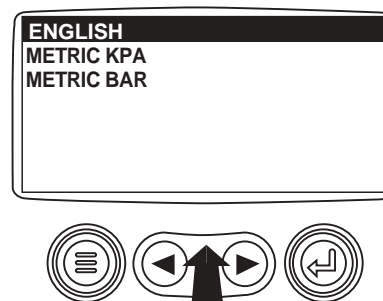
2. The main menu will pop up on the display. Use the arrow buttons to scroll through the menu until the "Select Units" is highlighted.



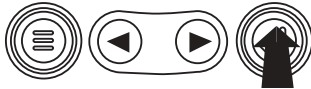
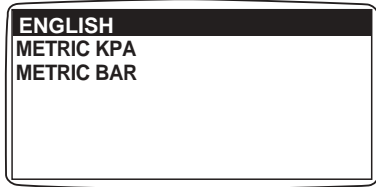
3. Once the "Select Units" menu item has been highlighted press the "Enter Button" to access the "Select Units" function.



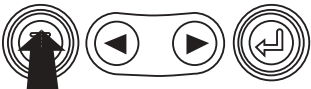
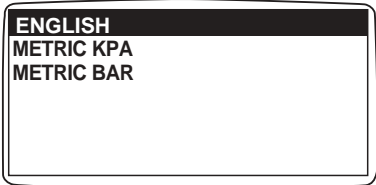
4. Use the arrows to highlight the desired units. "English" for Imperial units i.e. PSI, °F or Metric kPa, Metric Bar for IS units i.e. kPa, Bar, °C.



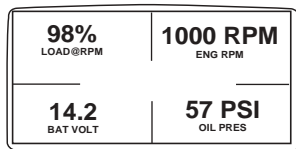
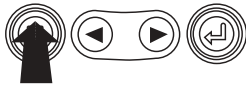
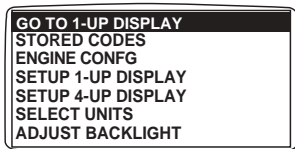
5. Press the "Enter Button" to select the highlighted units.



6. Press the "Menu Button" to return to the "Main Menu".

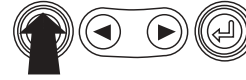
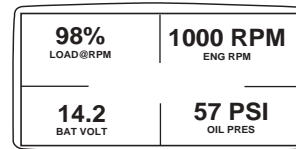
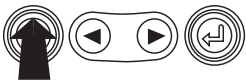
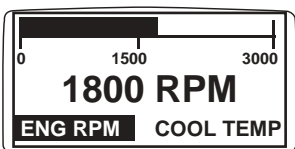


7. Press the "Menu Button" to exit the Main menu and return to the engine parameter display.

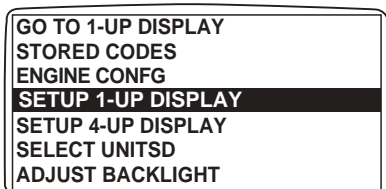


Setup 1-Up Display

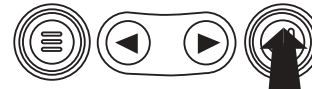
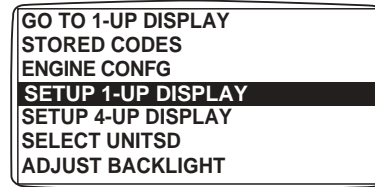
1. Starting at the single engine parameter display press the "Menu Button".



2. The main menu will pop up on the display. Use the "Arrow Buttons" to scroll through the menu until the "Setup 1-up Display" is highlighted.



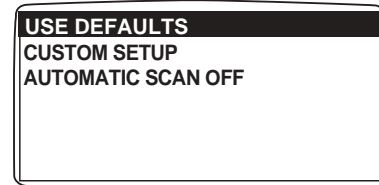
3. Once the "Setup 1-up Display" menu item has been highlighted press the "Enter Button" to access the "Setup 1-up Display" function.



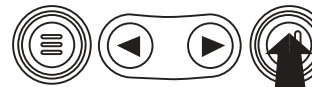
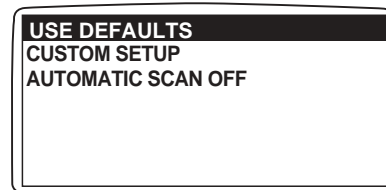
4. Three options are available for modification of the 1-Up display.

- a). **Use Defaults** – This option contains a set of engine parameters: Engine Hours, Engine RPM, System Voltage, Battery Voltage, % Engine Load at Current RPM, Coolant Temperature, Oil Pressure.
- b). **Custom Setup** – This option allows for the modification of what parameter, the number of parameters, and the order in which the parameters are being displayed.
- c). **Automatic Scan** – Selecting the scan function will cause the 1-Up Display to scroll through the selected set of parameters one at a time, momentarily pausing at each.

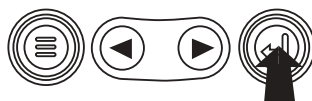
5. **Use Defaults** - To select "Use Defaults" use the arrow buttons to scroll to and highlight "Use Defaults" in the menu display.



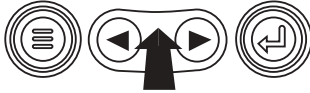
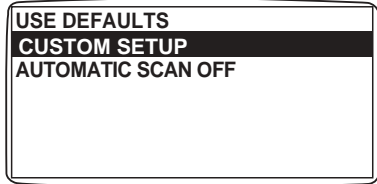
6. Press the "Enter Button" to activate the "Use Defaults" function.



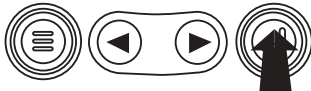
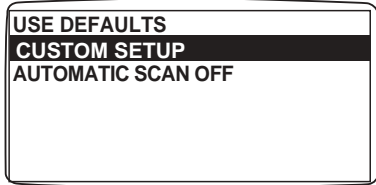
7. A message indicating the "Single Engine" parameter display parameters are reset to the factory defaults will be displayed, then the display will return to the "Custom Setup" menu.



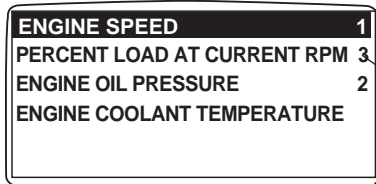
8. Custom Setup - To perform a custom setup of the 1-Up Display use the arrow buttons to scroll to and highlight "Custom Setup" on the display.



9. Pressing the "Enter Button" will display a list of engine parameters.



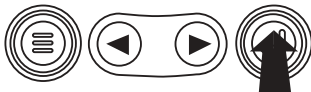
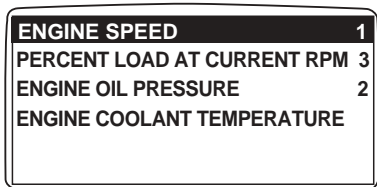
10. Use the "Arrow Buttons" to scroll to and highlight a selected parameter (parameter with a # symbol to right of it).



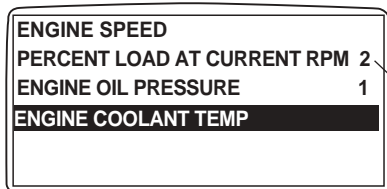
This number indicates the order of display for the parameters and that the parameter is selected for display.



11. Press the "Enter Button" to disselect the selected parameter removing it from the list of parameters being displayed on the 1-up display.



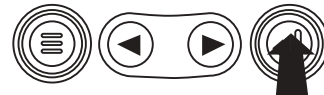
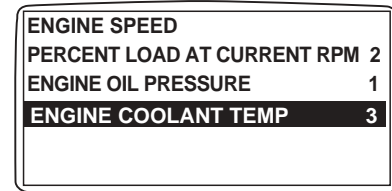
12. Use the "Arrow Buttons" to scroll and highlight the desired parameter that has not been selected for display.



Note that the numbers now indicate the new order of display for the parameters.

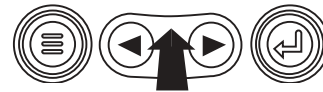
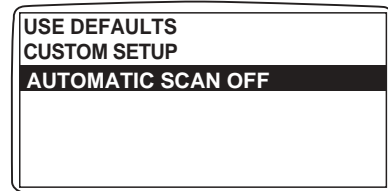


13. Press the "Enter button" to select the highlighted parameter for inclusion in the Single Engine Parameter Display.

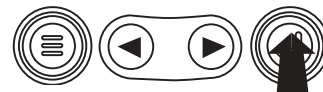
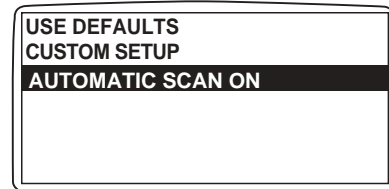


14. Continue to scroll and select additional parameters for the custom 1-Up Display. Press the "Menu button" at any time to return to the "Custom Setup" menu.

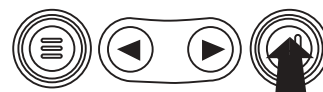
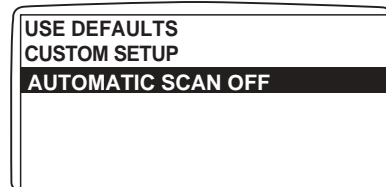
15. Automatic Scan - Selecting the scan function will cause the 1-Up Display to scroll through the selected set of parameters one at a time. Use the "Arrow Buttons" to scroll to the "Automatic Scan" function.



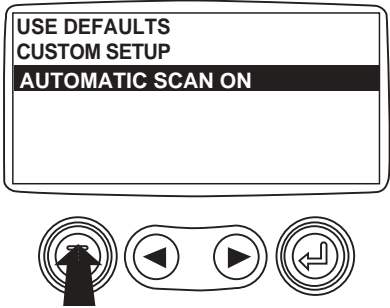
16. Pressing the "Enter Button" toggles the "Automatic Scan" function on.



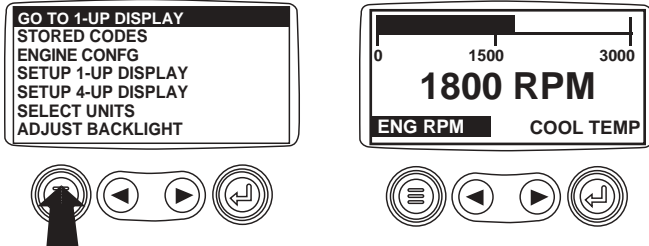
17. Pressing the "Enter Button" again toggles the "Automatic Scan" function off.



18. Once the "Use Defaults", "Custom Setup" and "Automatic Scan" functions have been set press the "Menu Button" to return to the main menu.

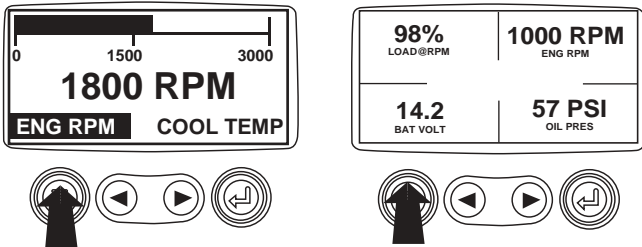


19. Press the "Menu Button" to exit the Main menu and return to the engine parameter display.

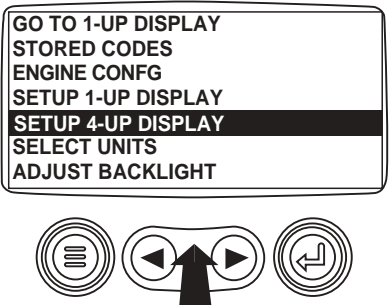


Setup 4-Up Display

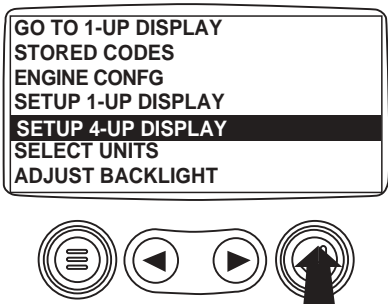
1. From the single or four engine parameter display press the "Menu Button".



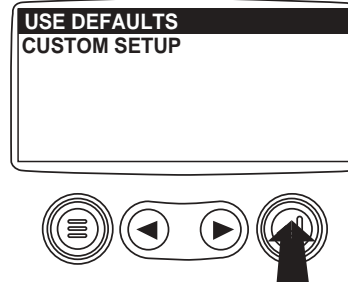
2. The main menu will pop up on the display. Use the "Arrow Buttons" to scroll through the menu until the "Setup 4-Up Display" is highlighted.



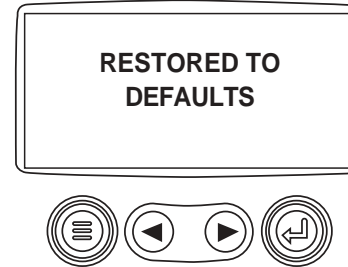
3. Once the "Setup 4-Up Display" menu item has been highlighted press the "Enter Button" to activate the "Setup 4-Up Display" menu.



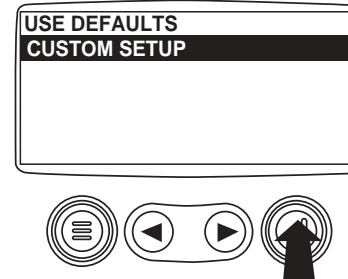
4. Press the "Enter Button" to activate the "Use Defaults" function. This action will reset the unit to the factory default.



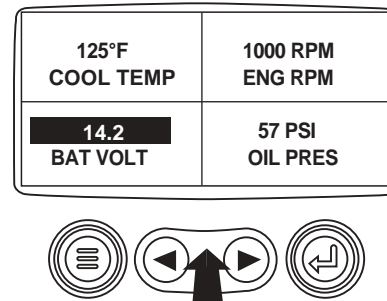
5. The "Use Defaults" screen will be displayed during the resetting period then will automatically return to the "Setup 4-Up Display" menu.



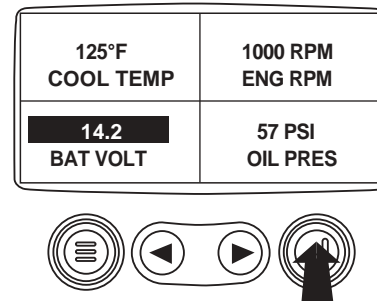
6. Select the "4-Up Custom Setup" from the "4-Up Setup" menu.



7. The quadrant with the backlit parameter value is the current selected parameter. Use the "Arrow Buttons" to highlight the parameter value in the quadrant you wish to place a new parameter.



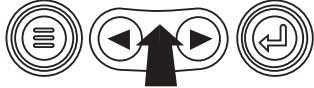
8. Press the "Enter Button" and a list of parameters will appear.



9. The parameter that is highlighted is the selected parameter for the screen. Use the "Arrow Buttons" to highlight the new parameter to be placed in the quadrant selected in the previous screen.

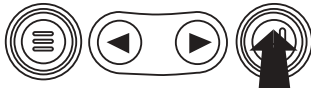
ENGINE SPEED	3
ENGINE HOURS	
ENGINE COOLANT TEMPERATURE	1
BATTERY POTENTIAL	
ENGINE OIL TEMPERATURE	2
ENGINE OIL PRESSURE	4

The number to the right of the parameter indicates the quadrant in which it is displayed.
 1. = Upper Left Quadrant
 2. = Lower Left Quadrant
 3. = Upper Right Quadrant
 4. = Lower Right Quadrant



10. Press the "Enter Button" to change the selected parameter in the quadrant to the new parameter.

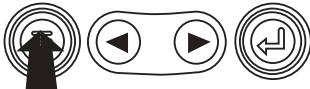
ENGINE SPEED	3
ENGINE HOURS	
ENGINE COOLANT TEMPERATURE	1
BATTERY POTENTIAL	2
ENGINE OIL TEMPERATURE	2
ENGINE OIL PRESSURE	4



11. Use the "Menu Button" to return to the "4-UP Custom Setup" screen.

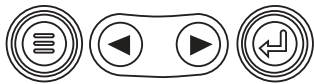
ENGINE SPEED	3
ENGINE HOURS	
ENGINE COOLANT TEMPERATURE	1
BATTERY POTENTIAL	
ENGINE OIL TEMPERATURE	2
ENGINE OIL PRESSURE	4

Note the number to the right of the selected parameter indicating that the parameter is now assigned to that display location.



12. The parameter in the selected quadrant has changed to the parameter selected in the previous screen.

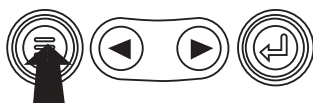
125°F COOL TEMP	1000 RPM ENG RPM
143°F OIL TEMP	57 PSI OIL PRES



13. Repeat the parameter selection process until all spaces are filled.

14. Press the "Menu Button" to return to the main menu.

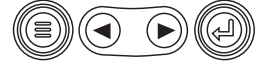
125°F COOL TEMP	1000 RPM ENG RPM
143°F OIL TEMP	57 PSI OIL PRES



15. Press the "Menu Button" to exit the Main menu and return to the engine parameter display.

GO TO 1-UP DISPLAY
STORED CODES
ENGINE CONFG
SETUP 1-UP DISPLAY
SETUP 4-UP DISPLAY
SELECT UNITS
ADJUST BACKLIGHT

125% COOL TEMP	1000 RPM ENG RPM
143°F OIL TEMP	57 PSI OIL PRES

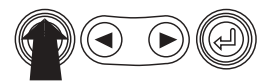
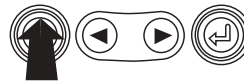


Utilities (Information and troubleshooting)

1. Starting at the single or four engine parameter display, press the "Menu button".

0	1500	3000
1800 RPM		
ENG RPM	COOL TEMP	

125% COOL TEMP	1000 RPM ENG RPM
143°F OIL TEMP	57 PSI OIL PRES



2. The main menu will be displayed. Use the "Arrow buttons" to scroll through the menu until the "Utilities" is highlighted.

STORED CODES
ENGINE CONFG
SETUP 1-UP DISPLAY
SETUP 4-UP DISPLAY
SELECT UNITS
ADJUST BACKLIGHT
UTILITIES



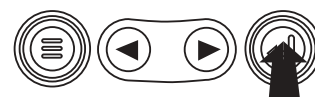
3. Once the "Utilities" menu item has been highlighted, press the "Enter Button" to activate the "Utilities" functions.

STORED CODES
ENGINE CONFG
SETUP 1-UP DISPLAY
SETUP 4-UP DISPLAY
SELECT UNITS
ADJUST BACKLIGHT
UTILITIES

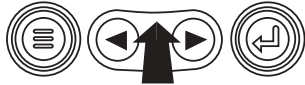
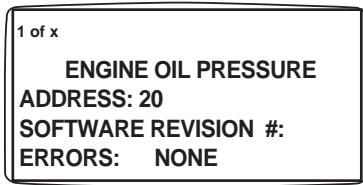


4. Press "Select" to enter the "Gages Data" display. When "Gage Data" is selected the PowerView will communicate with the analog gages at a fixed rate of 38.4 k Baud, 8 data bits, no parity check, 1 stop bits, half duplex.

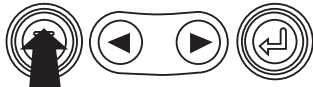
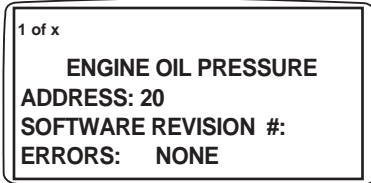
GAGE DATA
REMOVE ALL GAGES
SOFTWARE VERSION
FAULT CONVERSION



5. Use the “Arrow buttons” to scroll through the items or press “Menu” to return to the “Utilities” menu.



6. Press “Menu Button” to return to the “Utilities” menu.



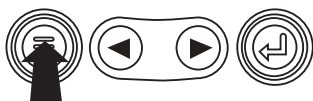
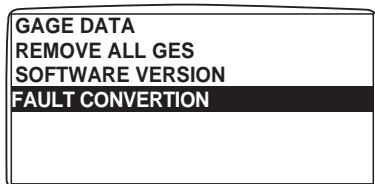
7. Use the “Arrows” to highlight “Remove All Gages”. Press “Select” to clear gage data from memory. It takes a moment to clear all gages.



8. When the gage data has cleared, the display automatically returns to the “Utilities” menu. Scroll to “Software Version”. Press “Select” to view the software version currently in the PowerView.



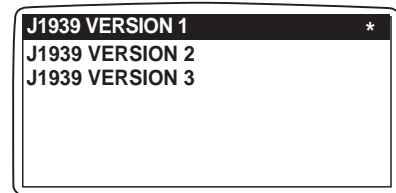
9. Press “Menu” to return to “Utilities”. Highlight “Fault Conversion” using the “Arrows”. Press “Select” to enter the Fault conversion menu.



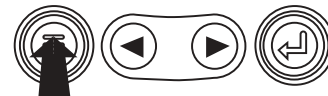
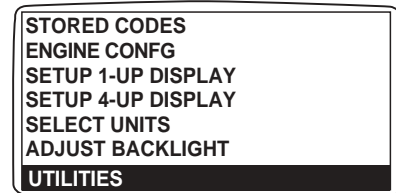
11. Using the “Arrow” buttons scroll to highlight the version to be selected. Press the “Select” button to select the version. Note that an asterisks appears to the right of the selection.

NOTE: There are four (4) different methods for converting fault codes. The PowerView always looks for J1939 Version 4 and can be set to use one of the three (3) other J1939 versions. Most engine ECU’s use Version 4, therefore in most cases adjustment of this menu option will not be required.

Upon receiving an unrecognizable fault, change to a different J1939 Version. If the fault SPN does not change when the version is changed, the ECU generating the fault is using Fault Conversion method 4. If the SPN number does change but is still unrecognizable, try changing to another J1939 Version not yet used and continue to check the SPN number.



12. Press the “Menu” button to return to “Utilities” menu. Press the “Menu” button again to return to the “Main” menu.



SAE J1939 MurphyLink System Implementation of J1939 Parameters

Source: SAEJ1939-71 Surface Vehicle Recommended Practice

SAE J1939 Section	Description	PGN	Parameter	Display Value
5.3.6	Elec Eng Cont #2 - EEC2	61443	Accelerator Pedal Position	THROTTLE
			Percent Load at Current RPM	LOAD@RPM
5.3.7	Elec Eng Cont #1 - EEC1	61444	Actual engine % torque	ENG TORQUE
			Engine Speed	ENG RPM
5.3.14	Vehicle Distance	65248	Trip Distance	TRIPSPNEDIST
			Total Vehicle Distance	VEH DIST
5.3.19	Engine hours, Revolutions	65253	Total Engine Hours	ENG HRS
5.3.23	Fuel Consumption	65257	Trip Fuel	TRIP FUEL
			Total Fuel Used	FUELUSED
5.3.28	Engine Temperature	65262	Engine Coolant Temp	COOL TEMP
			Fuel Temperature	FUEL TEMP
			Engine Oil Temperature	OIL TEMP
			Engine Intercooler Temperature	INTC TEMP
5.3.29	Engine Fluid Level/Pressure	65263	Fuel Delivery Pressure	FUEL PRES
			Engine Oil Level	OIL LVL
			Engine Oil Pressure	OIL PRES
			Coolant Pressure	COOL PRES
			Coolant Level	COOL LVL
5.3.31	Cruise Control /Vehicle Speed	65265	Wheel Based Vehicle Speed	VEH SPD
5.3.32	Fuel Economy	65266	Fuel Rate	FUEL RATE
			Instantaneous Fuel Economy	FUEL ECON
			Average Fuel Economy	AVG ECON
5.3.35	Ambient Conditions	65269	Barometric Pressure	BARO PRES
			Air Inlet Temperature	AIR IN TEMP
5.3.36	Inlet/Exhaust Conditions	65270	Boost Pressure	BST PRES
			Intake Manifold Temp	MANI TMP
			Air Filter Differential Pressure	AIRDIFFPR
			Exhaust Gas Temperature	EXH TEMP
5.3.37	Vehicle Electrical Power	65271	Alternator Voltage	ALT VOLT
			Electrical Potential (Voltage)	SYS VOLT
			Battery Pot. Voltage (Switched)	BAT VOLT
5.3.8	Electronic Transmission Controller #2	61445	Selected Gear	SELECT GEAR
		61445	Current Gear	CURNT GEAR
5.3.38	Transmission Fluids	65272	Transmission Oil Pressure	TRAN PRES
			Transmission Oil Temperature	TRAN TEMP
5.3.46	Engine Fluid Level/Pressure #2	65243	Injector Metering Rail 1 Pres	INJ PRES1
			Injector Metering Rail 2 Pres	INJ PRES2
5.3.58	Fan Drive	65213		FAN SPD
5.3.111	Auxiliary Pressures & Temperatures	65164	Auxiliary Temperature	AUX TEMP
			Auxiliary Pressure	AUX PRES
	Diagnostic Messages	65226	DM1 - Active Diagnostic	SRVCCODE
		65227	DM2 - Previously Act Diag Codes	STORCODE
		65228	DM3 - Diagnostic Clear	
J1939 N/A	Machine Hours (PowerView Calculated)	N/A	Machine Hours	MACH HRS
5.3.17	Engine Conf.	65251	Engine Configuration	ENG CONF
5.3.5	Electronic Transmission Controller #1	61442	Output Shaft Speed	OUT SFT SPD
	Electronic Transmission Controller #1	61442	Input Shaft Speed	IN SFT SPD
	Electronic Transmission Controller #1	61442	Torque Converter Lockup Engaged	TORQ LOCK

GLOSSARY (Troubleshooting information)

CANBUS FAILURE

PowerView has not received any CAN messages for at least 30 seconds.

NO DATA

PowerView has not received the particular message being displayed for at least 5 seconds.

NOT SUPPORTED

PowerView has received a message from the ECU stating the displayed message is not supported.

DATA ERROR

PowerView has received an error message from the ECU for the displayed message.

EMPTY

No parameter selected for this 4-UP quadrant.

WAIT TO START PREHEATING

This is a message from the engine indicating it is in a preheating cycle.
Wait until this message clears before starting the engine.

TIMEOUT ECU NOT RESPONDING

The ECU did not respond to the PowerView request.

NO GAGE DATA

The PowerView has no record of connected gages to the RS485 bus.



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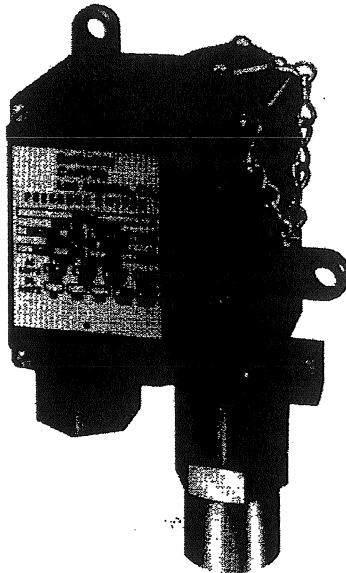


In order to consistently bring you the highest quality, full featured products, we reserve the right to change our specifications and designs at any time.

Printed in U.S.A.

OPERATING CHARACTERISTICS • ORDERING DATA

Sealed Piston Models with Double-Make-Double-Break Switch A9675 Single Setting



Oil Tight and Dust Tight — Indoor (NEMA 13)
Air, Oil or Water Service
Electrical connection through
1/2" npt conduit connection
to screw terminals on switch
Tamper Proof External Adjustment

PRESSURE SWITCHES — All values given in P.S.I. (Gauge)

Proof (Test) Press.	Adjustable Range				Approx. * Actuation Value (Differential)	Catalog Number
	Decreasing		Increasing			
	Min.	Max.	Min.	Max.		
3000	20	170	30	200	10 to 30	A9675-0
3000	75	495	95	540	20 to 45	A9675-1
7000	100	1370	140	1500	40 to 130	A9675-2
7000	235	3075	365	3400	130 to 325	A9675-3
12000	425	5500	600	6000	175 to 500	A9675-4
Approximate shipping weight lbs.						1.75

*Fixed at any pressure setting, varies as shown from lowest to highest setting; for adjustable differential models, refer to page 30.

DETAIL DATA

ELECTRICAL CHARACTERISTICS: All models incorporate Underwriters' Laboratories, Inc. listed double-make-double-break snap-action switching elements. Electrical rating (continuous inductive): 15 amps 125, 250, 480 VAC; 7.5 amps 600 VAC. 1 amp 125 VDC, 0.5 amps 250 VDC. Automatically reset by snap-action of switch.

ELECTRICAL CONNECTION: Through 1/2" npt conduit connection to screw terminals on switch. May be wired Normally Open or Normally Closed.

PRESSURE CONNECTION: 1/4" npt internal thread.

WETTED MATERIALS: Fitting and piston — stainless steel; 'O' ring — Buna N; back-up ring — Teflon.

ADJUSTMENT INSTRUCTIONS: Loosen adjustment cover screw and open. Using screwdriver, turn adjustment screw clockwise to raise, counter-clockwise to lower actuation point. All dials are calibrated for increasing settings.

OPTIONAL MODIFICATIONS

AND 10050-4 (tube) pressure port. To order, add suffix "-X" to switch catalog number. Example: A9675-1-X.

Machined drain port (1/8" npt). To order, add prefix "D" to switch catalog number. Example: DA9675-2.

Note: A maximum of two suffixes only may be used — three or more modifications require a special switch.

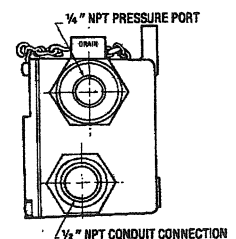
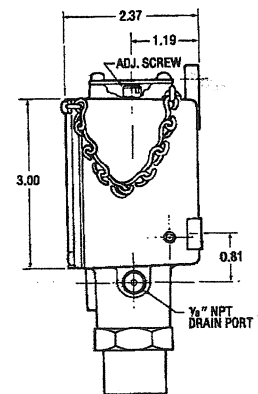
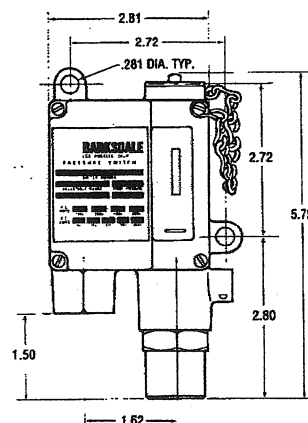
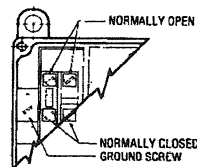
When ordering: To ensure correct switch is furnished, always specify full switch catalog number (including required modifications), service and setting.

For adjustable differential models, see page 28.

A9675 CONFIGURATION DOUBLE-MAKE-DOUBLE-BREAK SWITCH

ELECTRICAL RATING MAX. CONTINUOUS CURRENT AMPS

BASIC SWITCH ASSY. NO.	A9675	
A.C. @ 50% POWER FACTOR	125V	15.0
	250V	15.0
	480V	15.0
	600V	7.5
D.C. L/R = .026	125V	1.0
	250V	0.5



Port
2.....1/4"

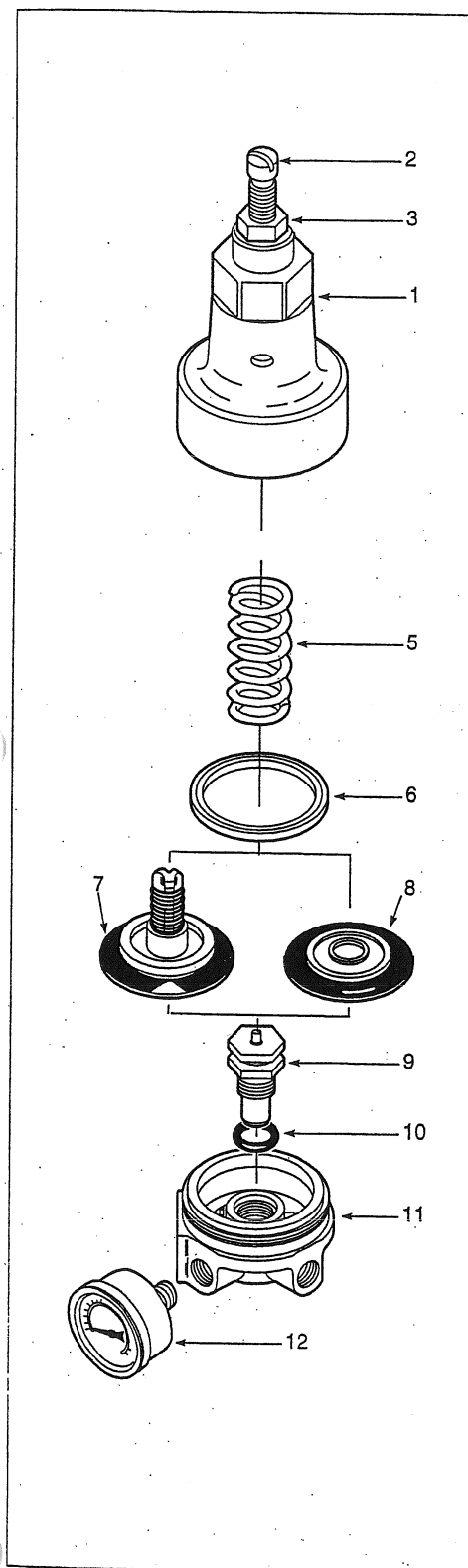
Relief Type
RRelieving
NNonrelieving

Gauge
NNo gauge

Spring (Outlet pressure adjustment range) *
E...2 to 50 psig (0.14 to 3.4 bar)
L...5 to 125 psig (0.34 to 8.6 bar)
N...10 to 175 psig (0.7 to 12.1 bar)

Thread
APTF

*. Outlet pressure can be adjusted to pressures in excess of, and less than, those specified. Do not use these units to control pressures outside of the specified ranges.



R83 APPLICATION

The R83 cylinder gas pressure regulator is used in industrial cylinder gas systems to control pressures of carbon dioxide, nitrogen, water pumped air, argon, helium, krypton, neon, and xenon.

R83 RELIEF TYPE

R83 regulators are available with a relieving or nonrelieving diaphragm. Regulators with a relieving diaphragm vent downstream gas, and hence reduce downstream pressure, when the regulator pressure adjusting screw is turned counterclockwise. **Downstream pressure will not be reduced when the adjusting screw is turned counterclockwise if back-flow check valves are installed in the regulator outlet line.** Regulators with a nonrelieving diaphragm do not vent downstream gas or reduce downstream pressure when the adjusting screw is turned counterclockwise.

TECHNICAL DATA

Fluids: Carbon dioxide, nitrogen, water pumped air, argon, helium, krypton, neon, and xenon. For use with other gases, including oxygen, consult Norgren. See **WARNING** if regulator is to be used in a beverage dispensing application.

Maximum primary (inlet) pressure: 3000 psig (206.9 bar)

Operating temperature: 0° to +140°F (-18° to +60°C)

Materials:

Body: Brass
Bonnet: Zinc
Cartridge valve: Teflon, brass, stainless steel
Seals: Nitrile
Diaphragm: Acetal and nitrile

REPLACEMENT ITEMS

Diaphragm	
Relieving (7)	570-51
Nonrelieving (8)	570-10
Cartridge valve (9, 10)	5086-55

INSTALLATION

This regulator has two primary (inlet) ports marked **PRI**, and two secondary (outlet) ports marked **SEC** (secondary).

1. Connect the high pressure supply to either of the **PRI** ports. The other primary port can be plugged, used as a manifold port to another regulator, or used for a primary pressure gauge. Use a U.L. listed gauge.
2. Connect outlet lines which lead to the downstream system to either of the **SEC** ports. The other secondary port can be plugged, used as an additional secondary outlet, or used for a secondary pressure gauge. Use a U.L. listed gauge.

WARNING

Never connect the high pressure supply to the regulator ports marked **SEC**. Never connect the outlet lines to the regulator ports marked **PRI**. Improper connections will expose the downstream system to excessive pressure, resulting in equipment damage and/or personal injury. Before turning on gas pressure, turn regulator adjusting screw (2) fully counterclockwise.

ADJUSTMENT

1. Turn regulator adjusting screw (2) fully counterclockwise.
2. Turn on gas pressure.
3. Turn adjustment clockwise to increase secondary (outlet) pressure setting. Turn adjustment counterclockwise to decrease pressure setting.
4. Always approach the desired pressure from a lower pressure. When reducing from a higher to a lower setting, first reduce to some pressure less than that desired, then bring up to the desired pressure.
5. Tighten lock nut (3) to secure pressure setting.

DISASSEMBLY

1. Shut off inlet pressure. Reduce pressure in inlet and outlet lines to zero.
2. Turn regulator adjusting screw (2) fully counterclockwise.
3. Unit can be disassembled without removal from air line.
4. Disassemble in general accordance with the item numbers on exploded view. Use 5/8" socket to remove cartridge valve (9).

CLEANING

1. Clean parts with warm water and soap.
2. Rinse and dry parts. Blow out internal passages in body with clean, dry compressed air.
3. Inspect parts. Replace those found to be damaged.

NOTE

Cartridge valve (9) is factory sealed and is not repairable. Replace cartridge valve if not sealing properly. Use only the specified Norgren parts for replacement. Do not use damaged or inoperative parts or assemblies. Maintain strict cleanliness when reassembling regulator.

ASSEMBLY

1. Lubricate threads and tip of adjusting screw (2), with a light, even coat of Lubriplate Aero.
2. Lubricate bonnet threads (1), with a light, even coat of Led-Plate 250.
3. Lubricate O-ring (10) with a light coat of Dow Corning DC 44 silicone grease.
4. Assemble the unit as shown on the exploded view.

Item	Torque
9 (Cartridge valve)	45 to 65 in-lbs (5 to 7 Nm)
1 (Bonnet)	25 to 30 ft-lbs (34 to 40 Nm)

WARNING

For safety using Model R83 Regulators in system applications, the following procedures must be followed.

1. Pressure relief devices of sufficient capacity must always be used in the secondary (outlet) lines downstream of the pressure regulator. Do not remove or attempt to adjust, plug, block or otherwise defeat the purpose of the relief device in any manner. Failure to provide pressure relief of sufficient capacity to hold outlet pressure below the lowest working pressure rating of any piece of equipment installed in the outlet lines can result in equipment damage and/or personal injury.
2. Norgren approval must be obtained before using a type R83 regulator in any beverage dispensing application.
3. Regulators must not be used where temperature or pressure may exceed those specified in the **TECHNICAL DATA** paragraph.
4. These regulators are not intended for use in life support systems or beverage dispensing systems.
5. The accuracy of the indication of pressure gauges can change, both during shipment (despite care in packaging) and during the service life. If a pressure gauge is to be used in conjunction with these products and if inaccurate indications may be hazardous to personnel or property, the gauge should be calibrated before initial installation and at regular intervals during use. For gauge standards refer to ANSI B40.1.

Installation & Maintenance Instructions



OPEN-FRAME, GENERAL PURPOSE, WATERTIGHT/EXPLOSIONPROOF SOLENOIDS

SERIES

8003G

8202G

Form No.V6584R8

— SERVICE NOTICE —

ASCO® solenoid valves with design change letter "G" or "H" in the catalog number (ex. 8210G 1) have an epoxy encapsulated ASCO® Red Hat II® solenoid. This solenoid replaces some of the solenoids with metal enclosures and open-frame constructions. Follow these installation and maintenance instructions if your valve or operator uses this solenoid.

See separate instructions for basic valve.

DESCRIPTION

Catalog numbers 8003G and 8202G are epoxy encapsulated pull-type solenoids. The green solenoid with lead wires and 1/2" conduit connection is designed to meet Enclosure Type 1—General Purpose, Type 2—Dripproof, Types 3 and 3S—Raintight, and Types 4 and 4X—Watertight. The black solenoid on catalog numbers prefixed "EF" or "EV" is designed to meet Enclosure Types 3 and 3S—Raintight, Types 4 and 4X—Watertight, Types 6 and 6P—Submersible, Type 7 (A, B, C & D) Explosionproof Class I, Division 1 Groups A, B, C, & D and Type 9 (E, F, & G)—Dust—Ignitionproof Class II, Division 1 Groups E, F & G. The Class II, Groups F & G Dust Locations designation is not applicable for solenoids or solenoid valves used for steam service or when a class "H" solenoid is used. See *Temperature Limitations* section for solenoid identification and nameplate/retainer for service. When installed just as a solenoid and not attached to an ASCO valve, the core has a 0.250–28 UNF–2B tapped hole, 0.38 or 0.63 minimum full thread.

NOTE: Catalog number prefix "EV" denotes stainless steel construction.

Catalog numbers 8202G1, 8202G3, 8202G5 and 8202G7 are epoxy encapsulated push-type, reverse-acting solenoids having the same enclosure types as previously stated for Catalog numbers 8003G1 and 8003G2.

Series 8003G and 8202G solenoids are available in:

- **Open-Frame Construction:** The green solenoid may be supplied with 1/4" spade, screw or DIN terminals. (Refer to Figure 4)
- **Panel Mounted Construction:** These solenoids are specifically designed to be panel mounted by the customer through a panel having a .062 to .093 maximum wall thickness. Refer to Figure 1 and section on *Installation of Panel Mounted Solenoid*.

Optional Features For Type 1 – General Purpose Construction Only

- **Junction Box:** This junction box construction meets Enclosure Types 2,3,3S,4, and 4X. Only solenoids with 1/4" spade or screw terminals may have a junction box. The junction box provides a 1/2" conduit connection, grounding and spade or screw terminal connections within the junction box (See Figure 5).
- **DIN Plug Connector Kit No.K236034:** Use this kit only for solenoids with DIN terminals. The DIN plug connector kit provides a two pole with grounding contact DIN Type 43650 construction (See Figure 6).

OPERATION

Series 8003G – When the solenoid is energized, the core is drawn into the solenoid base sub-assembly. **IMPORTANT:** When the solenoid is de-energized, the initial return force for the core, whether developed by spring, pressure, or weight, must exert a minimum force to overcome residual magnetism created by the solenoid. Minimum return force for AC construction is 11 ounces, and 5 ounces for DC construction.

Series 8202G – When the solenoid is energized, the disc holder assembly seats against the orifice. When the solenoid is de-energized, the disc holder assembly returns. **IMPORTANT:** Initial return force for the disc or disc holder assembly, whether developed by spring, pressure, or weight, must exert a minimum force to overcome residual magnetism created by the solenoid. Minimum return force is 1 pound, 5 ounces.

INSTALLATION

Check nameplate for correct catalog number, service, and wattage. Check front of solenoid for voltage and frequency.

▲ WARNING: Electrical hazard from the accessibility of live parts. To prevent the possibility of death, serious injury or property damage, install the open-frame solenoid in an enclosure.

FOR BLACK ENCLOSURE TYPES 7 AND 9 ONLY

▲ CAUTION: To prevent fire or explosion, do not install solenoid and/or valve where ignition temperature of hazardous atmosphere is less than 165° C. On valves used for steam service or when a class "H" solenoid is used, do not install in hazardous atmosphere where ignition temperature is less than 180° C. See nameplate/retainer for service.

NOTE: These solenoids have an internal non-resettable thermal fuse to limit solenoid temperature in the event that extraordinary conditions occur which could cause excessive temperatures. These conditions include high input voltage, a jammed core, excessive ambient temperature or a shorted solenoid, etc. This unique feature is a standard feature only in solenoids with black explosionproof/dust-ignitionproof enclosures (Types 7 & 9).

▲ CAUTION: To protect the solenoid valve or operator, install a strainer or filter, suitable for the service involved in the inlet side as close to the valve or operator as possible. Clean periodically depending on service conditions. See ASCO Series 8600, 8601, and 8602 for strainers.

Temperature Limitations

For maximum valve ambient temperatures, refer to chart. The temperature limitations listed, only indicate maximum application temperatures for field wiring rated at 90°C. Check catalog number prefix and watt rating on nameplate to determine maximum ambient temperature. See valve installation and maintenance instructions for maximum fluid temperature.

NOTE: For steam service, refer to *Wiring* section, *Junction Box* for temperature rating of supply wires.

Temperature Limitations For Series 8003G or 8202G Solenoids for use on Valves Rated at 10.1, 11.6, 17.1, or 22.6 Watts			
Watt Rating	Catalog Number Coil Prefix	Class of Insulation	Maximum † Ambient Temp.
10.1 & 17.1	None, FB, KF, KP SC, SD, SF, & SP,	F	125°F (51.7°C)
10.1 & 17.1	HB, HT, KB, KH, SS, ST, SU,	H	140°F (60°C)
11.6 & 22.6	None, FB, KF, KP, SC, SD, SF, & SP.	F	104°F (40°C)
11.6 & 22.6	HP, HT, KB, KH, SS, ST, SU, & SV	H	104°F (40°C)

† Minimum ambient temperature –40° F (–40° C).

Positioning

This solenoid is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the solenoid base sub-assembly area.

Wiring

Wiring must comply with local codes and the National Electrical Code. All solenoids supplied with lead wires are provided with a grounding wire which is green or green with yellow stripes and a 1/2" conduit connection. To



MM

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Page 1 of 4

facilitate wiring, the solenoid may be rotated 360°. For the watertight and explosionproof solenoid, electrical fittings must be approved for use in the approved hazardous locations.

▲ CAUTION: Cryogenic Applications – Solenoid lead wire insulation should not be subjected to cryogenic temperatures. Adequate lead wire protection and routing must be provided.

Additional Wiring Instructions For Optional Features:

- **Open-Frame solenoid with 1/4" spade terminals.**

For solenoids supplied with screw terminal connections use #12–18 AWG stranded copper wire rated at 90°C or greater. Torque terminal block screws to 10 ± 2 in-lbs [1,0 ± 1,2 Nm]. A tapped hole is provided in the solenoid for grounding, use a #10–32 machine screw. Torque grounding screw to 15 – 20 in-lbs [1,7 – 2,3 Nm]. On solenoids with screw terminals, the socket head screw holding the terminal block to the solenoid is the grounding screw. Torque the screw to 15 – 20 in-lbs [1,7 – 2,3 Nm] with a 5/32" hex key wrench.

- **Junction Box**

The junction box is used with spade or screw terminal solenoids only and is provided with a grounding screw and a 1/2" conduit connection. Connect #12–18 AWG standard copper wire only to the screw terminals. Within the junction box use field wire that is rated 90°C or greater for connections. For steam service use 105°C rated wire up to 50 psi or use 125°C rated wire above 50 psi. After electrical hookup, replace cover gasket, cover, and screws. Tighten screws evenly in a crisscross manner.

- **DIN Plug Connector Kit No.K236034**

1. The open-frame solenoid is provided with DIN terminals to accommodate the plug connector kit.
2. Remove center screw from plug connector. Using a small screwdriver, pry terminal block from connector cover.
3. Use #12–18 AWG stranded copper wire rated at 90°C or greater for connections. Strip wire leads back approximately 1/4" for installation in socket terminals. The use of wire-end sleeves is also recommended for these socket terminals. Maximum length of wire-end sleeves to be approximately 1/4". Tinning of the ends of the lead wires is not recommended.

4. Thread wire through gland nut, gland gasket, washer and connector cover. NOTE: Connector housing may be rotated in 90° increments from position shown for alternate positioning of cable entry.

5. Check DIN connector terminal block for electrical markings. Then make electrical hookup to terminal block according to markings on it. Snap terminal block into connector cover and install center screw.

6. Position connector gasket on solenoid and install plug connector. Torque center screw to 5 ± 1 in-lbs [0,6 ± 1,1 Nm].

NOTE: Alternating current (AC) and direct current (DC) solenoids are built differently. To convert from one to the other, it may be necessary to change the complete solenoid including the core and solenoid base sub-assembly, not just the solenoid. Consult ASCO.

Installation of Solenoid

Solenoids may be assembled as a complete unit. Tightening is accomplished by means of a hex flange at the base of the solenoid.

Installation of Panel Mounted Solenoid (See Figure 1)

1. Disassemble solenoid following instruction under *Solenoid Replacement* then proceed.
2. Install solenoid base sub-assembly through customer panel.
3. Position spring washer on opposite side of panel over solenoid base sub-assembly.
4. Replace solenoid, nameplate/retainer and red cap.
5. Make electrical hookup, see *Wiring* section.

Solenoid Temperature

Standard solenoids are designed for continuous duty service. When the solenoid is energized for a long period, the solenoid becomes hot and can be touched by hand only for an instant. This is a safe operating temperature.

MAINTENANCE

▲ WARNING: To prevent the possibility of death, serious injury or property damage, turn off electrical power, depressurize solenoid operator and/or valve, and vent fluid to a safe area before servicing.

Cleaning

All solenoid operators and valves should be cleaned periodically. The time between cleaning will vary depending on medium and service conditions. In general, if the voltage to the solenoid is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. Clean strainer or filter when cleaning the valve.

Preventive Maintenance

- Keep the medium flowing through the solenoid operator or valve as free from dirt and foreign material as possible.
- While in service, the solenoid operator or valve should be operated at least once a month to insure proper opening and closing.
- Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. Replace any worn or damaged parts.

Causes of Improper Operation

- **Faulty Control Circuit:** Check the electrical system by energizing the solenoid. A metallic *click* signifies that the solenoid is operating. Absence of the *click* indicates loss of power supply. Check for loose or blown fuses, open-circuited or grounded solenoid, broken lead wires or splice connections.
- **Burned-Out Solenoid:** Check for open-circuited solenoid. Replace if necessary. Check supply voltage; it must be the same as specified on nameplate/retainer and marked on the solenoid. Check ambient temperature and check that the core is not jammed.
- **Low Voltage:** Check voltage across the solenoid leads. Voltage must be at least 85% of rated voltage.

Solenoid Replacement

1. Disconnect conduit, coil leads, and grounding wire.

NOTE: Any optional parts attached to the old solenoid must be reinstalled on the new solenoid. For 3-way construction, piping or tubing must be removed from pipe adapter.

2. Disassemble solenoids with optional features as follows:

- **Spade or Screw Terminals**

Remove terminal connections, grounding screw, grounding wire, and terminal block (screw terminal type only).

NOTE: For screw terminals, the socket head screw holding the terminal block serves as a grounding screw.

- **Junction Box**

Remove conduit and socket head screw (use 5/32" hex key wrench) from center of junction box. Disconnect junction box from solenoid.

- **DIN Plug Connector**

Remove center screw from DIN plug connector. Disconnect DIN plug connector from adapter. Remove socket head screw (use 5/32" hex key wrench), DIN terminal adapter, and gasket from solenoid.

3. Snap off red cap from top of solenoid base sub-assembly. For 3-way construction with pipe adapter (Figure 3), remove pipe adapter, nameplate and solenoid. Omit steps 4 and 5.
4. Push down on solenoid. Then using a suitable screwdriver, insert blade between solenoid and nameplate/retainer. Pry up slightly and push to remove.

NOTE: Series 8202G solenoids have a spacer between the nameplate/retainer and solenoid.

5. Remove solenoid from solenoid base sub-assembly.
6. Reassemble in reverse order of disassembly. Use exploded views for identification and placement of parts.
7. Torque pipe adapter to 90 inch-pounds maximum [10,2 Nm maximum]. Then make up piping or tubing to pipe adapter on solenoid.

Disassembly and Reassembly of Solenoids

1. Remove solenoid, see *Solenoid Replacement*.
2. Remove spring washer from solenoid base sub-assembly. For 3-way construction, remove plugnut gasket.
3. Unscrew solenoid base sub-assembly from valve body.
4. Remove internal solenoid parts for cleaning or replacement. Use exploded views for identification and placement of parts.
5. If the solenoid is part of a valve, refer to basic valve installation and maintenance instructions for further disassembly.
6. Torque solenoid base sub-assembly and adapter to 175 ± 25 in-lbs [19,8 ± 2,8 Nm].

ORDERING INFORMATION FOR ASCO SOLENOIDS

When Ordering Solenoids for ASCO Solenoid Operators or Valves, order the number stamped on the solenoid. Also specify voltage and frequency.

Torque Chart

Part Name	Torque Value Inch-Pounds	Torque Value Newton-Meters
solenoid base sub-assembly & adapter	175 ± 25	19,8 ± 2,8
pipe adapter	90 maximum	10,2 maximum

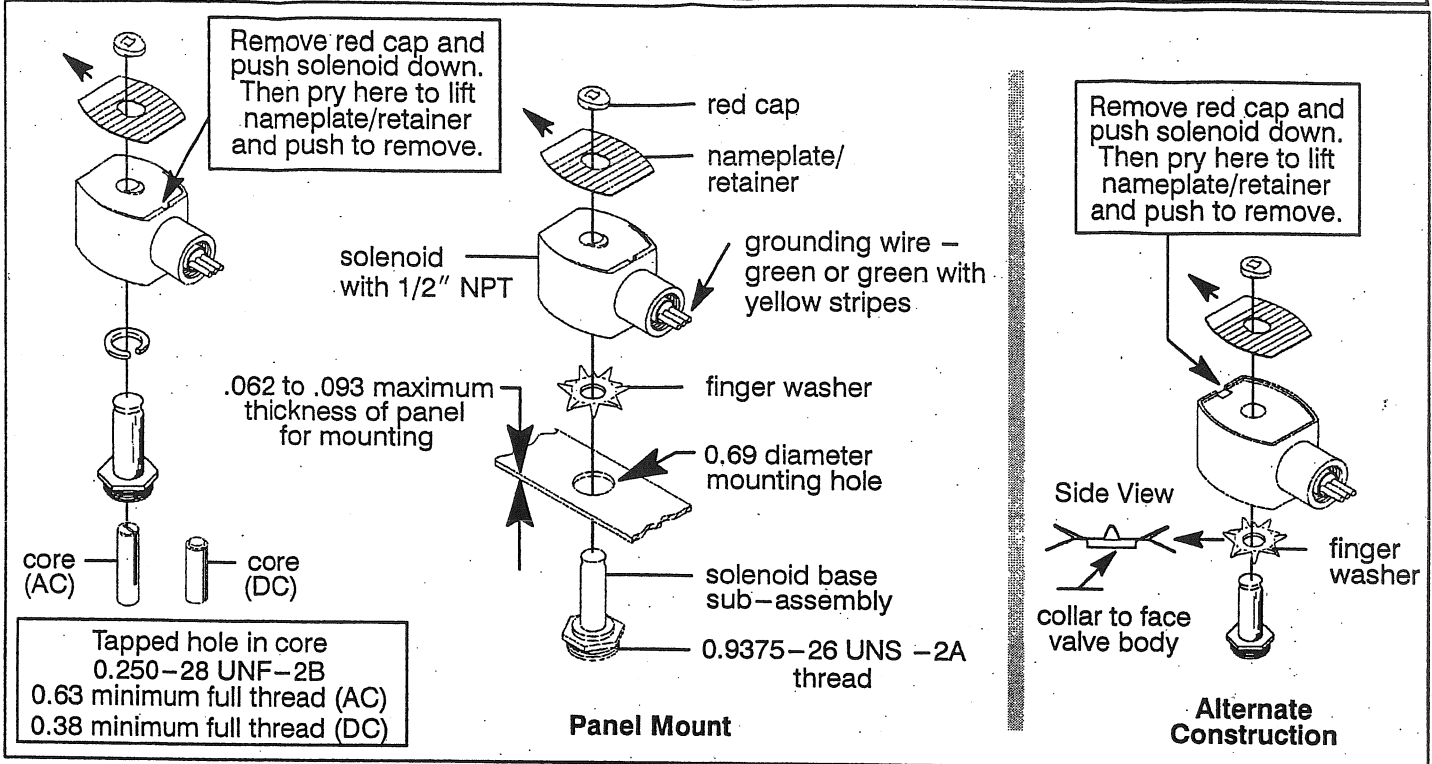


Figure 1. Series 8003G solenoids

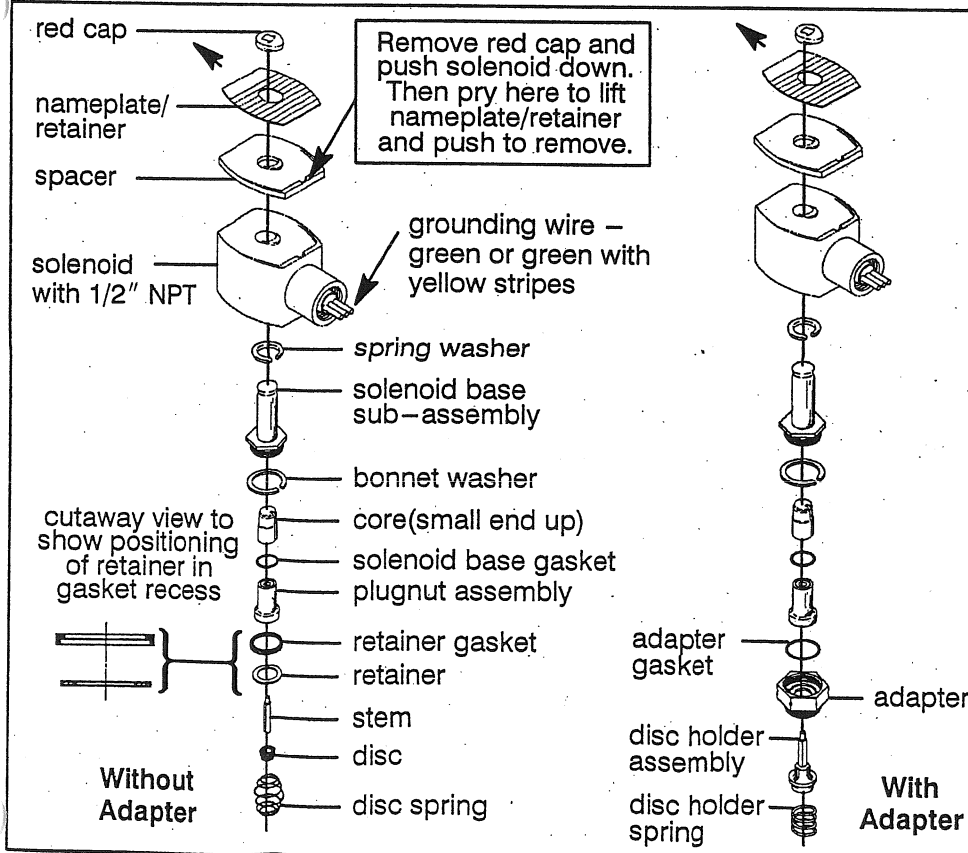


Figure 2. Series 8202G solenoids

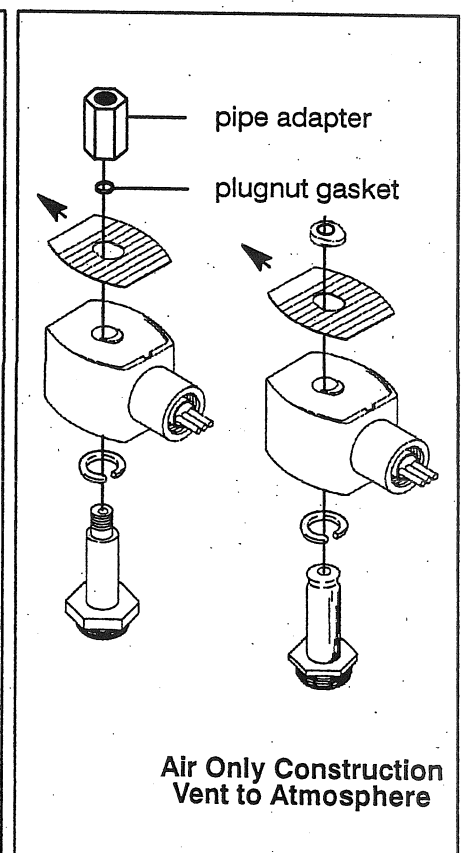


Figure 3. 3-Way Construction

Torque Chart

Part Name	Torque Value in Inch-Pounds	Torque Value in Newton-Meters
terminal block screws	10 ± 2	1,1 ± 0,2
socket head screw	15 – 20	1,7 – 2,3
center screw	5 ± 1	0,6 ± 0,1

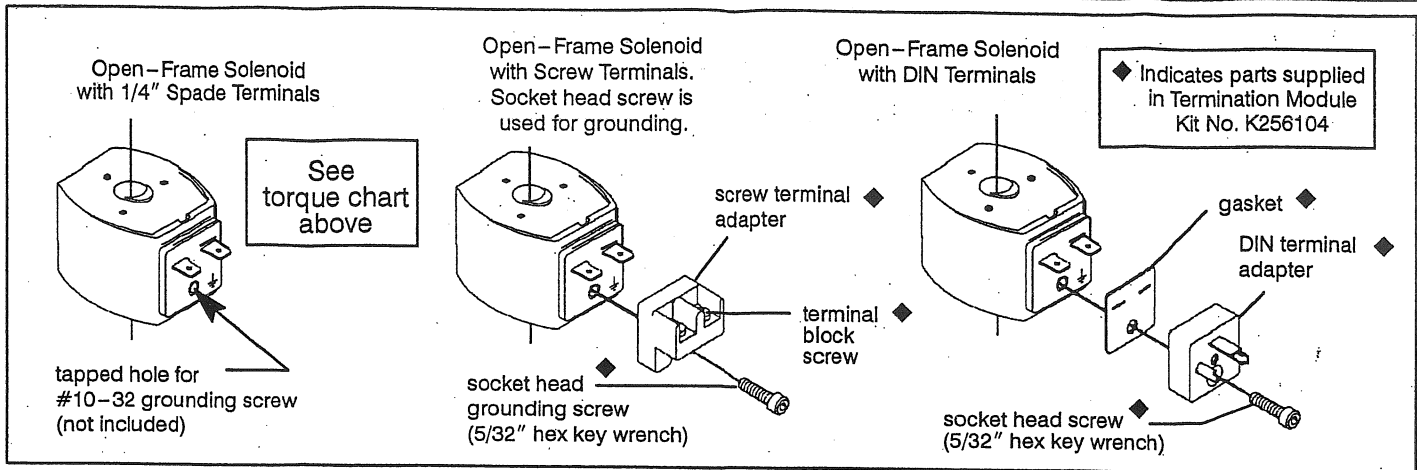


Figure 4. Open-frame solenoids

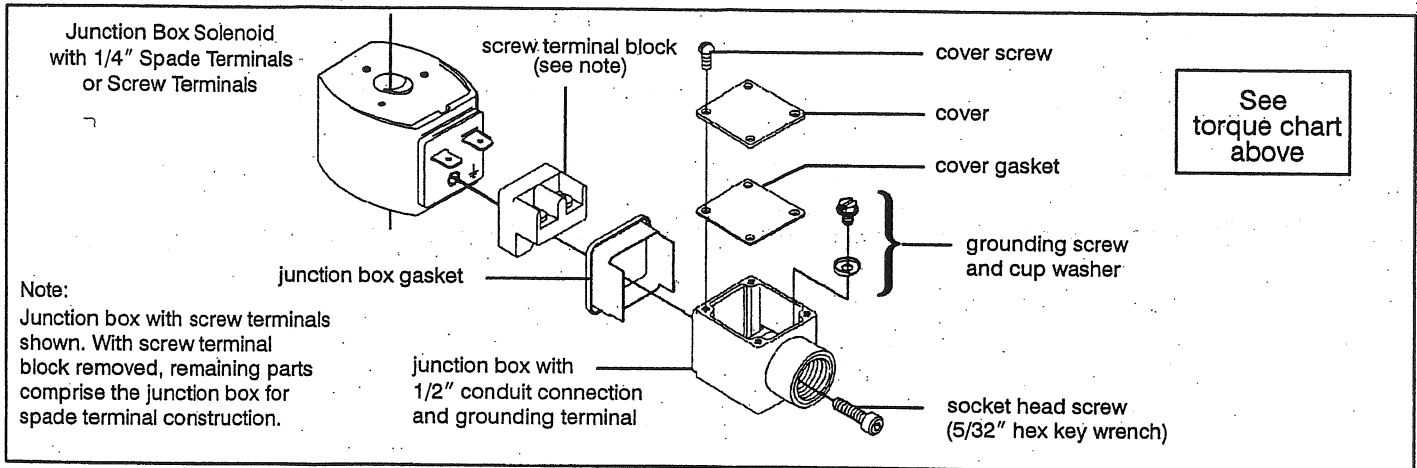


Figure 5. Junction box (optional feature)

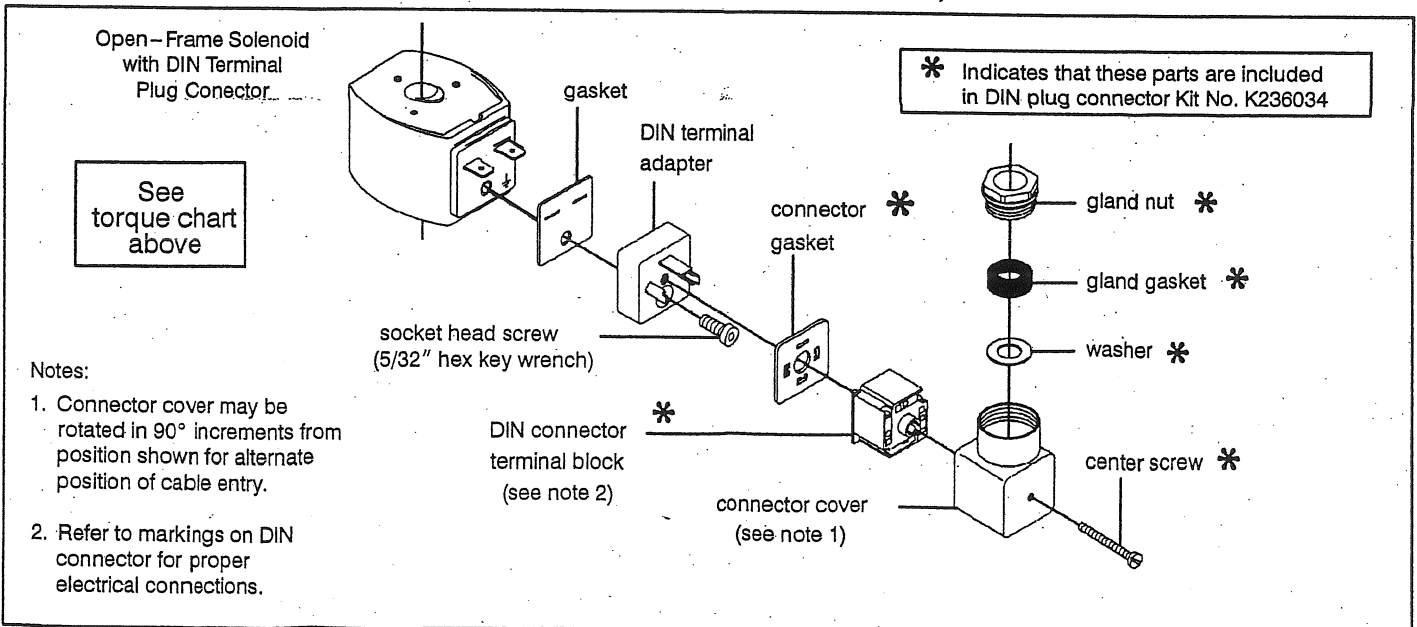


Figure 6. DIN plug connector kit No. K236034 (optional feature)

Installation & Maintenance Instructions

3-WAY INTERNAL OR EXTERNAL PILOTED SOLENOID VALVES
NORMALLY CLOSED OPERATION — AIR OR INERT GAS SERVICE
1/4", 3/8" OR 1/2" NPT — 5/16" OR 5/8" ORIFICE

SERIES

8316

Form No. V6928R2 — Sec. 1
(Section 1 of 2)

NOTICE: See separate solenoid installation and maintenance instructions for information on: Wiring, Solenoid Temperature, Causes of Improper Operation, and Solenoid Replacement.

For exploded views, see Form No. V6928 — Section 2 of 2.

DESCRIPTION

Series 8316 valves are 3-way solenoid valves designed for air or inert gas service. Depending upon requirements, this valve may be used in either the **Internal Piloting Mode** or **External Piloting Mode** of operation. This unique valve design allows the user to relocate (*turn over*) the **Support with Flow Gaskets** to change the mode of valve operation. For additional information on valve operation, see sections on **OPERATION** and **CHANGING MODE OF OPERATION**.

Series 8316 valves are available in three solenoid versions; standard, low power and intrinsically safe. Valves are rugged forged brass with internal parts of stainless steel and low temperature Buna N elastomers.

NOTICE

This valve is supplied from the factory in the **Internal Piloting Mode** of operation. Refer to **OPERATION — INTERNAL PILOTING MODE** following.

To change valve mode of operation to **External Piloting Mode**, see section on **CHANGING MODE OF OPERATION** on page 2 of 6.

OPERATION — INTERNAL PILOTING MODE

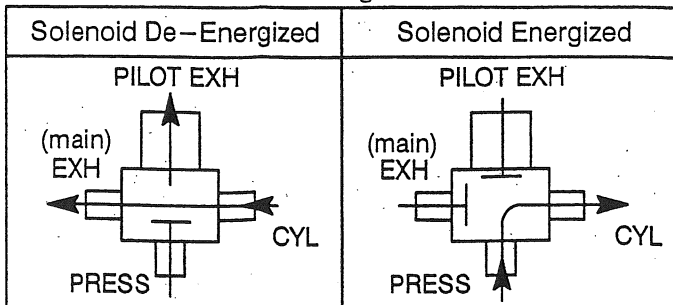
IMPORTANT: Internal piloted valves require a minimum operating pressure differential of 15 psi.

Normally Closed

Solenoid De-energized: Flow is from cylinder "CYL" to main exhaust "EXH". Internal pressure is vented briefly through pilot exhaust. Pressure "PRESS" is closed.

Solenoid Energized: Flow is from pressure "PRESS" to cylinder "CYL". Main exhaust "EXH" and pilot exhaust are closed.

Flow Diagrams



OPERATION — EXTERNAL PILOTING MODE

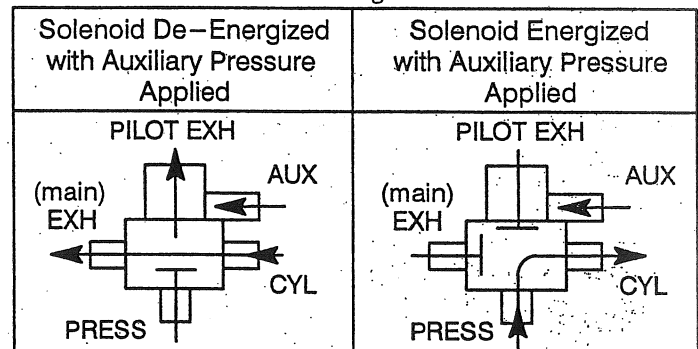
The external piloting mode of operation allows a zero minimum main line pressure with the application of proper auxiliary air pressure. Refer to operating instructions (to follow) and the graph *Auxiliary Pilot Pressure vs Main Line Pressure*. Use this graph to determine the minimum auxiliary air pressure required for a given main line pressure.

Normally Closed

Solenoid De-energized with Auxiliary Pressure Applied: Flow is from cylinder "CYL" to main exhaust "EXH". Internal pressure is vented briefly through pilot exhaust. Pressure "PRESS" is closed.

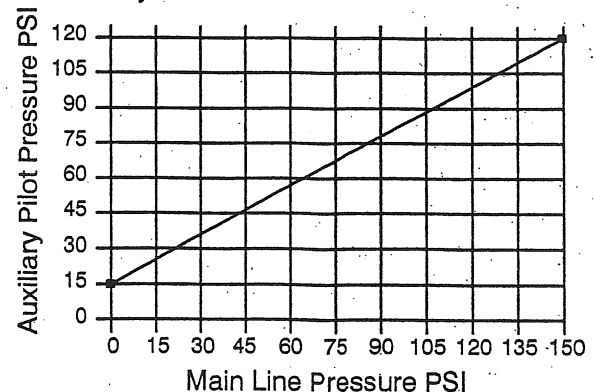
Solenoid Energized with Auxiliary Pressure Applied: Flow is from pressure "PRESS" to cylinder "CYL". Main exhaust "EXH" and pilot exhaust are closed.

Flow Diagrams



Note: If main line pressure is lost, with solenoid de-energized or energized external piloted valves will not change position as long as auxiliary pilot pressure is present. If auxiliary pilot pressure is lost while main line pressure is present, valve will change position if solenoid is energized, but will not change position if solenoid is de-energized.

Auxiliary Pilot Pressure vs Main Line Pressure



CHANGING MODE OF OPERATION

▲ WARNING: To prevent the possibility of personal injury or property damage, turn off electrical power, depressurize valve, and vent fluid to a safe area before changing mode of operation.

The piloting (Mode of Operation) of the valve is determined by the positioning of the **Support with Flow Gaskets** on the side of the valve body. See Figures 1 & 2 for proper positioning of **Support with Flow Gaskets** for internal or external piloting mode of operation.

Positioning of Support with Flow Gaskets for Internal Piloting Mode

To change to the **Internal Piloting Mode** of operation if previously installed in the external piloting mode or rebuild after valve disassembly for maintenance, proceed as follows:

1. Install a 1/8" NPT pipe plug in the port marked AUX, auxiliary pressure connection.

NOTE: To change to internal piloting, remove cover screws (2), cover and support with large and small flow gaskets. Just **turn over** the support 180° to change piloting and reassemble. To verify piloting selection, follow rebuild instructions steps below.

2. Refer to views in Figure 1 for proper location and position of parts for **Internal Piloting Mode** of operation.
3. Position large and small flow gaskets in support. Large gasket must be compressed to fit support configuration.
4. Line up support (with flow gaskets) on side wall of valve body using machine screw holes as a guide. When support is correctly positioned (as shown in Figure 1.) the letters

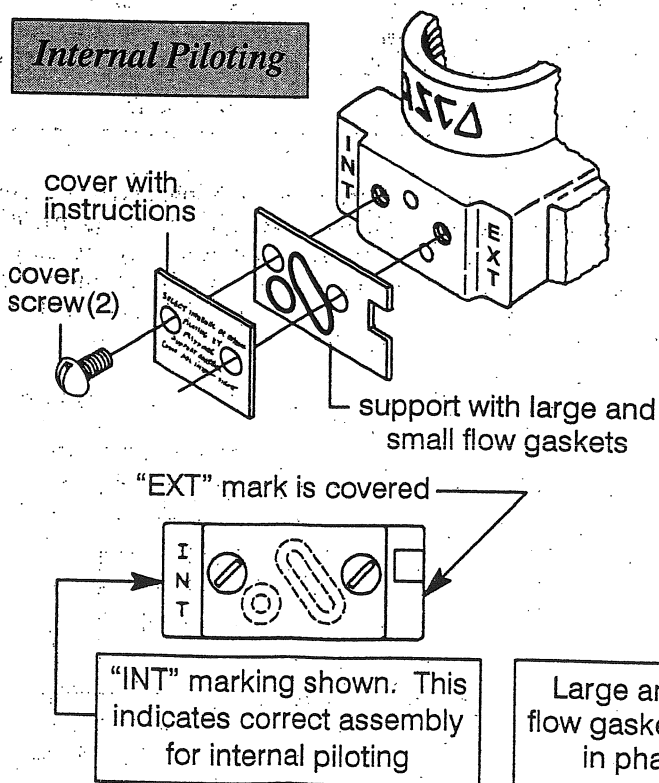


Figure 1. Positioning of support with flow gaskets for internal piloting mode.

INT are visible and letters EXT on opposite side are covered by the support. Confirm proper alignment with views in Figure 1. Then replace cover and cover screws. Torque cover screws evenly to 13 ± 1 in-lbs [1.5 ± 0.1 Nm].

5. Refer to **OPERATION – INTERNAL PILOTING MODE** section.

Positioning of Support with Flow Gaskets for External Piloting Mode

To change to the **External Piloting Mode** of operation before valve installation or rebuild after valve disassembly for maintenance, proceed as follows:

1. Remove a 1/8" NPT pipe plug from auxiliary pressure connection port marked AUX, using a 5/16" hex key wrench and connect auxiliary pilot pressure piping.

NOTE: To change to external piloting, remove cover screws (2), cover and support with large and small flow gaskets (2). Just **turn over** the support 180° to change piloting and reassemble. To verify piloting selection, follow rebuild instructions steps below.

2. Refer to views in Figure 2 for proper location and position of parts for **External Piloting Mode** of operation.
3. Position large and small flow gaskets in support. Large gasket must be compressed to fit support configuration.
4. Line up support (with flow gaskets) on side wall of valve body using machine screw holes as a guide. When support is correctly positioned (as shown in Figure 2.) the letters EXT are visible and letters INT on opposite side are covered by the support. Confirm proper alignment with views in Figure 2. Then replace cover and cover screws. Torque screws evenly to 13 ± 1 in-lbs [1.5 ± 0.1 Nm].
5. Refer to **OPERATION – EXTERNAL PILOTING MODE** section.

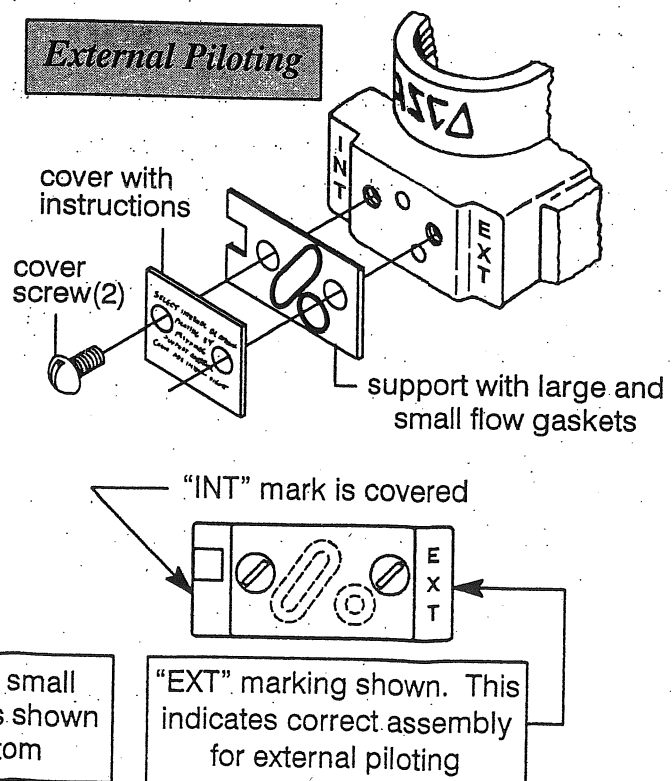


Figure 2. Positioning of support with flow gaskets for external piloting mode.

INSTALLATION

Check nameplate for correct catalog number, pressure, voltage, frequency, and service. Never apply incompatible fluids or exceed pressure rating of the valve. Installation and valve maintenance to be performed by qualified personnel.

Future Service Considerations

Provision should be made for performing seat leakage, external leakage, and operational tests on the valve with a nonhazardous, noncombustible fluid after disassembly and reassembly.

Temperature Limitations

Ambient and Fluid Temperature Ranges:

- Standard Valves:
 - AC Construction -4°F (-20°C) to 125°F (54°C)
 - DC Construction -4°F (-20°C) to 104°F (40°C)
- Low Power & Intrinsically Safe: -20°F (-29°C) to 140°F (60°C)

Positioning

Valve may be mounted in any position.

Mounting

Mounting brackets (2) are optional. For valves with a 5/16" orifice, 1/4" or 3/8" NPT refer to Figure 3; for 5/8" orifice, 3/8" or 1/2" NPT Figure 4. Check nameplate to determine orifice size and pipe size.

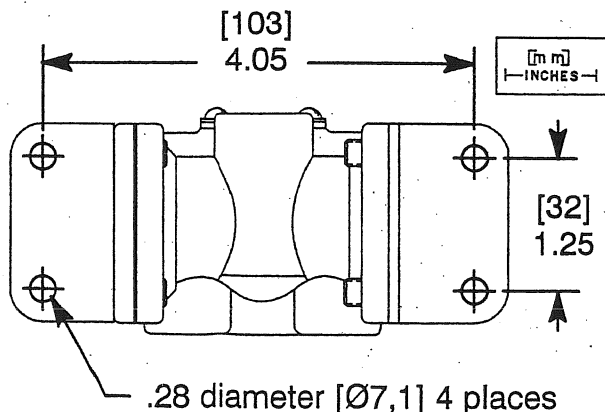


Figure 3. Mounting dimensions – 5/16" Orifice

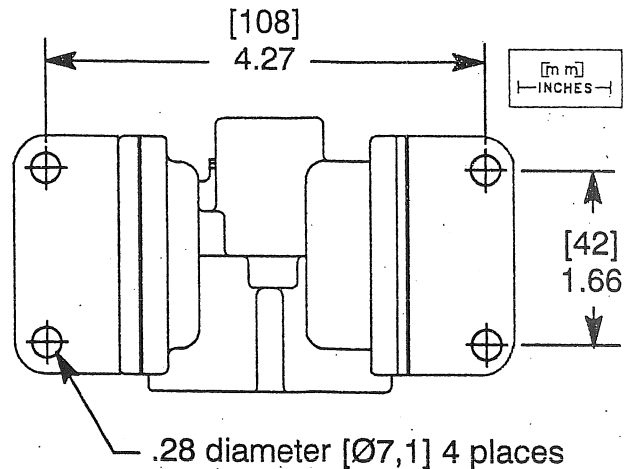


Figure 4. Mounting dimensions – 5/8" Orifice

Piping

There are two exhaust flows in the exhaust mode. There is pilot exhaust from the top of the solenoid when the valve shifts.

CAUTION: Debris entering 1/8" or 1/4" NPT connection at top of solenoid may cause valve to malfunction. Use a muffler to vent to atmosphere or connect to main exhaust system if the air or inert gas cannot be exhausted directly to the atmosphere.

Connect piping or tubing to valve according to markings on valve body. Refer to flow diagrams in **OPERATION** section.

CAUTION: To avoid damage or accidental disengagement of cartridge assembly from valve body, hold cartridge assembly securely by wrenching flats when installing or removing muffler or piping at top of solenoid.

Apply pipe compound sparingly to male pipe threads only. If applied to valve threads, the compound may enter the valve and cause operational difficulty. Avoid pipe strain by properly supporting and aligning piping. When tightening the pipe, do not use valve or solenoid as a lever. Locate wrenches applied to valve body or piping as close as possible to connection point.

Internal Piloting Mode Only: To insure proper operation of the valve, the pressure and exhaust piping must be full area without restriction. A minimum differential pressure (15 psi), as stamped on the nameplate, must be maintained between pressure and exhaust at the moment of shifting. Air reservoirs must have adequate capacity to maintain this minimum pressure during shifting. To check pressure during shifting, install a pressure gauge in the pressure piping as close to the valve as possible.

CAUTION: These solenoid valves are intended for use on clean dry air or inert gas, filtered to 50 micrometres or better. The dew point of the media should be at least 10° C (18° F) below the minimum temperature to which any portion of the clean air/inert gas system could be exposed to prevent freezing. If lubricated air is used, the lubricants must be compatible with Buna N elastomers. Diester oils may cause operational problems. Instrument air in compliance with ANSI/ISA Standard S7.3-1975 (R1981) exceeds the above requirements and is, therefore, an acceptable media for these valves.

Flow Controls (Speed or Metering Devices)

Flow control valves may be added to control cylinder speed. If used, these flow control valves must be located in cylinder piping between the solenoid valve and the cylinder.

IMPORTANT: Do not install flow controls (speed or metering devices) or any type of restrictive device in the pressure (inlet), exhaust or pilot exhaust (outlet) ports of the valve. Restricting any of these lines may cause valve malfunction.

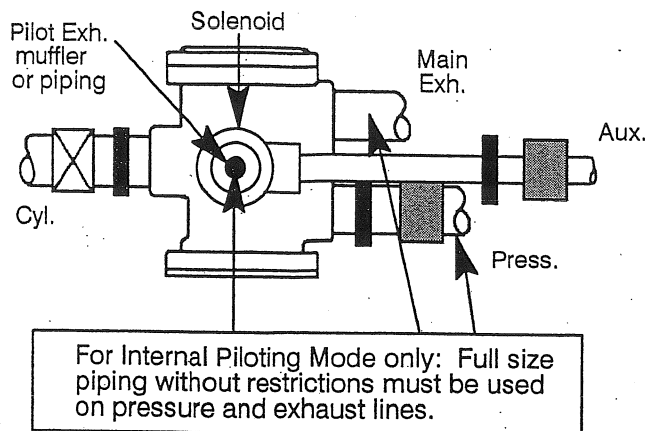


Figure 5. Piping diagram

MAINTENANCE

⚠ WARNING: To prevent the possibility of personal injury or property damage, turn off electrical power, depressurize valve, and vent fluid to a safe area before servicing the valve.

NOTE: It is not necessary to remove the valve from the pipeline for repairs. However, piping or tubing must be removed from pilot exhaust on top of the solenoid if present. See *Piping* section.

Cleaning

All solenoid valves should be cleaned periodically. The time between cleanings will vary depending on the medium and service conditions. In general, if the voltage to the coil is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. In the extreme case, faulty valve operation will occur and the valve may fail to shift. Clean filter when cleaning the valve.

Preventive Maintenance

- Keep the medium flowing through the valve as free from dirt and foreign material as possible.
- Periodic exercise of the valve should be considered if ambient or fluid conditions are such that corrosion, elastomer degradation, fluid contamination build up or

other conditions that could impede solenoid valve shifting are possible. In many cases, solenoid valves are periodically exercised during normal system use or as part of routine maintenance or surveillance activities and no additional exercise is necessary. The actual frequency of exercise necessary will depend on specific operating conditions. A successful operating history is the best indication of a proper interval between exercise cycles.

- Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Causes of Improper Operation

- **Incorrect Pressure:** Check valve pressure. Pressure to valve must be within range specified on nameplate.
- **Excessive Leakage:** Disassemble valve and clean all parts. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Valve Disassembly

NOTICE: Basic valve constructions are identified by orifice size and pipe size (NPT). Check valve nameplate for orifice and pipe size. See Figure 7 for 5/16" orifice, 1/4" or 3/8" NPT; Figure 8 for 5/8" orifice, 3/8" or 1/2" NPT. For Standard valve solenoid parts see Figure 6 in addition to Figures 7 or 8. Figures 7 and 8 show *Low Power and Intrinsically Safe* solenoid parts.

Determine valve construction and proceed as follows:

1. Disassemble valve in an orderly fashion using exploded views for identification and placement of parts.
2. **Low Power & Intrinsically Safe** – Using a suitable wrench hold cartridge assembly securely by wrenching flats. Then unscrew muffer or piping from 1/8" NPT connection on top of cartridge assembly.

Standard Valves – Hold pipe adapter securely and unscrew muffer or piping from 1/4" NPT connection on top of solenoid base sub-assembly.

3. Remove solenoid, see separate instructions.
4. **Low Power & Intrinsically Safe** – Unscrew cartridge assembly from valve body. Then remove cartridge gasket from valve body and orifice gasket from recess in base of cartridge assembly.

Standard Valves – Unscrew solenoid base sub-assembly from valve body. Then remove solenoid base gasket and core assembly with core spring and core guide. Core guide present on AC construction only. Remove plugnut gasket from groove in solenoid base sub-assembly.

5. Remove cover screws (2), cover, and support containing large and small flow gaskets from side of valve body.
6. At exhaust end, remove bonnet screws, lockwashers, valve bonnet, body passage gasket, retaining ring, diaphragm assembly, diaphragm support (see note below) and body gasket from valve body.

NOTE: Retaining ring and diaphragm support are only present on 5/8" orifice valve constructions. *However, they are not present on all 5/8" orifice valve constructions.*

continued on Form No. V6928 – Section 2 of 2

Installation & Maintenance Instructions

3-WAY INTERNAL OR EXTERNAL PILOTED SOLENOID VALVES
NORMALLY CLOSED OPERATION — AIR OR INERT GAS SERVICE

1/4", 3/8" OR 1/2" NPT — 5/16" OR 5/8" ORIFICE

SERIES

8316

Form No.V6928R2 — Sec. 2
(Section 2 of 2)

NOTICE: See Form No. V6928 — Section 1 of 2.

continued from Form No. V6928 — Section 1 of 2

- At opposite end remove bonnet screws, lockwashers, end cap, disc spring, body gasket, disc assembly and valve stem.
- All parts are now accessible for cleaning or replacement. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Valve Reassembly

- Lubricate cartridge gasket, orifice gasket, plugnut gasket, solenoid base gasket and large and small flow gaskets with DOW CORNING® 200 Fluid lubricant or an equivalent high-grade silicone fluid lubricant.
- Lubricate body gaskets (2), body passage gasket and retaining ring with DOW CORNING® 111 Compound lubricant or an equivalent high-grade silicone grease.
- Install valve stem in disc assembly. Then install disc assembly (with valve stem), body gasket, disc spring, end cap, and bonnet screws with lockwashers. Hand thread screws a few turns into valve body. Then torque bonnet screws in a crisscross manner to 95 ± 10 in-lbs [$10,7 \pm 1,1$ Nm].
- Install diaphragm support (see note below), body gasket, diaphragm assembly (engaged to valve stem), body passage gasket, retaining ring, valve bonnet and bonnet screws with lockwashers. Torque bonnet screws according to instructions in step 3.

NOTE: Retaining ring and diaphragm support are only present on 5/8" orifice valve constructions. *However, they are not present on all 5/8" orifice valve constructions.*

- Low Power & Intrinsically Safe** — Position cartridge gasket in valve body. Then install orifice gasket in recess in base of cartridge assembly. Thread cartridge assembly with orifice gasket into valve body. Then torque cartridge assembly to 175 ± 25 in-lbs [$19,8 \pm 2,8$ Nm].

Standard Valves — Replace solenoid base gasket, core assembly and solenoid base sub-assembly. Torque solenoid base sub-assembly to 175 ± 25 in-lbs [$19,8 \pm 2,8$ Nm]. Install plugnut gasket on solenoid base sub-assembly.

- Before installing flow gaskets, support, cover and cover screws, refer to section on **CHANGING MODE OF OPERATION** for the proper mode of operation and positioning of parts.
- Install large and small flow gaskets in the support. Large gasket must be compressed to fit support configuration.
- Orient the support (with flow gaskets) to the proper pilot flow mode of operation and position against side wall of valve body with flow orifices. Then install cover and two cover screws. Torque screws evenly to 13 ± 1 in-lbs [$1,5 \pm 0,1$ Nm].
- Install solenoid, see separate instructions. Then make electrical connection to solenoid.
- Install muffler or make up piping to pilot exhaust on top of solenoid.

▲ WARNING: To prevent the possibility of personal injury or property damage, check valve for proper operation before returning to service. Also perform internal seat and external leakage tests with a nonhazardous, noncombustible fluid.

- Restore line pressure and electrical power supply to valve.
- After maintenance is completed, operate the valve a few times to be sure of proper operation.

ORDERING INFORMATION FOR ASCO REBUILD KITS

Parts marked with an asterisk (*) in the exploded view are supplied in Rebuild Kits. When Ordering Rebuild Kits for ASCO valves, order the Rebuild Kit number stamped on the valve nameplate. If the number of the kit is not visible, order by indicating the number of kits required, and the Catalog Number and Serial Number of the valve(s) for which they are intended.

Lubrication Chart

Lubrication	Parts to be lubricated
DOW CORNING® 111 Compound lubricant or an equivalent high-grade silicone grease.	body passage gasket retaining ring body gaskets (2)
DOW CORNING® 200 Fluid lubricant or an equivalent high-grade silicone fluid.	orifice gasket plugnut gasket cartridge gasket solenoid base gasket large flow gasket small flow gasket

Torque Chart

Part Name (see note)	Wrench Size or Tool	Torque Value Inch-Pounds	Torque Value Newton-Meters
Cartridge assembly	1 1/8"	175 ± 25	19,8 ± 2,8
Solenoid base sub-assembly	1"		
Bonnet screws	7/16"	95 ± 10	10,7 ± 1,1
Cover screws	screw driver	13 ± 1	1,5 ± 0,1
Pipe adapter	11/16"	90 maximum	10,2 maximum

Note: Thread all parts by hand as far as possible. Then torque evenly in a crisscross manner where applicable.

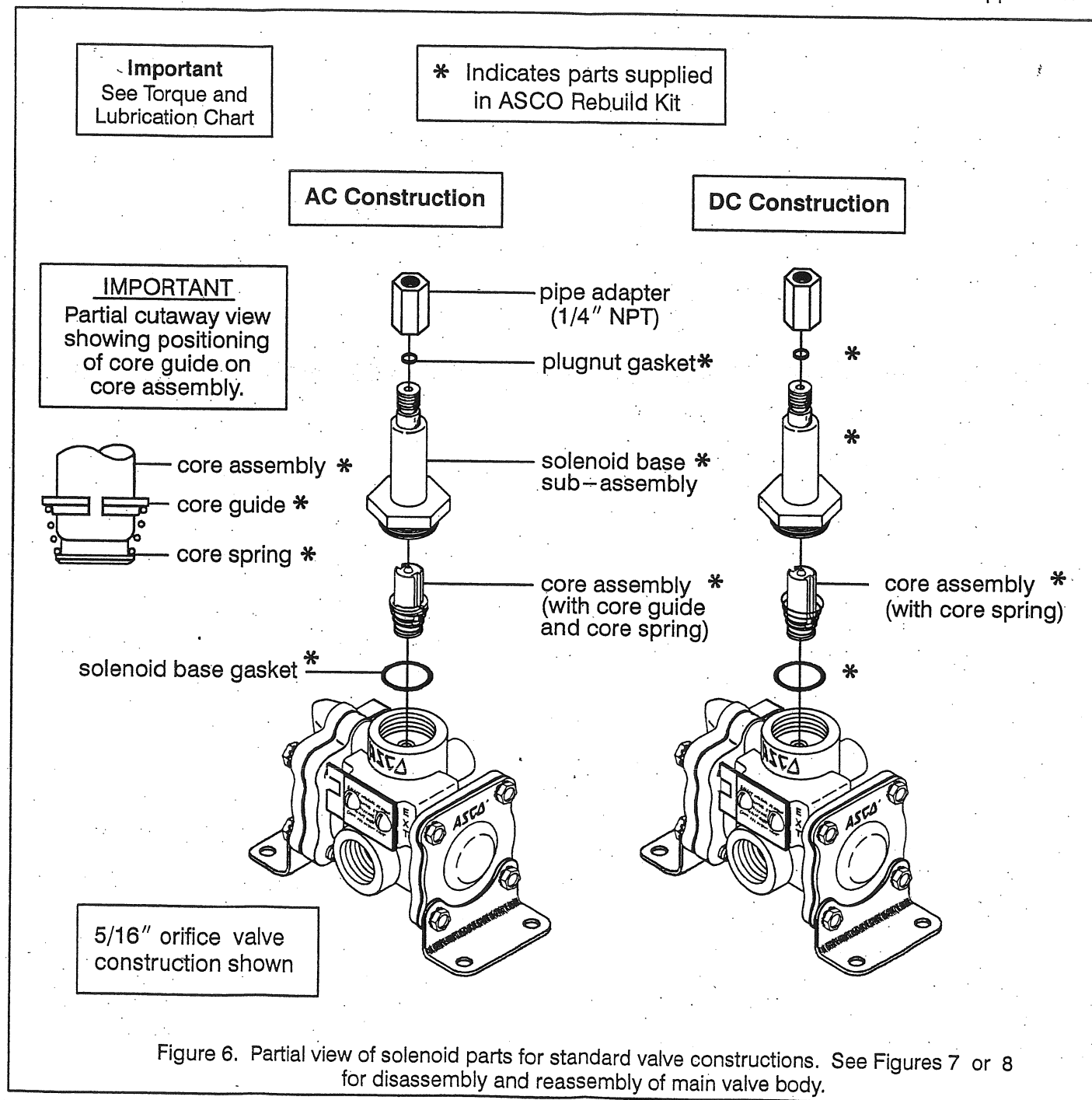
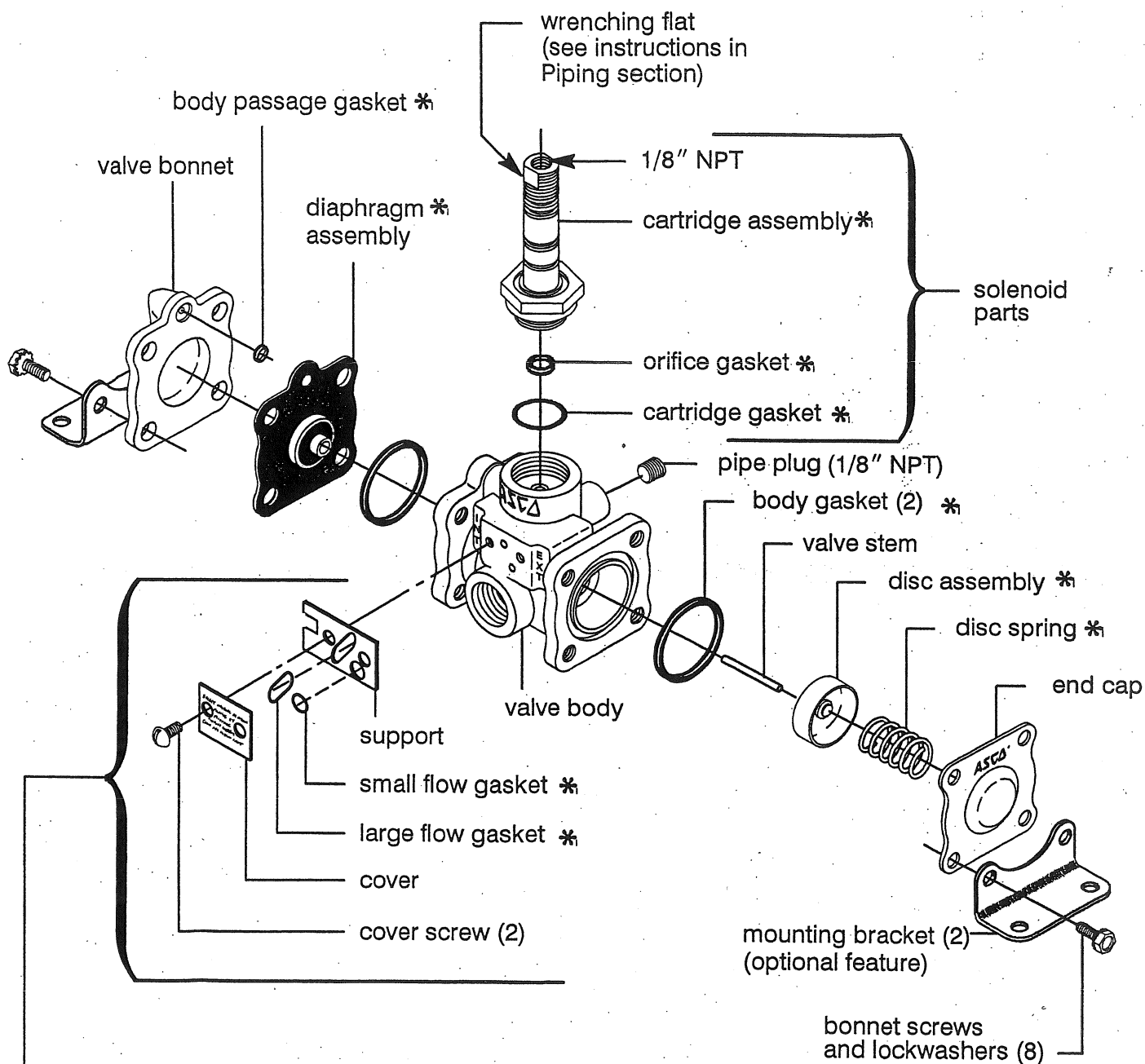


Figure 6. Partial view of solenoid parts for standard valve constructions. See Figures 7 or 8 for disassembly and reassembly of main valve body.

Important
See Torque and
Lubrication Chart

* Indicates parts supplied
in ASCO Rebuild Kit

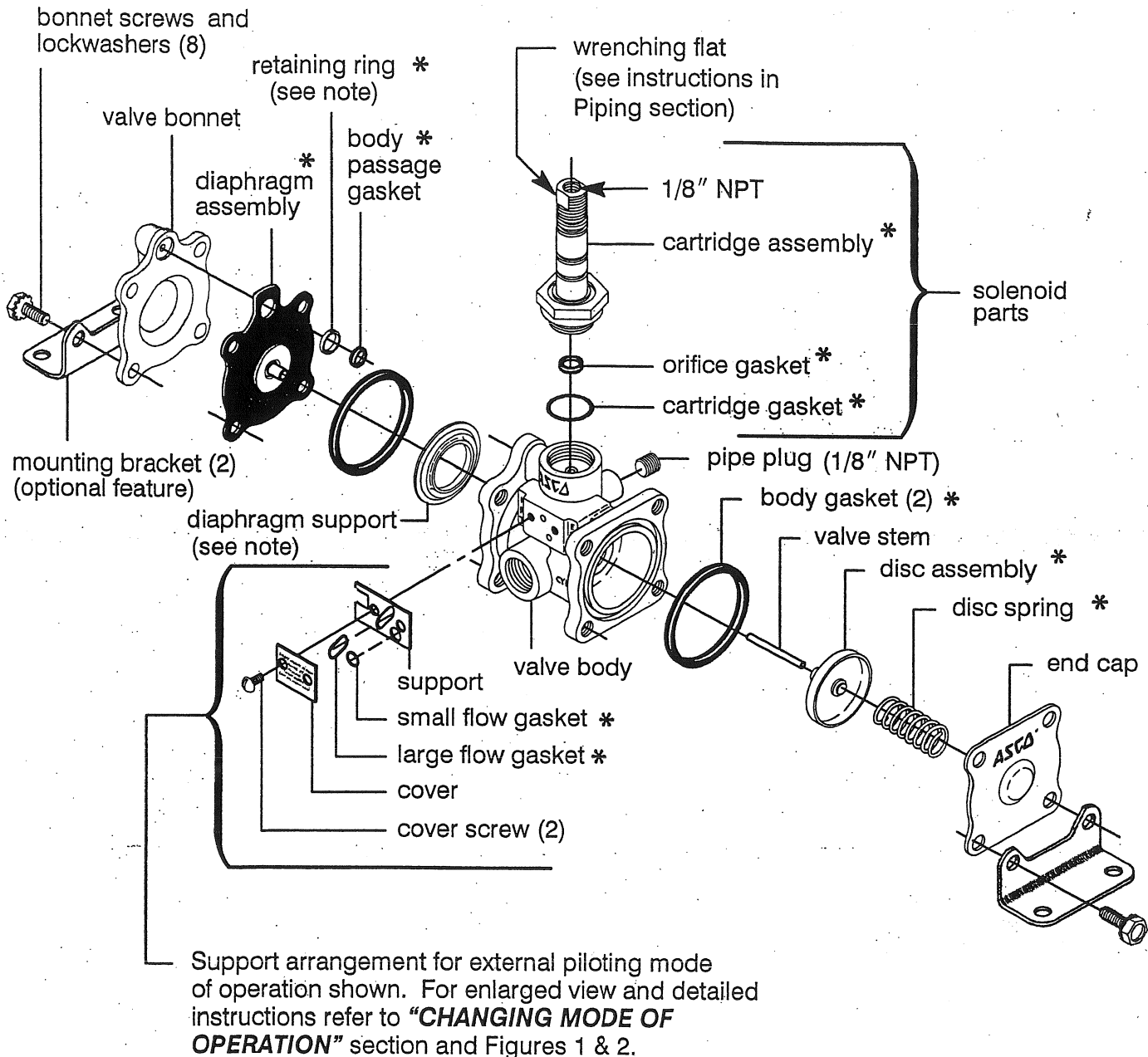


Support arrangement for external piloting mode of operation shown. For enlarged view and detailed instructions refer to **"CHANGING MODE OF OPERATION"** section and Figures 1 & 2.

Figure 7. Series 8316, 5/16" Orifice, 1/4" or 3/8" NPT with solenoid parts for Low Power or Intrinsically Safe constructions. For standard valve solenoid parts see Figure 6.

* Indicates parts supplied
in ASCO Rebuild Kit

Important
See Torque and
Lubrication Chart



Note: Diaphragm support and retaining ring are not present on all valve constructions.

Figure 8. Series 8316, 5/8" Orifice, 3/8" or 1/2" NPT with solenoid parts for Low Power
or Intrinsically Safe constructions. For standard valve solenoid parts see Figure 6.

GB



GENERAL INSTALLATION AND MAINTENANCE INSTRUCTIONS

Note: These General Installation and Maintenance Instructions must be read in conjunction with the Instruction Sheet for the specific product.

INSTALLATION

ASCO/JOUCOMATIC components are intended to be used only within the technical characteristics as specified on the nameplate. Changes to the equipment are only allowed after consulting the manufacturer or its representative. Before installation depressurize the piping system and clean internally. The equipment may be mounted in any position if not otherwise indicated on the product by means of an arrow. The flow direction and pipe connection of valves are indicated on the body.

The pipe connections have to be in accordance with the size indicated on the nameplate and fitted accordingly.

Caution:

- Reducing the connections may cause improper operation or malfunctioning.
- For the protection of the equipment install a strainer or filter suitable for the service involved in the inlet side as close to the product as possible.
- If tape, paste, spray or a similar lubricant is used when tightening, avoid particles entering the system.
- Use proper tools and locate wrenches as close as possible to the connection point.
- To avoid damage to the equipment, DO NOT OVERTIGHTEN pipe connections.
- Do not use valve or solenoid as a lever.
- The pipe connections should not apply any force, torque or strain to the product.

ELECTRICAL CONNECTION

In case of electrical connections, they are only to be made by trained personnel and have to be in accordance with the local regulations and standards.

Caution:

- Turn off electrical power supply and de-energize the electrical circuit and voltage carrying parts before starting work.
- All electrical screw terminals must be properly tightened according to the standards before putting into service.
- Dependent upon the voltage electrical components must be provided with an earth connection and satisfy local regulations and standards.

The equipment can have one of the following electrical terminals:

- Spade plug connections according to ISO-4400 or 3 x DIN-46244 (when correctly installed this connection provides IP-65 protection).
- Embedded screw terminals in metal enclosure with "Pg" cable gland.
- Spade terminals (AMP type).
- Flying leads or cables.

PUTTING INTO SERVICE

Before pressurizing the system, first carry-out an electrical test. In case of solenoid valves, energize the coil a few times and notice a metal click signifying the solenoid operation.

SERVICE

Most of the solenoid valves are equipped with coils for continuous duty service. To prevent the possibility of personnel or property damage do not touch the solenoid which can become hot under normal operation conditions.

SOUND EMISSION

The emission of sound depends on the application, medium and nature of the equipment used. The exact determination of the sound level can only be carried out by the user having the valve installed in his system.

MAINTENANCE

Maintenance of ASCO/JOUCOMATIC products is dependent on service conditions. Periodic cleaning is recommended, the timing of which will depend on the media and service conditions. During servicing, components should be examined for excessive wear. A complete set of internal parts is available as a spare parts or rebuild kit. If a problem occurs during installation/maintenance or in case of doubt please contact ASCO/JOUCOMATIC or authorized representatives.

A separate Declaration of Incorporation relating to EEC-Directive 89/392/EEC Annex II B is available on request. Please provide product identification number and serial numbers of products concerned.

The product complies with the essential requirements of the EMC Directive 89/336/EEC and amendments and the Low Voltage directives 73/23/EEC and 93/68/EEC. A separate Declaration of Conformity is available on request. Please provide product identification number and serial numbers of the products concerned.

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FR



INSTRUCTIONS GÉNÉRALES D'INSTALLATION ET D'ENTRETIEN

Nota : Ces instructions générales d'installation et d'entretien complètent la notice spécifique du produit.

MONTAGE

Les composants ASCO/JOUCOMATIC sont conçus pour les domaines de fonctionnement indiqués sur la plaque signalétique ou la documentation. Aucune modification ne peut être réalisée sur le matériel sans l'accord préalable du fabricant ou de son représentant. Avant de procéder au montage, dépressuriser les canalisations et effectuer un nettoyage interne.

A moins qu'une flèche ou la notice n'indique un sens de montage spécifique de la tête magnétique, le produit peut être monté dans n'importe quelle position.

Le sens de circulation du fluide est indiqué par repères sur le corps et dans la documentation.

La dimension des tuyauteries doit correspondre au raccordement indiqué sur le corps, l'étiquette ou la notice.

Attention :

- Une restriction des tuyauteries peut entraîner des dysfonctionnements.
- Afin de protéger le matériel, installer une crépine ou un filtre adéquat en amont, aussi près que possible du produit.
- En cas d'utilisation de ruban, pâte, aérosol ou autre lubrifiant lors du serrage, veiller à ce qu'aucun corps étranger ne pénètre dans le circuit.
- Utiliser un outillage approprié et placer les clés aussi près que possible du point de raccordement.
- Afin d'éviter toute détérioration, NE PAS TROP SERRER les raccords des tuyauteries.
- Ne pas se servir de la vanne ou de la tête magnétique comme d'un levier.
- Les tubes de raccordement ne devront exercer aucun effort, couple ou contrainte sur le produit.

RACCORDEMENT ÉLECTRIQUE

Le raccordement électrique doit être réalisé par un personnel qualifié et selon les normes et règlements locaux.

Attention :

- Avant toute intervention, couper l'alimentation électrique pour mettre hors tension les composants.
- Toutes les bornes à vis doivent être serrées correctement avant la mise en service.
- Selon la tension, les composants électriques doivent être mis à la terre conformément aux normes et règlements locaux.

Selon les cas, le raccordement électrique s'effectue par :

- Connecteur débrochable ISO4400 ou 3 x DIN46244 avec degré de protection IP65 lorsque le raccordement est correctement effectué.
- Bornes à vis solidaires du bobinage, sous boîtier métallique avec presse-étoupe "Pg" - -.
- Cosses (type AMP).
- Fils ou câbles solidaires de la bobine.

MISE EN SERVICE

Avant de mettre le circuit sous pression, effectuer un essai électrique. Dans le cas d'une électrovanne, mettre la bobine sous tension plusieurs fois et écouter le "clac" métallique qui signale le fonctionnement de la tête magnétique.

FONCTIONNEMENT

La plupart des électrovannes comportent des bobinages prévus pour mise sous tension permanente. Pour éviter toute brûlure, ne pas toucher la tête magnétique qui, en fonctionnement normal et en permanence sous tension, peut atteindre une température élevée.

BRUIT DE FONCTIONNEMENT

Le bruit de fonctionnement varie selon l'utilisation, le fluide et le type de matériel employé. L'utilisateur ne pourra déterminer avec précision le niveau sonore émis qu'après avoir monté le composant sur l'installation.

ENTRETIEN

L'entretien nécessaire aux produits ASCO/JOUCOMATIC varie avec leurs conditions d'utilisation. Il est souhaitable de procéder à un nettoyage périodique dont l'intervalle varie suivant la nature du fluide, les conditions de fonctionnement et le milieu ambiant. Lors de l'intervention, les composants doivent être examinés pour détecter toute usure excessive. Un ensemble de pièces internes est proposé en pièces de rechange pour procéder à la réparation. En cas de problème lors du montage/entretien ou en cas de doute, veuillez contacter ASCO/JOUCOMATIC ou ses représentants officiels.

Conformément à la directive CEE 89/392/CEE Annexe II B, une Déclaration d'Incorporation peut être fournie sur demande. Veuillez nous indiquer le numéro d'accusé de réception (AR) et les références ou codes des produits concernés. Ce produit est conforme aux prescriptions les plus importantes de la directive CEM 89/336/CEE et amendements et aux directives basse tension 73/23/CEE et 94/68/CEE. Une déclaration de conformité peut être fournie sur simple demande. Veuillez nous indiquer le numéro d'accusé de réception (AR) ainsi que les numéros de série des produits concernés.

DE



ALLGEMEINE BETRIEBSANLEITUNG

ACHTUNG: Diese Allgemeine Betriebsanleitung gilt in Zusammenhang mit der jeweiligen Betriebsanleitung für die speziellen Produkte.

EINBAU

Die ASCO/JOUCOMATIC-Komponenten dürfen nur innerhalb der auf den Typenschildern angegebenen Daten eingesetzt werden. Veränderungen an den Produkten sind nur nach Rücksprache mit ASCO/JOUCOMATIC zulässig.

Vor dem Einbau der Ventile muß das Rohrleitungssystem drucklos geschaltet und innen gereinigt werden.

Die Einbautage der Produkte ist generell beliebig. Ausnahme: Die mit einem Pfeil gekennzeichneten Produkte müssen entsprechend der Pfeilrichtung montiert werden.

Die Durchflußrichtung und der Eingang von Ventilen sind gekennzeichnet.

Die Rohranschlüsse sollten entsprechend den Größenangaben auf den Typenschildern mit handelsüblichen Verschraubungen durchgeführt werden. Dabei ist folgendes zu beachten:

- Eine Reduzierung der Anschlüsse kann zu Leistungs- und Funktionsminderungen führen.
- Zum Schutz der Ventile sollten Schmutzfänger oder Filter so dicht wie möglich in den Ventileingang integriert werden.
- Bei Abdichtung am "Gewinde" ist darauf zu achten, daß kein Dichtungsmaterial in die Rohrleitung oder das Ventil gelangt.
- Zur Montage darf nur geeignetes Werkzeug verwendet werden.
- Konische Verschraubungen sind sorgfältig anzuziehen. Es ist darauf zu achten, daß beim Anziehen das Gehäuse nicht beschädigt wird.
- Spule und Führungsrohr von Ventilen dürfen nicht als Gegenhalter benutzt werden.
- Die Rohrleitungsanschlüsse sollen fluchten und dürfen keine Spannungen auf das Ventil übertragen.

ELEKTRISCHER ANSCHLUß

Der elektrische Anschluß ist von Fachpersonal entsprechend den geltenden VDE- und CEE-Richtlinien auszuführen. Es ist besonders auf folgendes zu achten:

- Vor Beginn der Arbeiten ist sicherzustellen, daß alle elektrischen Leitungen und Netzteile spannungslos geschaltet sind.
- Alle Anschlußklemmen sind nach Beendigung der Arbeiten vorschriftsmäßig entsprechend den geltenden Regeln anzuziehen.
- Je nach Spannungsbereich muß das Ventil nach den geltenden Regeln einen Schutzleiteranschluß erhalten.

Der Magnetantrieb kann je nach Bauart folgende Anschlüsse haben:

- Anschluß für Gerätesteckdose nach DIN 43650 Form A/ISO 4400 oder 3x DIN 46244 (durch ordnungsgemäße Montage der Gerätesteckdose wird Schutzklasse IP 65 erreicht).
- Anschlüsse innerhalb eines Blechgehäuses mittels Schraubklemmen. Kabeleinführung ins Gehäuse mit PG-Verschraubung.
- Offene Spulen mit Flachsteckern (AMP-Fahren) oder mit eingegossenen Kabelenden.

INBETRIEBNAHME

Vor Druckbeaufschlagung des Produktes sollte eine elektrische Funktionsprüfung erfolgen:

Bei Ventilen Spannung an der Magnetspule mehrmals ein- und ausschalten. Es muß ein Klicken zu hören sein.

BETRIEB

Die meisten Ventile sind mit Spulen für Dauerbetrieb ausgerüstet. Zur Vermeidung von Personen- und Sachschäden sollte jede Berührung mit dem Ventil vermieden werden, da die Magnetspule bei längerem Betrieb sehr heiß werden kann.

GERÄUSCHEMISSION

Diese hängt sehr stark vom Anwendungsfall, den Betriebsdaten und dem Medium, mit denen das Produkt beaufschlagt wird, ab. Eine Aussage über die Geräuschemission des Produktes muß deshalb von demjenigen getroffen werden, der das Produkt innerhalb einer Maschine in Betrieb nimmt.

WARTUNG

Die Wartung hängt von den Einsatzbedingungen ab. In entsprechenden Zeitabständen muß das Produkt geöffnet und gereinigt werden. Für die Überholung der ASCO/JOUCOMATIC-Produkte können Ersatzteilsätze geliefert werden. Treten Schwierigkeiten bei Einbau, Betrieb oder Wartung auf, sowie bei Unklarheiten, ist mit ASCO/JOUCOMATIC Rücksprache zu halten.

(ASCO/JOUCOMATIC Produkte sind entsprechend der EG-Richtlinie 89/392/EWG gefertigt).

Eine separate Herstellererklärung im Sinne der Richtlinie 89/392/EWG Anhang IIB ist auf Anfrage erhältlich. Geben Sie bitte für die Produkte die Nummer der Auftragsbestätigung und die Seriennummer an.

Dieses Produkt entspricht den grundlegenden Bestimmungen der EMV-Richtlinie 89/336/EWG, cinschi. Nachträge, sowie den Niederspannungsrichtlinien 73/23/EWG u. 93/68/EWG. Bitte geben Sie die Auftragsbestätigungsnummer und die Seriennummern der betreffenden Produkte an.

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ES

CE

INSTRUCCIONES GENERALES DE INSTALACION Y MANTENIMIENTO

Nota: Estas Instrucciones Generales de Instalación y Mantenimiento deben considerarse en conjunción con la Hoja de Instrucciones de cada producto.

INSTALACION

Los componentes ASCO/JOUCOMATIC sólo deben utilizarse dentro de las especificaciones técnicas que se especifican en su placa de características o catálogo. Los cambios en el equipo sólo estarán permitidos después de consultar al fabricante o a su representante. Antes de la instalación despresurice el sistema de tuberías y limpie internamente.

El equipo puede utilizarse en cualquier posición si no estuviera indicado lo contrario sobre el mismo mediante una flecha o en el catálogo.

En el cuerpo o en el catálogo se indican el sentido del fluido y la conexión de las válvulas a la tubería.

Las conexiones a la tubería deben corresponder al tamaño indicado en la placa de características la etiqueta o el catálogo y ajustarse adecuadamente.

Precaución:

- La reducción de las conexiones puede causar operaciones incorrectas o defectos de funcionamiento.
- Para la protección del equipo se debe instalar, en la parte de la entrada y tan cerca como sea posible del producto, un filtro adecuado.
- Si se utiliza cinta, pasta, spray u otros lubricantes en el ajuste, se debe evitar que entren partículas en el producto.
- Se debe utilizar las herramientas adecuadas y colocar llaves inglesas lo mas cerca posible del punto de conexión.
- Para evitar daños al equipo, NO FORZAR las conexiones a la tubería.
- No utilizar la válvula o el solenoide como palanca.
- Las conexiones a la tubería no producirán ninguna fuerza, par o tensión sobre el producto.

CONEXION ELECTRICA

Las conexiones eléctricas serán realizadas por personal cualificado y deberán adaptarse a las normas y regulaciones locales.

Precaución:

- Antes de comenzar el trabajo, desconecte el suministro de energía eléctrica y desenergice el circuito eléctrico y los elementos portadores de tensión.
- Todos los terminales eléctricos deben estar apretados adecuadamente según normas antes de su puesta en servicio.
- Según el voltaje, los componentes eléctricos deben disponer de una conexión a tierra y satisfacer las normas y regulaciones locales.

El equipo puede tener uno de los siguientes terminales eléctricos:

- Conexiones desenchufables según ISO 4400 o 3 x DIN-46244 (cuando se desenchufa correctamente esta conexión proporciona una protección IP-65).

- Terminales de tornillo con carcasa metálica con entrada de cable de conexión rosca "PG".
- Conector desenchufable (tipo AMP).
- Salida de cables.

PUESTA EN MARCHA

Se debe efectuar una prueba eléctrica antes de someter a presión el sistema. En el caso de las válvulas solenoides, se debe energizar varias veces la bobina y comprobar que se produce un sonido metálico que indica el funcionamiento del solenoide.

SERVICIO

La mayor parte de las válvulas solenoides se suministran con bobinas para un servicio continuo. Con el fin de evitar la posibilidad de daños personales o materiales no se debe tocar el solenoide, ya que puede haberse calentado en condiciones normales de trabajo.

EMISION DE RUIDOS

La emisión de ruidos depende de la aplicación, medio y naturaleza del equipo utilizado. Una determinación exacta del nivel de ruido solamente se puede llevar a cabo por el usuario que disponga la válvula instalada en su sistema.

MANTENIMIENTO

El mantenimiento de los productos ASCO/JOUCOMATIC depende de las condiciones de servicio. Se recomienda una limpieza periódica, dependiendo de las condiciones del medio y del servicio. Durante el servicio, los componentes deben ser examinados por si hubieran desgastes excesivos. Se dispone de un juego completo de partes internas como recambio o kit de montaje. Si ocurriera un problema durante la instalación/mantenimiento o en caso de duda contactar con ASCO/JOUCOMATIC o representantes autorizados.

Se dispone, por separado y bajo demanda, de una Declaración de Incorporación conforme a la Directiva CEE 89/392/EEC Anexo II B. Rogamos que nos faciliten los códigos y números de aceptación de pedido correspondientes.

Este producto es conforme a las principales prescripciones de la directiva CEM 89/336/CEE y a las enmiendas y directivas baja tensión 73/23/CEE y 94/68/CEE. Si lo desea, podemos facilitar una Declaración de Conformidad por separado. Rogamos faciliten el número de confirmación de pedido y los números de serie de los respectivos productos.

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IT

CE

ISTRUZIONI DI INSTALLAZIONE E DI MANUTENZIONE GENERALE

Nota: Queste istruzioni devono essere lette in congiunzione con il manuale specifico del prodotto.

INSTALLAZIONE

Le elettrovalvole devono essere utilizzate esclusivamente rispettando le caratteristiche tecniche specificate sulla targhetta. Variazioni sulle valvole o sui piloti sono possibili solo dopo aver consultato il costruttore o i suoi rappresentanti. Prima dell'installazione depressurizzare i tubi e pulire internamente.

Le elettrovalvole possono essere montate in tutte le posizioni. Diversamente, una freccia posta sulla valvola indica che deve essere montata in posizione verticale e dritta.

La direzione del flusso è indicata sul corpo della valvola per mezzo di una freccia oppure con l'etichetta "IN", "I", "A", o "P".

I raccordi devono essere conformi alla misura indicata sulla targhetta apposta.

Attenzione:

- Ridurre i raccordi può causare operazioni sballiate o malfunzionamento.
- Per proteggere il componente installare, il più vicino possibile al lato ingresso, un filtro adatto al servizio.
- Se si usano nastro, pasta, spray o lubrificanti simili durante il serraggio, evitare che delle particelle entrino nel corpo della valvola.
- Usare un'attrezzatura appropriata e utilizzare le chiavi solo sul corpo della valvola.
- Per evitare danni al corpo della valvola, NON SERRARE ECCESSIVAMENTE i tubi.
- Non usare la valvola o il pilota come una leva.
- I raccordi non devono esercitare pressione, torsione o sollecitazione sull'elettrovalvola.

ALLACCIAMENTO ELETTRICO

L'allacciamento elettrico deve essere effettuato esclusivamente dal personale specializzato e deve essere conforme alle Norme locali.

Attenzione:

- Prima di mettere in funzione togliere l'alimentazione elettrica, disaccettare il circuito elettrico e le parti sotto tensione.
- I morsetti elettrici devono essere correttamente avvitati, secondo le Norme, prima della messa in servizio.
- Le elettrovalvole devono essere provviste di morsetti di terra a seconda della tensione e delle Norme di sicurezza locali.

I piloti possono avere una delle seguenti caratteristiche elettriche:

- Connettore ISO-4400 o 3 x DIN-46244 (se installato correttamente e' IP-65).
- Morsetteria racchiusa in custodia metallica. Entrata cavi con pressacavi tipo "PG".
- Bobina con attacchi FASTON (tipo AMP).
- Bobine con fili o cavo.

MESSA IN FUNZIONE

Prima di dare pressione alla valvola, eseguire un test elettrico. Eccitare la bobina diverse volte fino a notare uno scatto metallico che dimostra il funzionamento del pilota.

SERVIZIO

Molte elettrovalvole sono provviste di bobine per funzionamento continuo. Per prevenire la possibilità di danneggiare cose o persone, non toccare il pilota. La custodia della bobina o del pilota può scaldarsi anche in normali condizioni di funzionamento.

EMISSIONE SUONI

L'emissione di suoni dipende dall'applicazione e dal tipo di elettrovalvola. L'utente può stabilire esattamente il livello del suono solo dopo aver installato la valvola sul suo impianto.

MANUTENZIONE

Generalmente questi componenti non necessitano spesso di manutenzione. Comunque, in alcuni casi è necessario fare attenzione a depositi o ad eccessiva usura. Questi componenti devono essere puliti periodicamente, il tempo che intercorre tra una pulizia e l'altra varia a seconda delle condizioni di funzionamento. Il ciclo di durata dei componenti dipende dalle condizioni di funzionamento. Incaso di usura è disponibile un set completo di parti interne per la revisione.

Se si incontrano problemi durante l'installazione e la manutenzione o se si hanno dei dubbi, consultare ASCO/JOUCOMATIC o i suoi rappresentanti.

L'utente può richiedere al costruttore una dichiarazione separata riguardante le Direttive EEC 89/392/EEC e 91/368/EEC (vedere allegato II B) fornendo il numero di serie e il riferimento dell'ordine relativo.

Questo prodotto soddisfa i requisiti essenziali della direttiva CEM 89/336/CEE nonché gli emendamenti e le direttive sulla bassa tensione 73/23/CEE e 93/68/CEE. Una Dichiarazione di Conformità separata può essere ottenuta su richiesta. Si prega di fornire il numero della conferma dell'ordinativo ed i numeri di serie dei relativi prodotti.

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NL

CE

ALGEMENE INSTALLATIE- EN ONDERHOUDSINSTRUCTIES

N.B.: Deze algemene instructies t.a.v. installatie en onderhoud moeten in acht worden genomen tezamen met de specifieke voorschriften van het product.

INSTALLATIE

ASCO/JOUCOMATIC producten mogen uitsluitend toegepast worden binnen de op de naamplaat aangegeven specificaties. Wijzigingen, zowel elektrisch als mechanisch, zijn alleen toegestaan na overleg met de fabrikant of haar vertegenwoordiger. Voor het inbouwen dient het leidingsstelsel droog te worden en inwendig gereinigd.

De positie van de afsluiter is naar keuze te bepalen, behalve in die gevallen waarbij het tegendeel door pijlen wordt aangegeven. De doorstroomrichting wordt bij afsluiters aangegeven op het afsluiterhuis.

De pijp aansluiting moet overeenkomstig de naamplaatgegevens plaatsvinden.

Hierbij moet men letten op:

- Een reductie van de aansluitingen kan tot prestatie- en funktieschade leiden.
- Ter bescherming van de interne delen wordt een filter in het leidingsnet aanbevolen.
- Bij het gebruik van draadafdichtingspasta of tape mogen er geen deeltjes in het leidingswerk geraken.
- Men dient uitsluitend geschikt gereedschap voor de montage te gebruiken.
- Bij konische/tape koppelingen moet met een zodanig koppel worden gewerkt dat het product niet wordt beschadigd.
- Het product, de behuizing of de spoel mag niet als hefboom worden gebruikt.
- De pijp aansluitingen mogen geen krachten of momenten op het product overdragen.

ELEKTRISCHE AANSLUITING

In geval van elektrische aansluiting dient dit door vakkundig personeel te worden uitgevoerd volgens de door de plaatselijke overheid bepaalde richtlijnen.

Men dient in het bijzonder te letten op:

- Voordat men aan het werk begint moeten alle spanningsvoerende delen spanningsloos worden gemaakt.
- Alle aansluitklemmen moeten na het beëindigen van het werk volgens de juiste normen worden aangedraaid.
- Al naar gelang het spanningsbereik, moet het product volgens de geldende normen van een aarding worden voorzien.

Het product kan de volgende aansluitingen hebben:

- Stekeraansluiting volgens ISO-4400 of 3x DIN-46244 (bij juiste montage wordt de dichtheidsklasse IP-65 verkregen).
- Aansluiting binnen in het metaal huis d.m.v. schroefaansluiting. De kabeldoorvoer heeft een "PG" aansluiting.
- Spoelen met platte stekker (AMP type).
- Lösse of aangeconnecte kabels

IN GEBRUIK STELLEN

Voordat de druk aangesloten wordt dient een elektrische test te worden uitgevoerd. Ingeval van magneetafsluiters, legt men meerdere malen spanning op de spoel aan waarbij een duidelijk "klikken" hoorbaar moet zijn bij juist functioneren.

GBRUIK

De meeste magneetafsluiters zijn uitgevoerd met spoelen voor continu gebruik. Omdat persoonlijke of zakelijke schade kan ontstaan bij aanraking dient men dit te vermijden, daar bij langdurige inschakeling de spoel of het spoelhuis heet kan worden.

GELUIDSEMISSIE

Dit hangt sterk af van de toepassing en het gebruikte medium. De bepaling van het geluidsniveau kan pas uitgevoerd worden nadat het ventiel is ingebouwd.

ONDERHOUD

Het onderhoud aan de afsluiters is afhankelijk van de bedrijfsomstandigheden.

In bepaalde gevallen moet men bedacht zijn op media welke sterke vervuiling binnen in het product kunnen veroorzaken. Men dient dan regelmatig inspecties uit te voeren door de afsluiter te openen en te reinigen. Indien ongewone slijtage optreedt dan zijn reserve onderdelen beschikbaar om een inwendige revisie uit te voeren.

Ingeval problemen of onduidelijkheden tijdens montage, gebruik of onderhoud optreden dan dient men zich tot ASCO of haar vertegenwoordiger te wenden.

Een aparte fabrikanten verklaring van inbouw, in de zin van EU-richtlijn 89/392/EEG aanhangsel IIB kan door de afnemer na opgave van orderbevestigingsnummer en serienummer verkregen worden.

Dit product voldoet aan de essentiële vereisten van de EMC Richtlijn 89/336/EEG en amendementen, net als aan de richtlijnen 73/23/EEG en 93/68/EEG inzake laagspanning. Een afzonderlijke verklaring van overeenstemming is op verzoek verkrijgbaar. Vermeld a.u.b. het nummer van de opdrachtbevestiging en de serienummers van de betreffende producten.

Design HP and HPA Control Valves

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Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for 1- through 6-inch Design HP valves with Class 900 and 1500 ratings; and 1- through 2-inch Design HP and HPA valves with Class 900, 1500, and 2500 ratings. Refer to separate manuals for instructions covering the actuator, positioner, and accessories.

No person may install, operate, or maintain HP Series valves without first • being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance, and •



W5785A-1

Figure 1. Design HP Valve with Type 657 Actuator

carefully reading and understanding the contents of this manual. If you have any questions about these instructions, contact your Fisher sales office before proceeding.

Note

Fisher does not assume responsibility for the selection, use, or maintenance of any product. Responsibility for proper selection, use, and maintenance of any Fisher product remains solely with the purchaser and end-user.



Table 1. Specifications

<p>End Connection Styles and Ratings^(1,2,3,4)</p> <p>Flanged: Consistent with Class 900, 1500, and 2500 per ASME B16.34</p> <p>Socket Welding: Consistent with Class 900, 1500, and 2500 per ASME B16.34</p> <p>Buttwelding: Consistent with Class 900, 1500, and 2500 per ASME B16.34</p> <p>Also see table 2</p> <p>Shutoff Classifications</p> <p>See table 3</p> <p>C-seal trim: High-temperature, Class V. See table 4</p> <p>TSO (Tight Shutoff) trim: See tables 5 and 6</p> <p>Flow Characteristic</p> <p>Standard Cage: ■ Equal percentage, ■ Modified equal percentage or, ■ Linear</p> <p>Standard Cage with Micro-Form™ Valve Plug: (Design HPS and HPAS only): ■ Equal percentage or ■ Modified equal percentage</p> <p>Standard Cage with Micro-Flute™ Valve Plug: (Design HPS and HPAS only): ■ Equal percentage or ■ Modified equal percentage</p>	<p>Standard Cage with Micro-Flat™ Valve Plug: (Design HPAS only): ■ Linear</p> <p>Cavitrol® III or Whisper Trim® III Cage: ■ Linear</p> <p>Special cages: Special characterized flow cages are available. Consult your local Fisher sales office.</p> <p>Flow Direction</p> <p>Standard Cage</p> <p>■ <i>Design HPD and HPAD:</i> Normally flow down ■ <i>Design HPS and HPAS:</i> Normally flow up⁽⁵⁾ ■ <i>Design HPAS Micro-Flat:</i> Flow down ■ <i>Design HPT and HPAT:</i> Normally flow down ■ <i>Design HPS and HPAS Micro-Form:</i> Flow up only</p> <p>Cavitrol III Cage: Flow down</p> <p>Whisper Trim III Cage: Flow up</p> <p>Approximate Weights (valve body and bonnet assemblies)</p> <p>See table 2</p> <p>Additional Specifications</p> <p>For specifications such as materials, valve plug travels, and port, yoke boss, and stem diameters, see the Parts List section</p>
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1. DIN (or other) ratings and end connections can usually be supplied; consult your Fisher sales office.

2. Class 900 and 1500 globe valves are identical for size 1- and 2-inch valves. Class 900 and 1500 globe valves for size 3-, 4-, and 6-inch valves, however, are not identical.

3. The centerline-to-face dimension for Class 2500 1- and 2-inch Design HPA valves does not conform to ANSI/ISA S75.12.

4. The pressure or temperature limits in this manual and any applicable standard limitations should not be exceeded.

5. Design HPS and HPAS valves may be used flow down for on-off service only or where further limited by trim design. Design HPAS valves may be used flow down for erosive service.

Description

The HP Series high-pressure globe and angle valves (figure 1) have metal seats, cage guiding, quick change trim, and push-down-to-close valve plug action. The Design HPD, HPAD, HPT, and HPAT valves use balanced valve plugs. The Design HPS and HPAS valves use an unbalanced valve plug. To provide a seal between the cage and a balanced valve plug, the Design HPD and HPAD valve plugs use piston rings; the Design HPT and HPAT valve plugs use a pressure-assisted seal ring. A Whisper Trim cage can be used with a Design HPD, HPAD, HPS, HPAS, HPT, or HPAT valve plug. A Cavitrol III cage can be used with a Design HPS, HPAS, HPT, or HPAT valve plug.

C-seal trim is available for Design HPD valves, class 900 and 1500, in sizes 3, 4, and 6.

With C-seal trim, a balanced valve can achieve high-temperature, Class V shutoff. Because the C-seal plug seal is formed from metal (N07718 nickel alloy, Inconel 718) rather than an elastomer, a valve equipped with the C-seal trim can be applied in processes with a fluid temperature of up to 593°C (1100°F), provided other material limits are not exceeded.

Specifications

Specifications for the HP Series valves are shown in table 1.

Table 2. Approximate Weights (Valve and Bonnet Assemblies)

VALVE SIZE, INCHES	CLASS	KILOGRAMS		POUNDS	
		Fig	SWE & BWE	Fig	SWE & BWE
Globe Valves					
1	900 & 1500	42	38	93	85
	2500	45	34	100	76
1.5 x 1	2500	---	34	---	76
2	900 & 1500	72	52	158	115
	2500	104	74	229	164
3	900	125	---	276	---
	1500	129	97	284	213
4	900	230	---	507	---
	1500	249	201	548	444
6	900	511	---	1127	---
	1500	557	455	1228	1003
Angle Valves					
1	900 & 1500	40	36	88	80
	2500	---	72 ⁽¹⁾	---	160 ⁽¹⁾
2	900 & 1500	69	50	153	110
	2500	---	109 ⁽¹⁾	---	240 ⁽¹⁾

1. Only SWE is available for Class 2500.

1. Only SWE is available for Class 2500.

at the beginning of the Maintenance section in this instruction manual.



WARNING

Some bonnet flanges have a tapped hole that was used to handle the bonnet during manufacture. Do not use this tapped hole to lift the valve assembly or personal injury may result.

CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions indicated when the valve was ordered. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your Fisher sales office.

Installation



WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING

1. Before installing the valve, inspect it to ensure that the valve body cavity is free of foreign material.
2. Clean out all pipelines to remove scale, welding slag, and other foreign materials before installing the valve.

Note

If the valve body being installed has small internal flow passages, such as with Whisper Trim III or Cavitrol III cages, consideration should be given to installing an upstream strainer to prevent the lodging of particles in these passages. This is especially important if the pipeline cannot be thoroughly cleaned or if the flowing medium is not clean.

3. Flow through the valve must be in the direction indicated by the flow arrow, which is stamped on or attached to the valve body.
4. Use accepted piping practices when installing the valve in the pipeline. For flanged valve bodies, use a suitable gasket between the body and pipeline flanges.

HP and HPA Valves

Table 3. Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4

VALVE DESIGN	PORT DIAMETER, mm (INCHES)	LEAKAGE CLASS
HPD, HPAD	47.6 (1.875) and smaller	II
	58.7 (2.3125) to 92.1 (3.625)	II - Standard
		III - Optional
	111.1 (4.375) and larger	III - Standard
HPS, HPAS w/ Cavitrol III, or HPT, HPAT w/ Cavitrol III, or HPAS w/Micro-Flat	All	IV - Optional
HPS, HPAS, HPT, HPAT, HPS, HPAS w/ Micro-Form, or HPS, HPAS w/ Micro-Flute	All	V
		V - Standard
HPT w/ PEEK anti-extrusion rings	47.6 (1.875) to 136.5 (5.375)	V to 316°C (600°F)

Table 4. Additional Shutoff Classification per ANSI/FCI 70-2 and IEC 60534-4

VALVE DESIGN (CLASS)	VALVE SIZE, INCHES	PORT DIAMETER, mm (INCHES)	CAGE STYLE	LEAKAGE CLASS
Design HPD with optional C-seal trim	3	73.0 (2.875)	Equal Percentage, Modified Equal Percentage, Linear (std. cage), Linear (Whisper III, A1, B1)	V
	4	73.0 (2.875)	Linear (Whisper III, D3), Linear (Cavitrol III, 3-stage)	V
	4	87.3 (3.4375)	Linear (Cavitrol III, 2-stage)	V
	4	92.1 (3.625)	Equal Percentage, Modified Equal Percentage, Linear (std. cage), Linear (Whisper III, A1, B3, C3)	V
	6	111.1 (4.375)	Linear (Whisper III, D3)	V
		115.8 (4.5625)	Linear (Cavitrol III, 3-stage)	
	6	136.5 (5.375)	Equal Percentage, Modified Equal Percentage, Linear (std. cage), Linear (Whisper III, A1, B3, C3)	V
		133.4 (5.25)	Linear (Cavitrol III, 2-stage)	

Table 5. TSO (Tight Shutoff) Leakage Class per ANSI/FCI 70-2 and IEC 60534-4

Leakage Class	Maximum Leakage	Test Medium	Test Pressure	Leakage Class
TSO (Tight Shutoff)	Valves with TSO trim are factory tested to a more stringent Fisher test requirement of no leakage at time of shipment.	Water	Service $\Delta P^{(1)}$	V
1. Specify service ΔP when ordering.				

Table 6. TSO Shutoff Availability

TYPE	CONSTRUCTION	LEAK CLASS	
		Standard	Optional
HPS, HPT	Std or Cavitrol III trim. Replaceable, protected soft seat	TSO	- - -

Table 7. Recommended Torque for Packing Flange Nuts (non live-loaded)

STEM DIAMETER	STEM DIAMETER	VALVE BODY RATING	TORQUE			
			N•m		lbf•ft	
			Min	Max	Min	Max
12.7	0.5	Class 900	12	18	9	13
12.7	0.5	Class 1500	15	22	11	16
12.7	0.5	Class 2500	18	24	13	18
19.1	0.75	Class 900	27	41	20	30
19.1	0.75	Class 1500	34	50	25	37
19.1	0.75	Class 2500	41	61	30	45
25.4	1	Class 900	42	62	31	46
25.4	1	Class 1500	52	77	38	57
25.4	1	Class 2500	61	91	45	67
31.8	1.25	Class 900	56	83	41	61
31.8	1.25	Class 1500	68	102	50	75

5. Install a three-valve bypass around the valve if continuous operation is required during maintenance.
6. If the actuator and valve body are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.
7. If the valve body was shipped without packing installed in the packing box, install the packing before putting the valve body into service. Refer to instructions given in the Packing Maintenance procedure.



WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

Valves with ENVIRO-SEAL® live-loaded packing or HIGH-SEAL™ Heavy-Duty live-loaded packing will not require this initial re-adjustment. See the Fisher instruction manuals titled ENVIRO-SEAL Packing System for Sliding-Stem Valves or HIGH-SEAL Live-Loaded Packing System (as appropriate) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the parts kit sub-section near the end of this manual.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection

and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing lubrication, packing maintenance, and trim maintenance. All maintenance operations may be performed with the valve in the line.



WARNING

Avoid personal injury or damage to property from sudden release of pressure or uncontrolled process fluid. Before starting disassembly:

- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

Table 8. Torque for Body-to-Bonnet Bolting Using Nickel Never-Seez® Lubricant

VALVE RATING	VALVE SIZE, INCHES	TORQUE			
		N•m		lbf•ft	
		B7, B16, BD and 660 Studs	B8 and B8M Studs	B7, B16, BD and 660 Studs	B8 and B8M Studs
Class 900 & 1500	1	260	150	190	110
	2	390	240	290	180
	3	730	530	540	390
	4	970	730	720	540
	6	1700	1300	1250	950
Class 2500	1	390	240	290	180
	2	730	530	540	390

- The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.

- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Note

The Design HP series valve uses spiral-wound gaskets which are crushed to provide their seal. A spiral-wound gasket should never be reused. Whenever a gasket seal is disturbed by removing or shifting gasketed parts, a new gasket must be installed upon reassembly. This is necessary to ensure a good gasket seal, since the used gasket will not seal properly.

The spiral-wound gaskets are of special design. Failure to use Fisher replacement parts may result in valve damage.

Note

If the valve has ENVIRO-SEAL live-loaded packing installed (figure 4), see the Fisher instruction manual entitled “ENVIRO-SEAL Packing System for Sliding Stem Valves” for packing instructions.

If the valve has HIGH-SEAL Heavy-Duty live-loaded packing installed (figure 4), see the Fisher instruction manual entitled

“HIGH-SEAL Live-Loaded Packing System” for packing instructions.

Packing Lubrication

Note

To avoid lubricants breaking down at elevated temperatures, do not lubricate packing used in processes with temperatures over 260°C (500°F).



WARNING

Do not lubricate parts when used in oxygen service, or where the lubrication is incompatible with the process media. Any use of lubricant can lead to the sudden explosion of media due to the oil/oxygen mixture, causing personal injury or property damage.

If a lubricator or lubricator/isolating valve (figure 2) is provided for PTFE/composition or other packings that require lubrication, it will be installed in place of the pipe plug (key 31, figure 16, 17, or 18). Use a good quality silicon-base lubricant. Packing used in oxygen service or in processes with temperatures over 260°C (500°F) should not be lubricated. To operate the lubricator, turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve operates the same way except the isolating valve must first be opened and then closed after lubrication is completed.

Packing Maintenance

If there is undesirable packing leakage in the spring-loaded PTFE V-ring packing shown in figure 3, tighten the packing flange nuts (key 21, figure 16, 17, or 18) until the shoulder on the packing follower

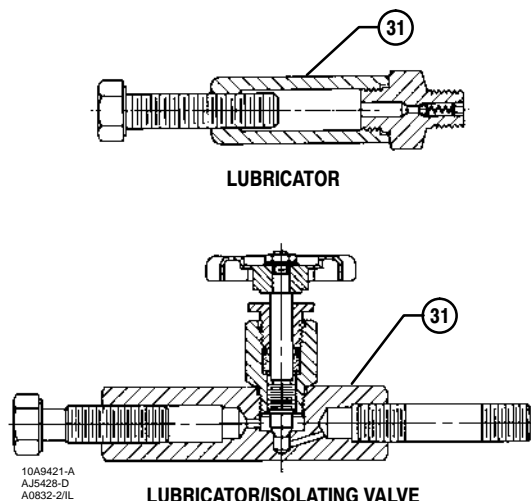


Figure 2. Lubricator and Lubricator/Isolating Valve

(key 28, figure 16, 17, or 18) contacts the bonnet (key 18, figure 16, 17, or 18). If leakage continues, replace the packing by following the numbered steps presented in the replacing packing procedure.

If there is undesirable packing leakage with other than spring-loaded PTFE V-ring packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts (key 21, figure 16, 17, or 18) to at least the minimum recommended torque in table 7. However, do not exceed the maximum recommended torque in table 7 or excessive friction may result. If leakage continues, replace the packing by following the numbered steps presented in the Replacing Packing procedure.

If the packing is relatively new and tight on the valve plug stem, and if tightening the packing flange nuts does not stop the leakage, it is possible that the stem is worn or nicked so that a seal cannot be made. The surface finish of a new stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. While replacing the packing according to the Replacing Packing procedure, inspect the valve plug stem and packing box wall for nicks or scratches.

Adding Packing Rings

Key numbers referred to in this procedure are shown in figure 16, 17, or 18, unless otherwise indicated.

When using packing with a lantern ring (key 24) it may be possible to add packing rings above the lantern ring as a temporary measure without removing the actuator from the valve body.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

2. Remove the packing flange nuts (key 21) and lift the packing flange, upper wiper, and packing follower (keys 19, 27, and 28) away from the valve body.

3. It may be possible to dig out the old packing rings on top of the lantern ring, but use care to avoid scratching the valve plug stem or packing box wall. Clean all metal parts to remove particles that would prevent the packing from sealing.

4. Remove the stem connector and slip the packing rings over the end of the valve plug stem.

5. Reassemble the packing follower, upper wiper, packing flange, and packing flange nuts (keys 28, 27, 19, and 21).

6. Reconnect the body-actuator stem connection according to the appropriate actuator instruction manual.

7. Tighten the packing flange nuts only far enough to stop leakage under operating conditions. Check for leakage around the packing follower when the valve is being put into service. Retighten the packing flange nuts as required (see table 7).

Replacing Packing



WARNING

Refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Key numbers referred to in this procedure are shown in figure 16, 17, or 18, unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

2. Remove the cap screws in the stem connector, and separate the two halves of the stem connector. Then exhaust all actuator pressure, if any was applied, and disconnect the actuator supply and any leakoff piping.

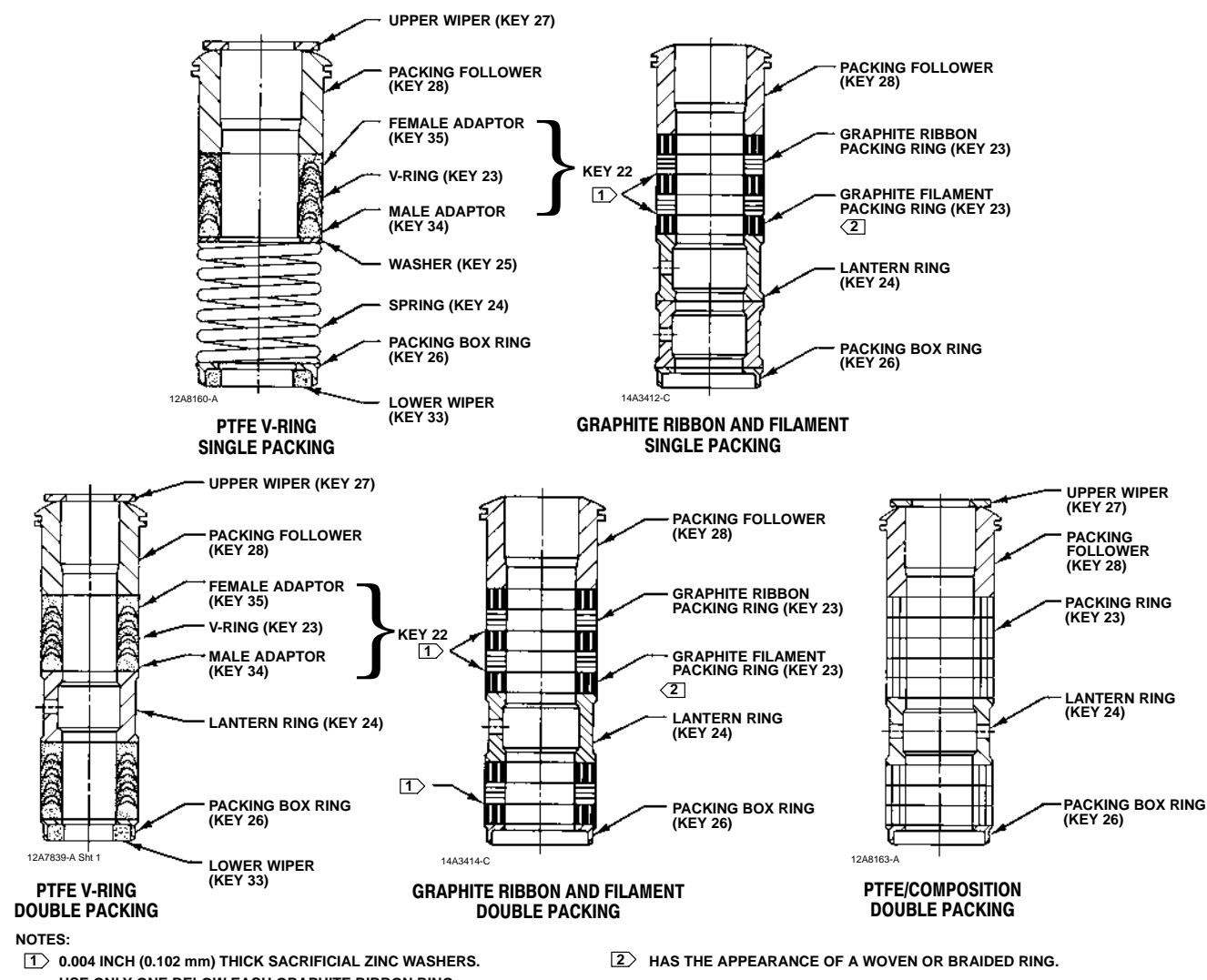


Figure 3. Packing Arrangements

3. Remove either the yoke locknut (key 32) or the hex nuts (key 30), and remove the actuator from the bonnet (key 18).
4. Loosen the packing flange nuts (key 21) so that the packing (keys 22, 23, 209, or 210, figure 3) is not tight on the valve plug stem (key 6). Remove any travel indicator disk and stem locknuts from the valve plug stem threads.

CAUTION

When lifting the bonnet (key 18), be sure that the valve plug and stem assembly (keys 5 and 6) remains on the seat ring (key 4). This avoids damage to the seating surfaces as a

result of the assembly dropping from the bonnet after being lifted part way out. The parts are also easier to handle separately.

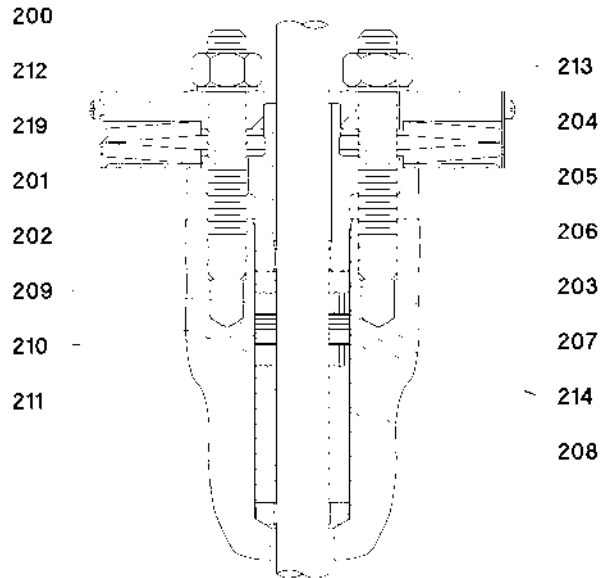
Use care to avoid damaging gasket sealing surfaces.

The Design HPD and HPAD piston rings (key 8) are brittle and in two pieces. Avoid damaging the piston rings by dropping or rough handling.



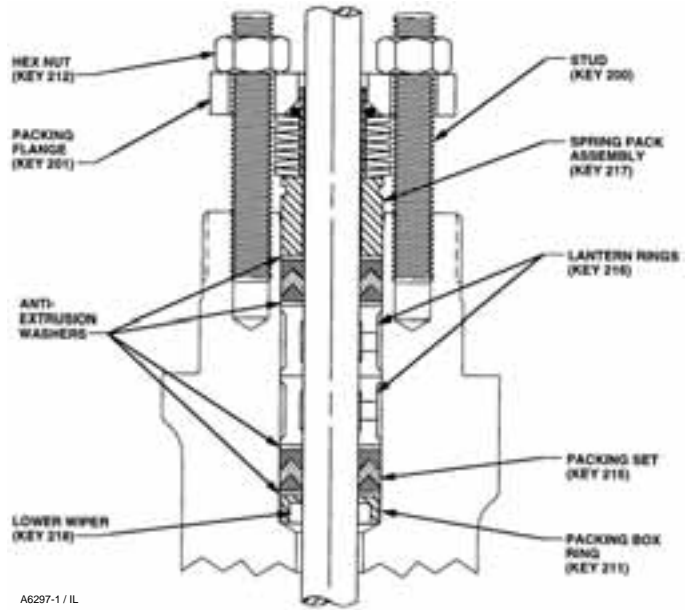
WARNING

To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the



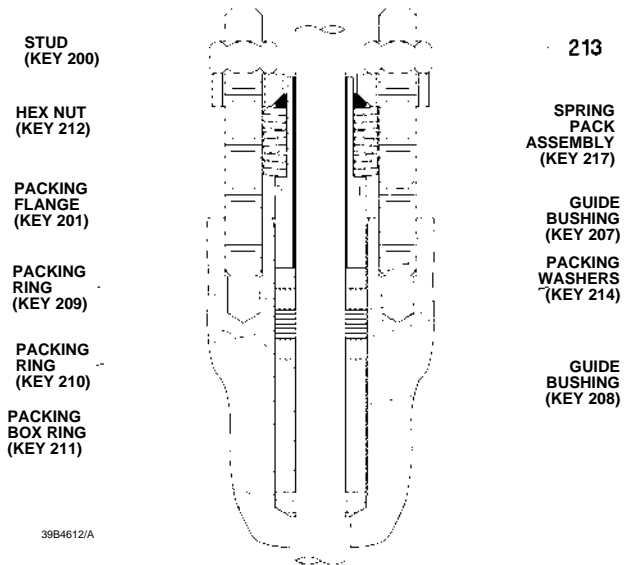
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Typical HIGH-SEAL Graphite ULF Packing System



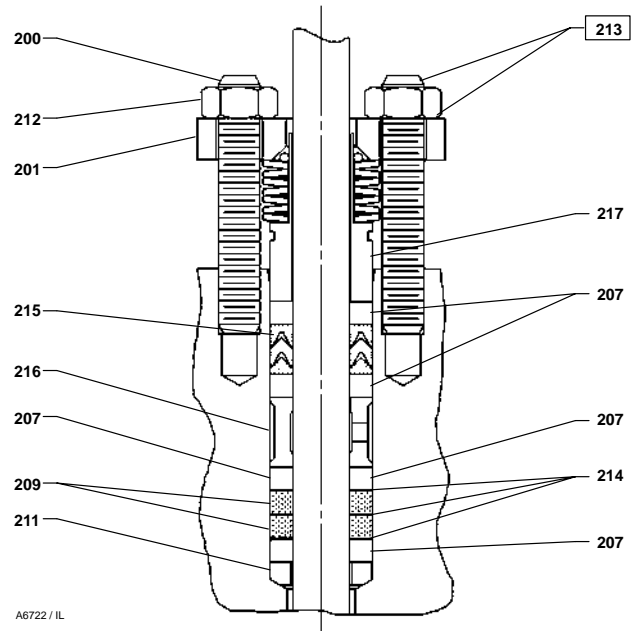
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Typical ENVIRO-SEAL Packing System with PTFE Packing



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Typical ENVIRO-SEAL Packing System with Graphite ULF Packing



A6722 / IL

Typical ENVIRO-SEAL Packing System with Duplex Packing

Figure 4. Live-Loaded Packing

HP and HPA Valves

bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet. If the cage sticks to the bonnet, proceed carefully with bonnet removal and support the cage so that it will not fall unexpectedly from the bonnet.

Note

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

5. Hex nuts (key 14) attach the bonnet to the valve body. Loosen these nuts or cap screws approximately 3 mm (0.125 inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, remove the nuts completely and carefully lift the bonnet and valve plug (keys 18 and 5) as a unit.

6. Unscrew the hex nuts (key 14) and carefully lift the bonnet off the valve stem. If the valve plug and stem assembly starts to lift with the bonnet, use a brass or lead hammer on the end of the stem and tap it back down. Set the bonnet on a cardboard or wooden surface to prevent damage to the bonnet gasket surface.

7. Remove the valve plug (key 5), bonnet gasket (key 11), cage (key 2), seat ring (key 4), and the seat ring gasket (key 12).

CAUTION

Inspect the seat ring, cage, bonnet, and body gasket surfaces. These surfaces must be in good condition, with all foreign material removed. Small burrs less than approximately 0.076 mm (0.003 inches) in height (the thickness of a human hair) can be ignored. Scratches or burrs that run across the serrations are not permitted under any conditions, since they will prevent the gaskets from sealing properly.

8. Clean all gasket surfaces with a good wire brush. Clean in the same direction as the surface serrations, not across them.

9. Cover the opening in the valve body to protect the gasket surface and to prevent foreign material from getting into the valve body cavity.

10. Remove the packing flange nuts (key 21), packing flange (key 19), upper wiper (key 27), and packing follower (key 28). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. For extension bonnets, also remove the baffle (key 36) and retaining ring (key 37).

11. Clean the packing box and the following metal packing parts: packing follower, packing box ring (key 26), spring or lantern ring (key 24), and, for single arrangements of PTFE V-ring packing only, special washer (key 25).

12. Inspect the valve stem threads for any sharp edges that might cut the packing. A whetstone or emery cloth may be used to smooth the threads if necessary.

13. Remove the protective covering from the valve body cavity, and install the seat ring and cage using a new seat ring gasket (key 12) and bonnet gasket (key 11). Install the plug, then slide the bonnet over the stem and onto the studs (key 20). For a valve body with extension bonnet, also install the baffle and retaining rings (keys 36 and 37).

Note

The prelubricated hex nuts (key 21) referred to in step 14 can be identified by a black film coating on the nut threads.

The proper bolting procedures in step 14 include—but are not limited to—ensuring that the bonnet stud threads are clean, and that the hex nuts are evenly tightened to the specified torque values.

CAUTION

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in table 8 may result in damage to the valve. Cheater bars or slug wrenches should not be used for this procedure.

Hot torquing is not recommended.

Table 9. Valve Stem Connection Torque and Drill Size for Pin Hole

VALVE SIZE, INCHES	VALVE STEM DIAMETER		DESIGN	VALVE STEM CONNECTION TORQUE (MINIMUM-MAXIMUM)		DRILL SIZE FOR PIN
	mm	Inches		N•m	Lbf•ft	
1	12.7	0.5	HPS, HPAS	81 - 115	60 - 85	0.125
	19.1	0.75	HPS, HPAS	237 - 339	175 - 250	0.1875
2	12.7	0.5	HPD, HPAD, HPS, HPAS, HPT, HPAT	81 - 115	60 - 85	0.125
	19.1	0.75	HPS, HPAS	237 - 339	175 - 250	0.1875
			HPD, HPAD, HPT, HPAT	237 - 339	175 - 250	0.125
	25.4	1	HPS, HPAS	420 - 481	310 - 355	0.25
3	12.7	0.5	HPD, HPS, HPT	81 - 115	60 - 85	0.125
	19.1	0.75	HPD, HPS, HPT	237 - 339	175 - 250	0.1875
	25.4	1	HPD, HPS, HPT	420 - 481	310 - 355	0.25
4	19.1	0.75	HPD, HPT	237 - 339	175 - 250	0.1875
	25.4	1	HPD, HPT	420 - 481	310 - 355	0.25
6	19.1	0.75	HPD, HPT	237 - 339	175 - 250	0.1875
	25.4	1	HPD, HPT	420 - 481	310 - 355	0.25
	31.8	1.25	HPD, HPT	827 - 908	610 - 670	0.25

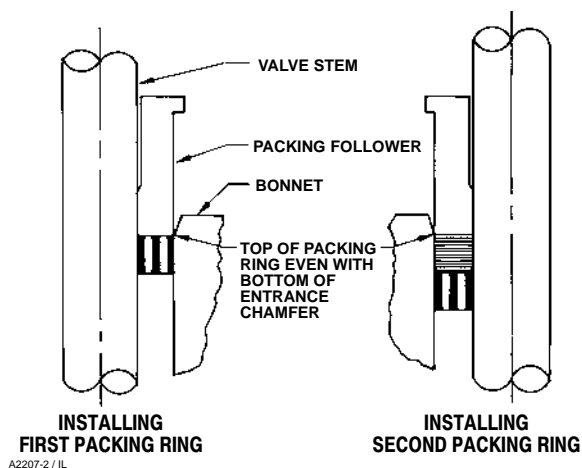


Figure 5. Installing Graphite Ribbon/Filament Packing Rings One at a Time

14. Lubricate the stud threads and the faces of the hex nuts (key 21) with Never-Seez Pure Nickel Special lubricant or equivalent (not necessary if new factory prelubricated hex nuts are used). Replace the hex nuts and tighten them finger-tight. Stroke the valve several times to center the trim. Torque the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in table 8.

When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.

Note

When installing packing rings, prevent entrapping air between the rings. Add the rings one at a time without forcing them below the chamfer of the packing box entrance chamber. As each successive ring is added, the stack should not be pushed down more than the thickness of the added ring (figure 5).

15. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 3. If desired, packing parts may be pre-lubricated with a silicon base grease for easier installation. Slip a smooth-edged pipe over the valve stem, and gently tamp each soft packing part into the packing box, being sure that air is not trapped between adjacent soft parts.

16. Slide the packing follower, wiper, and packing flange into position. Lubricate the packing flange studs (key 20) and the faces of the packing flange nuts (key 21). Replace the packing flange nuts.

For the spring-loaded PTFE V-ring packing shown in figure 3, tighten the packing flange nuts until the shoulder on the packing follower (key 28) contacts the bonnet.

For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in table 7. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 7.

For other packing types, tighten the packing flange nuts alternately in small equal increments until one

HP and HPA Valves

of the nuts reaches the minimum recommended torque shown in table 7. Then, tighten the remaining flange nuts until the packing flange is level and at a 90-degree angle to the valve stem.

For ENVIRO-SEAL or HIGH-SEAL live-loaded packing, refer to the note at the beginning of the Maintenance section.

17. Mount the actuator on the valve body assembly, and reconnect the actuator and valve plug stems according to the procedures in the appropriate actuator instruction manual.

Trim Removal

For C-seal construction, see the appropriate C-seal sections in this manual.

Key numbers referenced in this procedure are shown in figure 16, 17, or 18, except where indicated.

1. Remove the actuator and bonnet by following steps 1 through 4 of the replacing packing procedure. Observe all warnings and cautions.
2. Lift the valve stem and attached valve plug out of the valve body. If the valve plug is to be reused, tape or otherwise protect the valve plug stem and the valve plug seating surface to prevent scratches.
3. Lift out the cage (key 2) and the bonnet gasket (key 11). For a 2-inch valve body with a Cavitrol III two stage cage, also remove the bonnet spacer and two gaskets.

Constructions other than TSO trim

1. Remove the seat ring (key 4) and the seat ring gasket (key 12).
2. Refer to the Valve Plug Maintenance procedure or to the Lapping Seats procedure.

TSO Trim

TSO trim: 0.8125 Inch Port Diameter (figure 7)

1. Remove the pin that locks the inner plug to the stem.
2. Using a strap wrench or similar tool, unscrew the outer plug from the inner plug. Do not damage the outer plug guide surfaces.
3. Remove the protected soft seat seal.
4. Inspect the parts for damage and replace if needed.

5. Refer to the Valve Plug Maintenance procedure or to the Lapping Seats procedure.

TSO trim: 1.6875 Inch Port Diameter (figure 8)

1. Remove the retainer, backup ring, anti-extrusion rings, and piston ring.
2. Remove the set screws that lock the outer plug to the stem.
3. Using a strap wrench or similar tool, unscrew the outer plug from the inner plug. Do not damage the outer plug guide surfaces.
4. Remove the protected soft seat seal.
5. Inspect the parts for damage and replace if needed.
6. Refer to the Valve Plug Maintenance procedure or to the Lapping Seats procedure.

TSO trim: 2.6875 Inch and Larger Port Diameters (figure 9)

1. Remove the retainer, backup ring, anti-extrusion rings, and piston ring.
2. Remove the set screws that lock the outer plug to the inner plug.
3. Using a strap wrench or similar tool, unscrew the outer plug from the inner plug. Do not damage the outer plug guide surfaces.
4. Remove the protected soft seat seal.
5. Inspect the parts for damage and replace if needed.
6. Refer to the Valve Plug Maintenance procedure or to the Lapping Seats procedure.

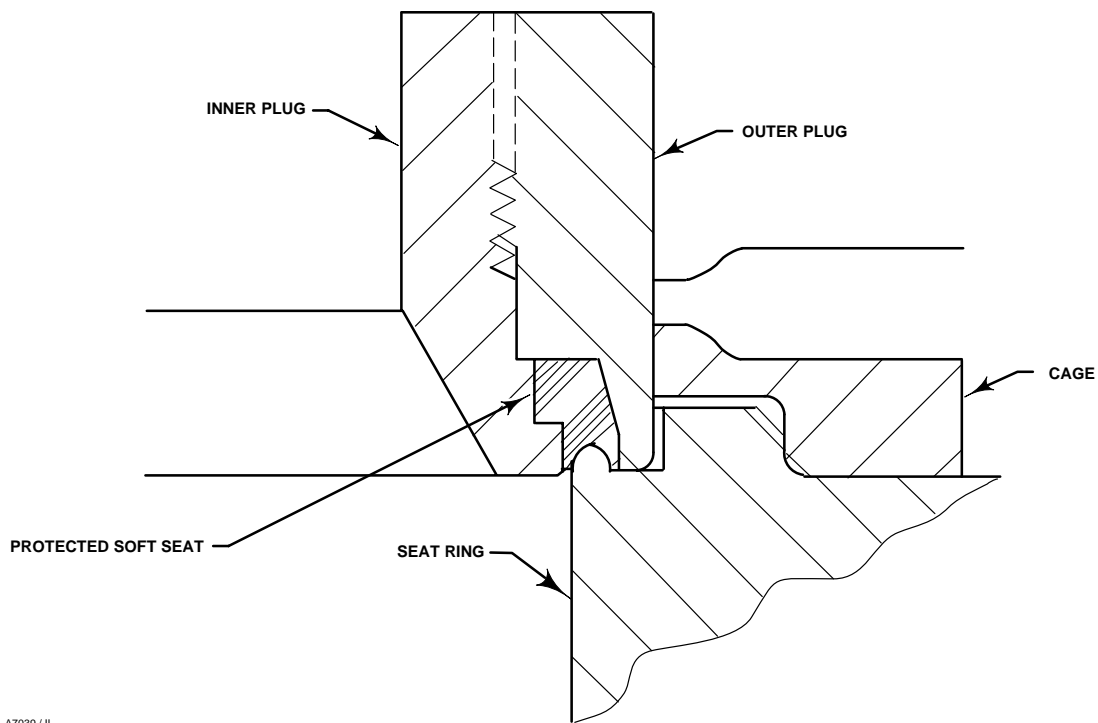
Valve Plug Maintenance

Key numbers used in this procedure are shown in figure 16, 17, or 18, except where indicated.

1. With the valve plug (key 5) removed according to the trim removal procedure, proceed as appropriate:

For Design HPD and HPAD valves, the piston rings (key 8) are each in at least two sections; remove the sections from the grooves in the valve plug.

For Design HPS and HPAS valves, proceed to step 2.



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Figure 6. Detail of Protected Soft Seat

For Design HPT and HPAT valves, work the retaining ring (key 10) off the valve plug with a screwdriver. Carefully slide the backup ring and seal ring (keys 9 and 8) off the valve plug.

2. To replace the valve plug stem (key 6), drive out the pin (key 7), and unscrew the stem from the valve plug.

CAUTION

Never reuse an old stem with a new valve plug. Using an old stem with a new plug requires drilling a new pin hole in the stem. This weakens the stem and may cause the stem to fail in service. If a new valve plug is required, always order a valve plug, stem, and pin as an assembly. Specify the correct part number of each of the three parts, but state that the parts are being ordered as an assembly.

A used valve plug may be reused with a new stem.

3. Thread the new stem into the valve plug and tighten it to the appropriate torque value given in table 9. Using the valve plug pin hole as a guide, drill the pin hole through the stem. Refer to table 9 for drill sizes.

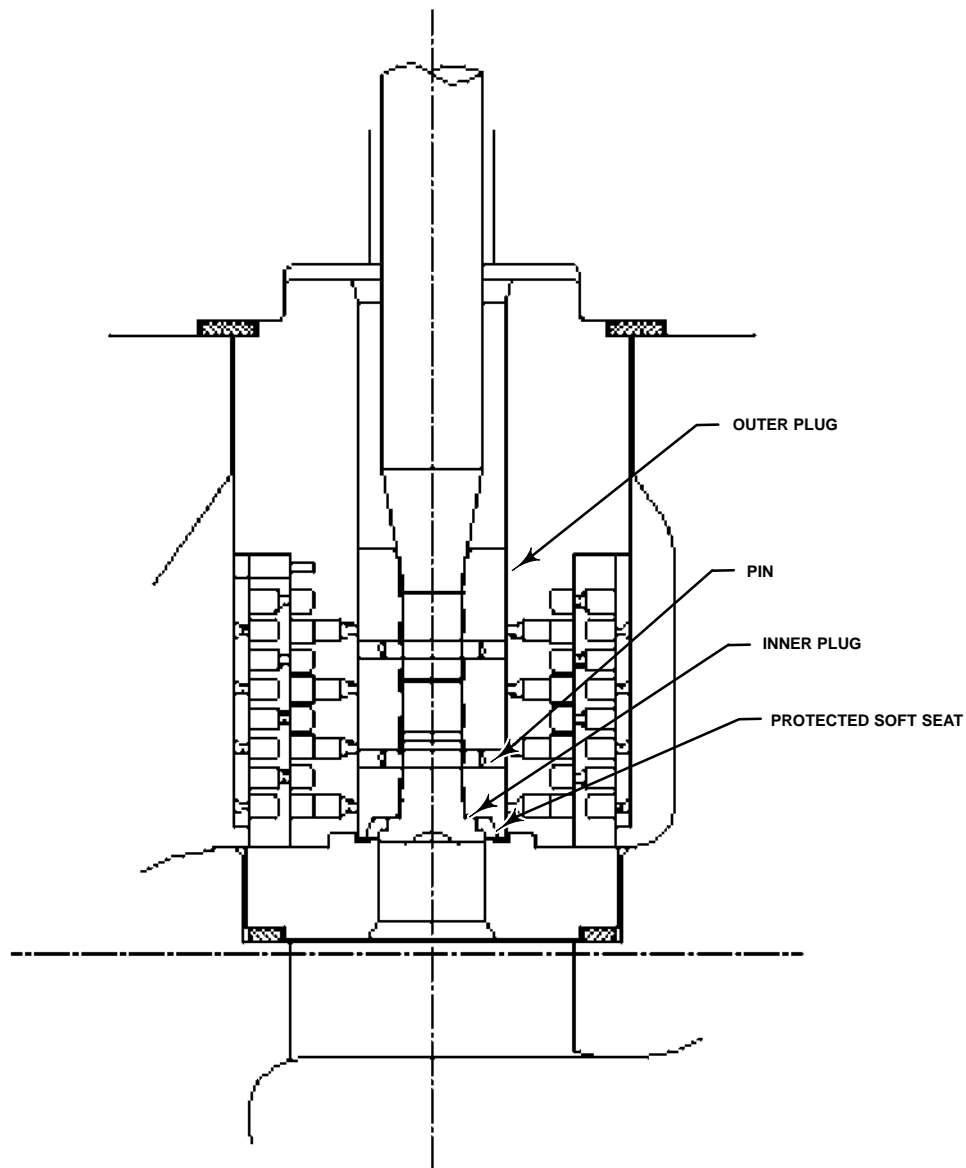
4. Drive in the pin to lock the assembly.

5. If it is necessary to lap the seating surfaces, complete the lapping seats procedure before installing the Design HPD/HPAD piston rings or the Design HPT/HPAT seal ring. The Trim Replacement procedure provides piston ring and seal ring installation instructions and valve reassembly instructions.

Lapping Seats

Key numbers referenced in this procedure are shown in figure 16, 17, or 18, except where indicated.

A certain amount of leakage should be expected with metal-to-metal seating in any valve body. If the leakage becomes excessive, however, the condition of the seating surfaces of the valve plug and seat ring can be improved by lapping. (Deep nicks should be machined out rather than ground out.) Use a



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Figure 7. Typical Unbalanced TSO Trim Assembly, Small Port Designs (0.8125 Inch Port Diameter)

good quality lapping compound of a mixture of 280 to 600-grit. Apply the compound to the bottom of the valve plug.

Note

The Design HP Series valves use spiral-wound gaskets. These gaskets provide their seal by being crushed and therefore should never be reused. This includes reusing a gasket after

the lapping procedure has been performed.

An "old" gasket can be used to lap the seat, however the gasket must be replaced with a new gasket.

To preserve the effects of lapping, do not change either the position of the seat ring in the valve body cavity or the position of the cage on the seat ring after lapping the seating surfaces. When the parts are removed for

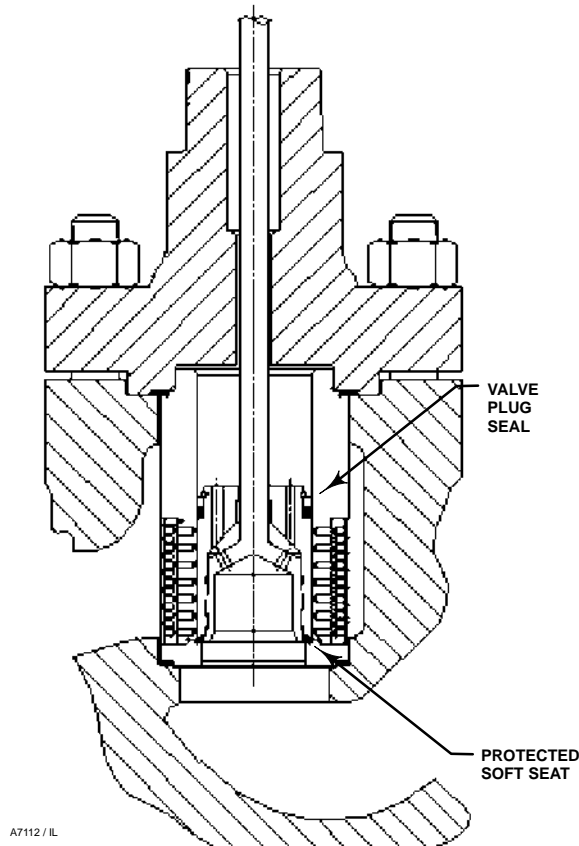


Figure 8. Typical Balanced TSO Trim
(1.6875 Inch Port Diameter)

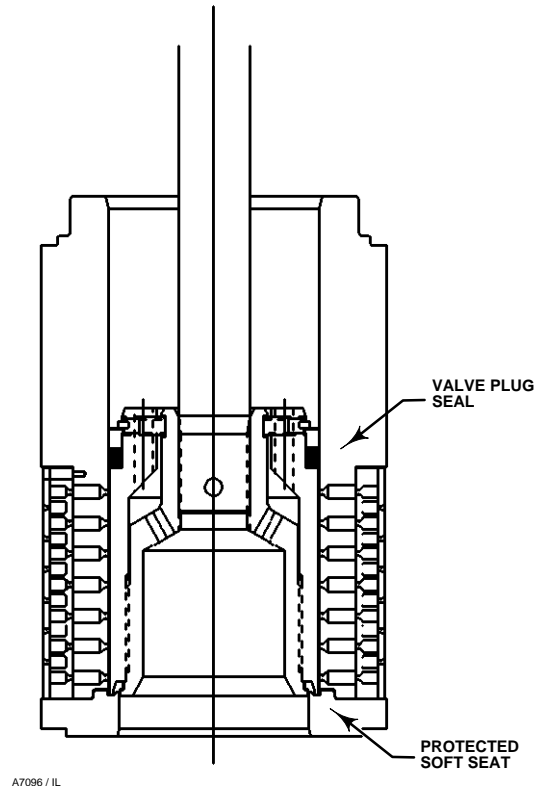


Figure 9. Typical Balanced TSO Trim, Large Port Designs
(2.6875 Inch and Larger Port Diameters)

cleaning and replacement of the “old” gaskets, return them to the original positions.

Use the following procedure to lap the seating surfaces.

1. Install the following parts according to the instructions presented in the trim replacement procedure: “old” seat ring gasket (key 12), seat ring (key 4), cage (key 2), and “old” bonnet gasket (key 11).

2. Proceed as appropriate:

For a Design HPD, HPAD, HPT, or HPAT valve, install the valve plug and stem assembly (keys 5 and 6)—without piston rings or seal ring (key 8)—into the cage.

For a Design HPS or HPAS valve, install the valve plug and stem assembly (keys 5 and 6) into the cage.

3. Install the bonnet (key 18) over the valve stem, and secure the bonnet with four of the hex nuts (key 14).

4. Attach a handle, such as a piece of strap iron secured by stem locknuts, to the valve stem. Rotate the handle alternately in each direction to lap the seats.

5. After lapping, disassemble as necessary (you may mark the position of the seat ring and cage with a soft tip marker). Clean the seating surfaces, replace the gaskets, reassembly (taking care to return the seat ring and cage to their original positions), and test for shutoff. Repeat the lapping procedure if necessary.

Table 10. Actuator Groups by Type Number

Group 1 71 & 90 mm (2.8125 & 3.5625 Inch) Yoke Boss	Group 100 127 mm (5-Inch) Yoke Boss
350—Except 90 mm (3.5625 inch) Yoke Boss 472 & 473 585C 603 & 1B 644 & 645 655 657 & 667 1008	350
	472
	473
	474
	476
	585C
	657
	Group 101 127 mm (5-Inch) Yoke Boss
	667

Trim Replacement



WARNING

Observe the warning at the start of the Maintenance section.

After all trim maintenance has been completed, reassemble the valve body by following the numbered steps below. Be certain that all gasketed surfaces have been well cleaned. Key numbers referenced in this procedure are shown in figure 16, 17, or 18, except where indicated.

CAUTION

Inspect the seat ring, cage, bonnet, and body gasket surfaces. These surfaces must be in good condition, with all foreign material removed. Small burrs less than approximately 0.076 mm (0.003 inches) in height (the thickness of a human hair) can be ignored. Scratches or burrs that run across the serrations are not permitted under any conditions, since they will prevent the gaskets from sealing properly.

1. Install the seat ring gasket (key 12) into the valve body. Install the seat ring (key 4).
2. Install the cage.

Constructions other than TSO trim

1. To install the piston rings and seal rings (key 8), proceed as appropriate:

For a Design HPD or HPAD valve, if it is necessary to install new piston rings, the replacement piston rings will arrive in one piece. Use a vise with smooth or taped jaws to break a replacement piston ring into

halves. Place the new ring in the vise so that the jaws compress the ring into an oval. Compress the ring slowly until the ring snaps on both sides. If one side snaps first, do not try to tear or cut the other side. Instead, keep compressing until the other side snaps. The piston ring can also be fractured by scoring and snapping over a hard surface such as a table edge. Sawing or cutting is not recommended.

Remove any protective tape or covering from the valve plug and stem assembly, and set it on a protective surface. Then, place the piston rings in the piston ring grooves with the fractured ends matched.

For a Design HPT or HPAT valve, install the seal ring (key 8) onto the valve plug (key 5). Install the ring with the open side facing the seat ring end of the valve plug for flow-down applications (view A of figure 19) or with the open side facing the valve plug stem end of the valve plug for flow-up applications (view B of figure 19). Slide the backup ring (key 9) onto the valve plug. Secure with the retaining ring (key 10).

2. Install the valve plug into the cage.

TSO Trim

TSO trim: 0.8125 Inch Port Diameter (figure 7)

1. Thread the outer plug onto the inner plug until the parts seat metal to metal, using a strap wrench or similar tool that will not damage the outer plug guide surfaces.
2. Mark the inner plug and outer plug with alignment marks in the assembled position.
3. Disassemble the outer plug from the inner plug and install the seal over the inner plug, so that the seal rests below the threaded area.
4. Thread the outer plug onto the inner plug and tighten with a strap wrench or similar tool until the

alignment marks line up. This will ensure that the plug parts are metal to metal and the seal is compressed properly. Do not damage the outer plug guide surfaces.

5. Drill through the inner plug with the proper size drill bit (same size as stem pinning) and install the pin.

TSO trim: 1.6875 Inch Port Diameter (figure 8)

1. Thread the outer plug onto the inner plug until the parts seat metal to metal, using a strap wrench or similar tool that will not damage the outer plug guide surfaces.
2. Mark the top of the outer plug and stem with alignment marks in the assembled position.
3. Disassemble the outer plug from the inner plug and install the seal over the inner plug, so that the seal rests below the threaded area.
4. Thread the outer plug onto the inner plug and tighten with a strap wrench or similar tool until the alignment marks line up. This will ensure that the plug parts are metal to metal and the seal is compressed properly. Do not damage the outer plug guide surfaces.
5. Install set screws centering the stem in the outer plug and torque to 11 N•m (8 lbf•ft).
6. Assemble the piston ring, anti-extrusion rings, backup ring, and retainer.

TSO trim: 2.6875 Inch and Larger Port Diameters (figure 9)

1. Thread the outer plug onto the inner plug until the parts seat metal to metal, using a strap wrench or similar tool that will not damage the outer plug guide surfaces.
2. Mark the top of the inner plug and outer plug with alignment marks in the assembled position.
3. Disassemble the outer plug from the inner plug and install the seal over the inner plug, so that the seal rests below the threaded area.
4. Thread the outer plug onto the inner plug and tighten with a strap wrench or similar tool until the alignment marks line up. This will ensure that the plug parts are metal to metal and the seal is

compressed properly. Do not damage the outer plug guide surfaces.

5. Install set screws centering the inner plug in the outer plug and torque to 11 N•m (8 lbf•ft).
6. Assemble the piston ring, anti-extrusion rings, backup ring, and retainer.

All Constructions

1. Install the bonnet gasket (key 11) on the cage.
2. Install the bonnet over the valve stem and onto the valve body.

Note

The prelubricated hex nuts (key 14) referred to in step 7 can be identified by a black film coating on the nut threads.

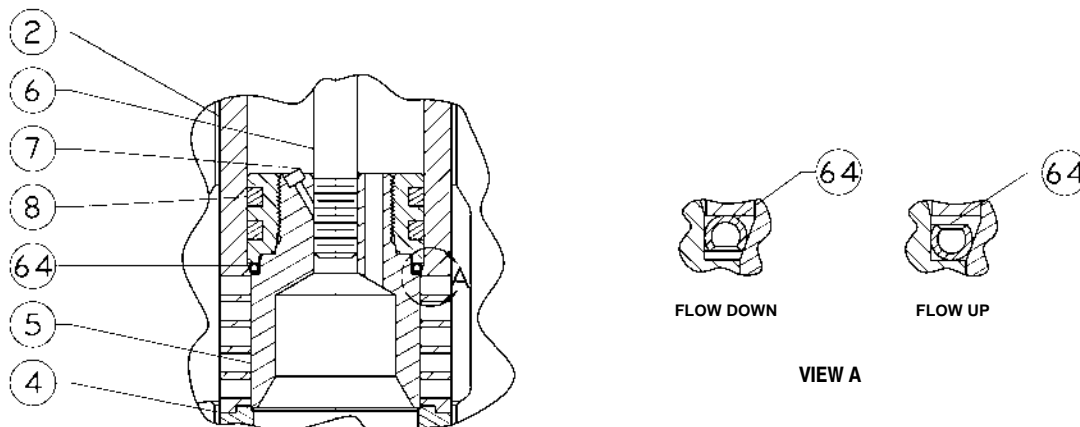
The proper bolting procedures in step 7 include—but are not limited to—ensuring that the bonnet stud threads are clean, and that the hex nuts are evenly tightened to the specified torque values.

CAUTION

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in table 8 may result in damage to the valve. Cheater bars or slug wrenches should not be used for this procedure.

Hot torquing is not recommended.

3. Lubricate the stud threads and the faces of the hex nuts (key 14) with Never-Seez Pure Nickel Special lubricant or equivalent (not necessary if new factory prelubricated hex nuts are used). Replace the hex nuts, but do not tighten them. Torque the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in table 8. When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.
4. Install new packing and packing box part per steps 12 and 13 of the Replacing Packing procedure. Be certain to observe the note given prior to step 12 of that procedure.



37B1399-A / IL

Figure 10. Design HPD with C-seal Trim

5. Mount the actuator by following the procedures in the actuator instruction manual. Check for packing leakage as the valve is being put into service. Retorque the packing flange nuts as required (see table 7).

Retrofit: Installing C-seal Trim

Note

Additional actuator thrust is required for a valve with C-seal trim. When installing C-seal trim in an existing valve, contact your Fisher sales office for assistance in determining new actuator thrust requirements.

Assemble the new valve plug/retainer assembly (with C-seal plug seal) using the following instructions:

CAUTION

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the new trim parts while assembling the individual parts and during installation in the valve body.

1. Apply a suitable high-temperature lubricant to the inside diameter of the C-seal plug seal. Also, lubricate the outside diameter of the valve plug

where the C-seal plug seal must be pressed into the proper sealing position (figure 10).

2. Orient the C-seal plug seal for correct sealing action based on the process fluid flow direction through the valve.

- The open interior of the C-seal plug seal must face up in a valve with flow-up construction (figure 10).
- The open interior of the C-seal plug seal must face down in a valve with flow-down construction (figure 10).

Note

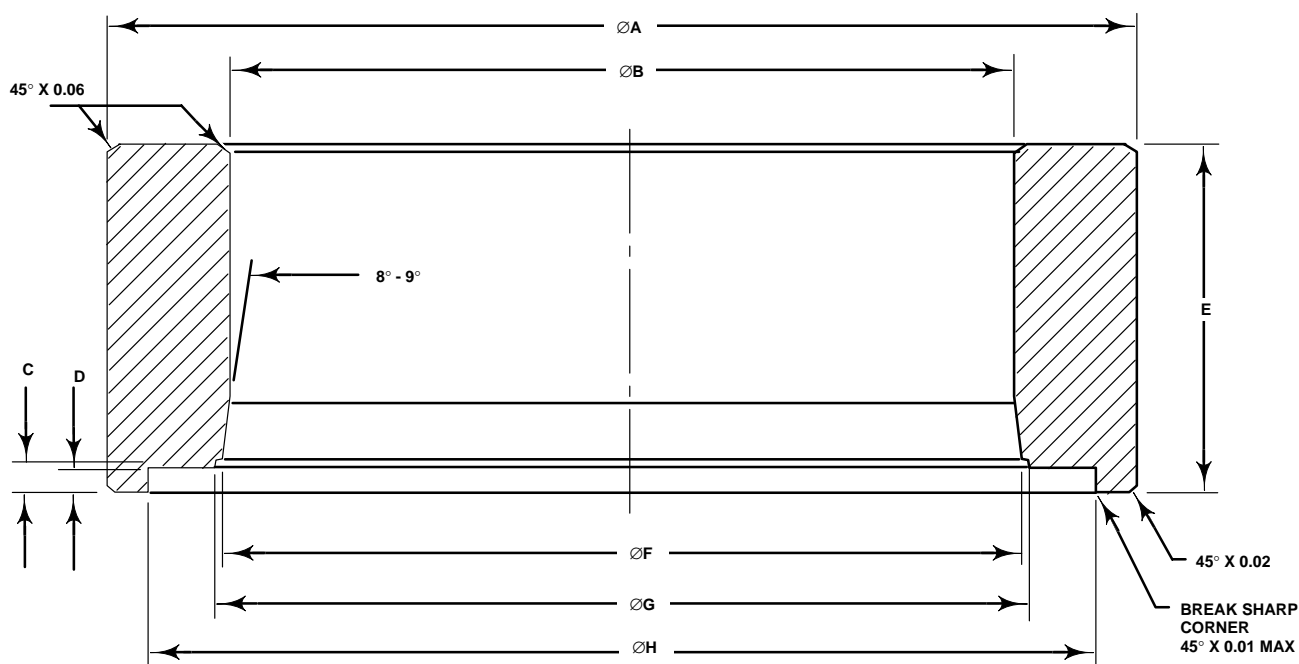
An installation tool must be used to properly position the C-seal plug seal on the valve plug. A tool is available as a spare part from Fisher or a tool could be manufactured following the dimensions given in figure 11.

3. Place the C-seal plug seal over the top of the valve plug and press the C-seal plug seal onto the plug using the C-seal installation tool. Carefully press the C-seal plug seal onto the plug until the installation tool contacts the horizontal reference surface of the valve plug (figure 12).

4. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the C-seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.

5. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place (figure 13) to secure the C-seal retainer.

FOR VALVE PLUGS FITTING PORT SIZE (Inches)	DIMENSIONS, INCHES (See Drawing Below)								PART NUMBER (To Order A Tool)
	A	B	C	D	E	F	G	H	
2.875	3.25	2.060 - 2.070	0.196 - 0.198	0.146 - 0.148	1.62	2.074 - 2.078	2.170 - 2.190	2.791 - 2.797	24B9816X012
3.4375	4.00	2.310 - 2.320	0.196 - 0.198	0.146 - 0.148	2.00	2.402 - 2.406	2.498 - 2.518	3.353 - 3.359	24B5612X012
3.625	4.11	2.560 - 2.570	0.196 - 0.198	0.146 - 0.148	2.00	2.714 - 2.718	2.810 - 2.830	3.541 - 3.547	24B3630X012
4.375	4.96	3.285 - 3.295	0.196 - 0.198	0.146 - 0.148	2.00	3.439 - 3.443	3.535 - 3.555	4.291 - 4.297	24B3635X012
5.375	5.62	3.940 - 3.950	0.196 - 0.198	0.146 - 0.148	1.81	4.088 - 4.092	4.184 - 4.204	5.048 - 5.054	23B9193X012
7	7.25	5.566 - 5.576	0.196 - 0.198	0.146 - 0.148	2.37	5.714 - 5.718	5.810 - 5.830	6.674 - 6.680	23B9180X012
8	8.25	6.566 - 6.576	0.196 - 0.198	0.146 - 0.148	2.20	6.714 - 6.718	6.810 - 6.830	7.674 - 7.680	24B9856X012



A6777 / IL

Figure 11. C-seal Plug Seal Installation Tool

6. Install the new plug/retainer assembly with C-seal plug seal on the new stem following the appropriate instructions in the Trim Replacement section in this manual.
7. Install piston rings by following instructions in the Trim Replacement section in this manual.
8. Remove the existing valve actuator and bonnet following the appropriate instructions in the Replacing Packing section in this manual.

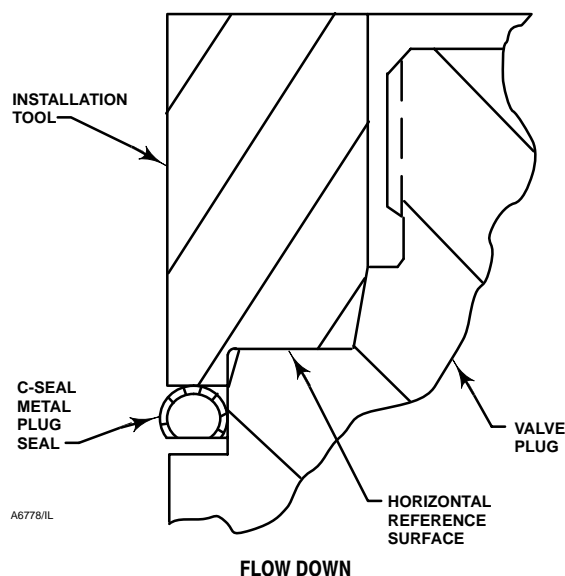
CAUTION

Do not remove the existing valve stem from the valve plug unless you are planning to replace the valve stem.

Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service. However, a used valve plug may be reused with a new valve stem.

9. Remove the existing valve stem and plug, cage, and seat ring from the valve body following the appropriate instructions in the Trim Removal section in this manual.

10. Replace all gaskets according to appropriate instructions in the Trim Replacement section in this manual.



NOTE: PRESS THE INSTALLATION TOOL OVER THE VALVE PLUG UNTIL THE TOOL CONTACTS THE HORIZONTAL REFERENCE SURFACE OF THE VALVE PLUG.

Figure 12. Installing the C-seal Plug Seal Using the Installation Tool

11. Install the new seat ring, cage, valve plug/retainer assembly, and stem into the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section in this manual.

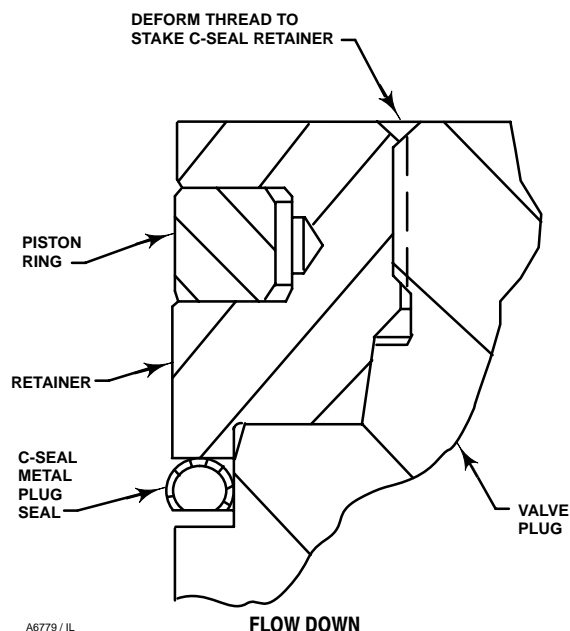


Figure 13. Stake the Threads of the C-seal Retainer

assembly, the cage, and the seat ring become a matched set.

With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

CAUTION

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the C-seal plug seal and contact the seat ring. You can correctly seat the valve plug by using the same force calculated for full load when sizing your actuator. With no pressure drop through the valve, this force will adequately drive the valve plug to the seat ring, thus giving the C-seal plug seal a predetermined permanent set. Once this is done, the plug/retainer

Replacement of Installed C-seal Trim

Trim Removal (C-seal Constructions)

1. Remove the valve actuator and bonnet following the appropriate instructions in the Replacing Packing section in this manual.

CAUTION

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the trim parts during maintenance.

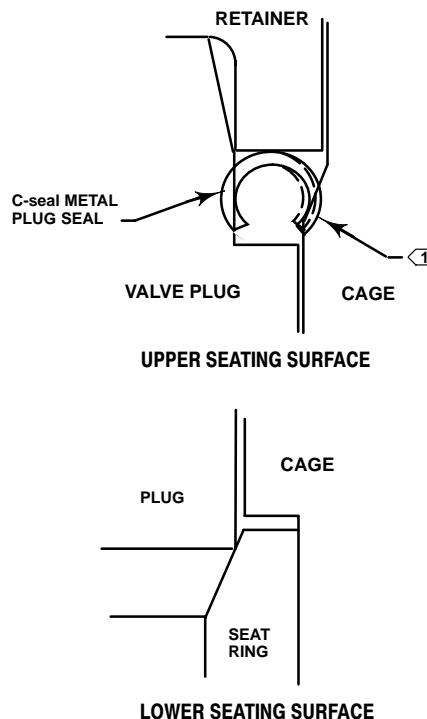
Use caution when removing piston ring(s) and C-seal plug seal to avoid scratching any sealing surface.

CAUTION

Do not remove the valve stem from the plug/retainer assembly unless you are planning to replace the valve stem.

Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service. However, a used valve plug may be reused with a new valve stem.

2. Remove the plug/retainer assembly (with C-seal plug seal), cage, and seat ring from the valve body following the appropriate instructions in the Trim Removal section in this manual.
3. Locate the staked thread on top of the valve plug (figure 13). The staked thread secures the retainer. Use a drill with a 0.125 inch bit to drill out the staked area of the thread. Drill approximately 1/8-inch into the metal to remove the staking.
4. Locate the break between sections of the piston ring(s). Using an appropriate tool such as a flat-blade screwdriver, carefully pry out the piston ring(s) from the groove(s) in the C-seal retainer.
5. After removing the piston ring(s), locate the 0.25-inch diameter hole in the groove. In a retainer with two piston ring grooves, the hole will be found in the upper groove.
6. Select an appropriate tool such as a punch and place the tip of the tool into the hole with the body of the tool held tangent to the outside diameter of the retainer. Strike the tool with a hammer to rotate the retainer and free it from the valve plug. Remove the retainer from the plug.
7. Use an appropriate tool such as a flat-blade screwdriver to pry the C-seal plug seal off the plug. Use caution to avoid scratches or other damage to the sealing surfaces where the C-seal plug seal makes contact with the valve plug (figure 14).
8. Inspect the lower seating surface where the valve plug contacts the seat ring for wear or damage which would prevent proper operation of the valve. Also, inspect the upper seating surface inside the cage where the C-seal plug seal contacts the cage, and inspect the sealing surface where the C-seal plug seal makes contact with the plug (figure 14).



NOTE:

1 UPPER SEATING SURFACE IS THE AREA OF CONTACT BETWEEN THE C-seal METAL PLUG SEAL AND THE CAGE.

A6780/IL

Figure 14. Lower (Valve Plug to Seat Ring) and Upper (C-seal Plug Seal to Cage) Seating Surfaces

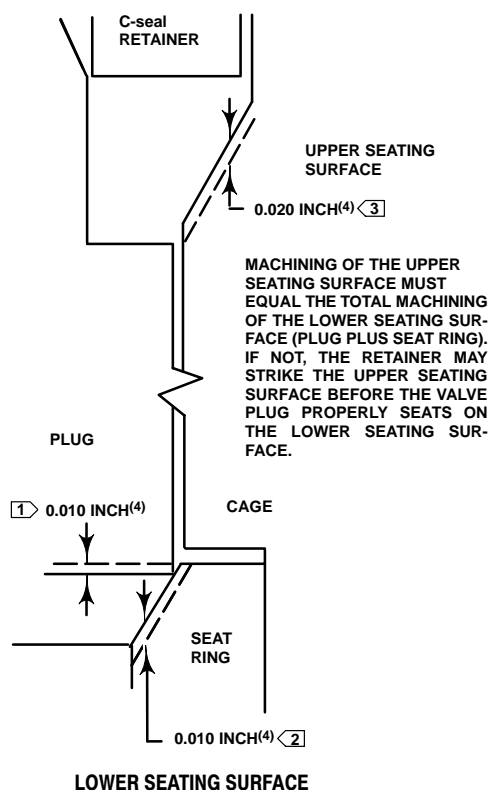
9. Replace or repair trim parts according to the following procedure for Lapping Metal Seats, Remachining Metal Seats, or other valve plug maintenance procedures as appropriate.

Lapping Metal Seats (C-seal Constructions)

Before installing a new C-seal plug seal, lap the lower seating surface (valve plug to seat ring, figure 14) following appropriate procedures in the Lapping Seats section in this manual.

Remachining Metal Seats (C-seal Constructions)

See figure 15. A valve plug with a C-seal metal plug seal features two seating surfaces. One seating surface is found where the valve plug contacts the seat ring. The second seating surface is found where the C-seal plug seal contacts the upper seating surface in the cage. If you machine the seats on the seat ring and/or plug, you must machine an equal dimension from the seating area in the cage.



NOTE:

- PLUS
MUST EQUAL
- ① REMOVAL OF 0.010 INCH FROM THE VALVE PLUG
 - ② REMOVAL OF 0.010 INCH FROM THE SEAT RING
 - ③ REMOVAL OF 0.020 INCH FROM THE UPPER SEATING SURFACE IN THE CAGE
 - 4. THESE VALUES ARE FOR EXAMPLE ONLY. REMOVE ONLY THE MINIMUM AMOUNT OF MATERIAL REQUIRED TO REFURBISH THE SEATS.

A6781 /IL

Figure 15. Example of Machining the Lower (Valve Plug to Seat Ring) and Upper (C-seal Plug Seal to Cage) Seating Surfaces

CAUTION

If metal is removed from the seat ring and plug and a corresponding amount is not removed from the cage seating area, the C-seal plug seal will be crushed as the valve closes and the C-seal retainer will strike the seating area of the cage, preventing the valve from closing.

Trim Replacement (C-seal Constructions)

1. Apply a suitable high-temperature lubricant to the inside diameter of the C-seal plug seal. Also, lubricate the outside diameter of the valve plug

where the C-seal plug seal must be pressed into the proper sealing position (figure 10).

2. Orient the C-seal plug seal for correct sealing action based on the process fluid flow direction through the valve.

- The open interior of the C-seal plug seal must face up in a valve with flow-up construction (figure 10).
- The open interior of the C-seal plug seal must face down in a valve with flow-down construction (figure 10).

Note

An installation tool must be used to properly position the C-seal plug seal on the valve plug. A tool is available as a spare part from Fisher or a tool could be manufactured following the dimensions given in Figure 11.

3. Place the C-seal plug seal over the top of the valve plug and press it onto the plug using the installation tool. Carefully press the C-seal plug seal onto the plug until the installation tool contacts the horizontal reference surface of the valve plug (figure 12).

4. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the C-seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.

5. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place (figure 13) to secure the C-seal retainer.

6. Replace the piston rings following instructions in the Trim Replacement section in this manual.

7. Return the seat ring, cage, plug/retainer assembly, and stem to the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section in this manual.

CAUTION

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the C-seal plug seal and contact the seat ring. You can correctly seat the valve plug by using the same force calculated for full load when sizing your actuator. With no pressure drop through the

valve, this force will adequately drive the valve plug to the seat ring, thus giving the C-seal plug seal a predetermined permanent set. Once this is done, the plug/retainer assembly, the cage, and the seat ring become a matched set.

With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

Parts Ordering

Each body-bonnet assembly is assigned a serial number, which can be found on the valve body. This same number also appears on the actuator nameplate when the valve body is shipped from the factory as part of a control valve assembly. Refer to the number when contacting your Fisher sales office

for technical assistance or when ordering replacement parts.

When ordering replacement parts, also be sure to include the 11-character part number for each part required from the following parts list.

Note

Use only genuine Fisher replacement parts. Components that are not supplied by Fisher should not, under any circumstances, be used in any Fisher valve, because they will void your warranty, might adversely affect the performance of the valve, and might jeopardize worker and workplace safety.

Note

Fisher does not assume responsibility for the selection, use, or maintenance of any product. Responsibility for proper selection, use, and maintenance of any Fisher product remains solely with the purchaser and end-user.

HP and HPA Valves

Parts Kits

Packing Kits (non live-loaded)

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	12.7 (0.5) 71 (2.8125)	19.1 (0.75) 90 (3.5625)
PTFE (Contains keys 22, 24, 25, 26, 27)	RPACKX00022	RPACKX00032
Double PTFE (Contains keys 22, 24, 26, 27)	RPACKX00052	RPACKX00062
PTFE/Composition (Contains keys 23, 24, 25, 26)	RPACKX00082	RPACKX00092
Single Graphite Ribbon/Filament (Contains keys 23, 23, 24, 26)	RPACKX00112	RPACKX00122
Double Graphite Ribbon/Filament (Contains keys 23, 23, 24, 26)	RPACKX00172	RPACKX00182

Repair Kits (ENVIRO-SEAL)

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	12.7 (0.5) 71 (2.8125)	19.1 (0.75) 90 (3.5625)	25.4 (1) 127 (5)	31.8 (1.25) 127 (5, 5H)
Double PTFE (Contains keys 214, 215, 218)	RPACKX00202	RPACKX00212	RPACKX00222	RPACKX00232
Graphite ULF (Contains keys 207, 208, 209, 210, 214)	RPACKX00602	RPACKX00612	RPACKX00622	RPACKX00632
Duplex (Contains keys 207, 209, 214, 215)	RPACKX00302	RPACKX00312	RPACKX00322	RPACKX00332

Retrofit Kits (ENVIRO-SEAL)

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	12.7 (0.5) 71 (2.8125)	19.1 (0.75) 90 (3.5625)	25.4 (1) 127 (5)	31.8 (1.25) 127 (5, 5H)
Double PTFE (Contains keys 200, 201, 211, 212, 214, 215, 216, 217, 218, tag, cable tie)	RPACKXRT022	RPACKXRT032	RPACKXRT042	RPACKXRT052
Graphite ULF (Contains keys 200, 201, 207, 208, 209, 210, 211, 212, 214, 217, tag, cable tie)	RPACKXRT272	RPACKXRT282	RPACKXRT292	RPACKXRT302
Duplex (Contains keys 200, 201, 207, 209, 211, 212, 214, 215, 216, 217, tag, cable tie)	RPACKXRT222	RPACKXRT232	RPACKXRT242	RPACKXRT252

Parts List

Numerous available combinations of valve parts make selection of some parts difficult; when ordering valve parts for which a part number is not listed, provide the valve serial number with the order, permitting proper selection of replacement parts to be made at the factory.

Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your Fisher sales office.

Key	Description	Part Number
1	Valve Body If you need a valve body as a replacement part, order by valve size, serial number, and desired material.	---
2*	Cage/Baffle Assy	See following table
3	Bonnet Spacer	See following table
4*	Seat Ring	See following table
5*	Valve Plug	See following table
6*	Valve Stem	See following table
7*	Pin	See following table
8*	Seal Ring/Piston Ring	See following table
9*	Back Up Ring	See following table

Key	Description	Part Number
10*	Retaining Ring (for Design HPT/HPAT only) S30200 (302 SST) For 38.1 mm (1.5 inch) port diameter For 47.6 mm (1.875 inch) port diameter For 63.5 mm (2.5 inch) port diameter For 73.0 mm (2.875 inch) port diameter For 87.3 mm (3.4375 inch) port diameter For 98.4 mm (3.625 inch) port diameter For 111.1 mm (4.375 inch) port diameter For 115.8 mm (4.5625 inch) port diameter For 133.4 mm (5.25 inch) port diameter For 136.5 mm (5.375 inch) port diameter N07750 (Inconel X750) for NACE For 38.1 mm (1.5 inch) port diameter For 47.6 mm (1.875 inch) port diameter For 63.5 mm (2.5 inch) port diameter For 73.0 mm (2.875 inch) port diameter For 87.3 mm (3.4375 inch) port diameter For 98.4 mm (3.625 inch) port diameter For 111.1 mm (4.375 inch) port diameter For 115.8 mm (4.5625 inch) port diameter For 133.4 mm (5.25 inch) port diameter For 136.5 mm (5.375 inch) port diameter	13A8519X012 10A4220X012 17A4311X012 10A4219X012 10A5350X012 16A5484X012 10A4225X012 17A4415X012 17A4398X012 10A5410X012 13A8519X032 10A4220X082 17A4311X032 10A4219X082 10A5350X082 16A5484X052 10A4225X062 17A4415X032 17A4398X042 10A5410X052
11*	Bonnet Gasket	See following table
12*	Seat Ring Gasket	See following table
13	Stud, Cont Thd	
14	Hex Nut	
15	Lubricant (Never-Seez Nickel Special 8 lb [3.6 Kg] can)	
16	Nameplate	
17	Wire	

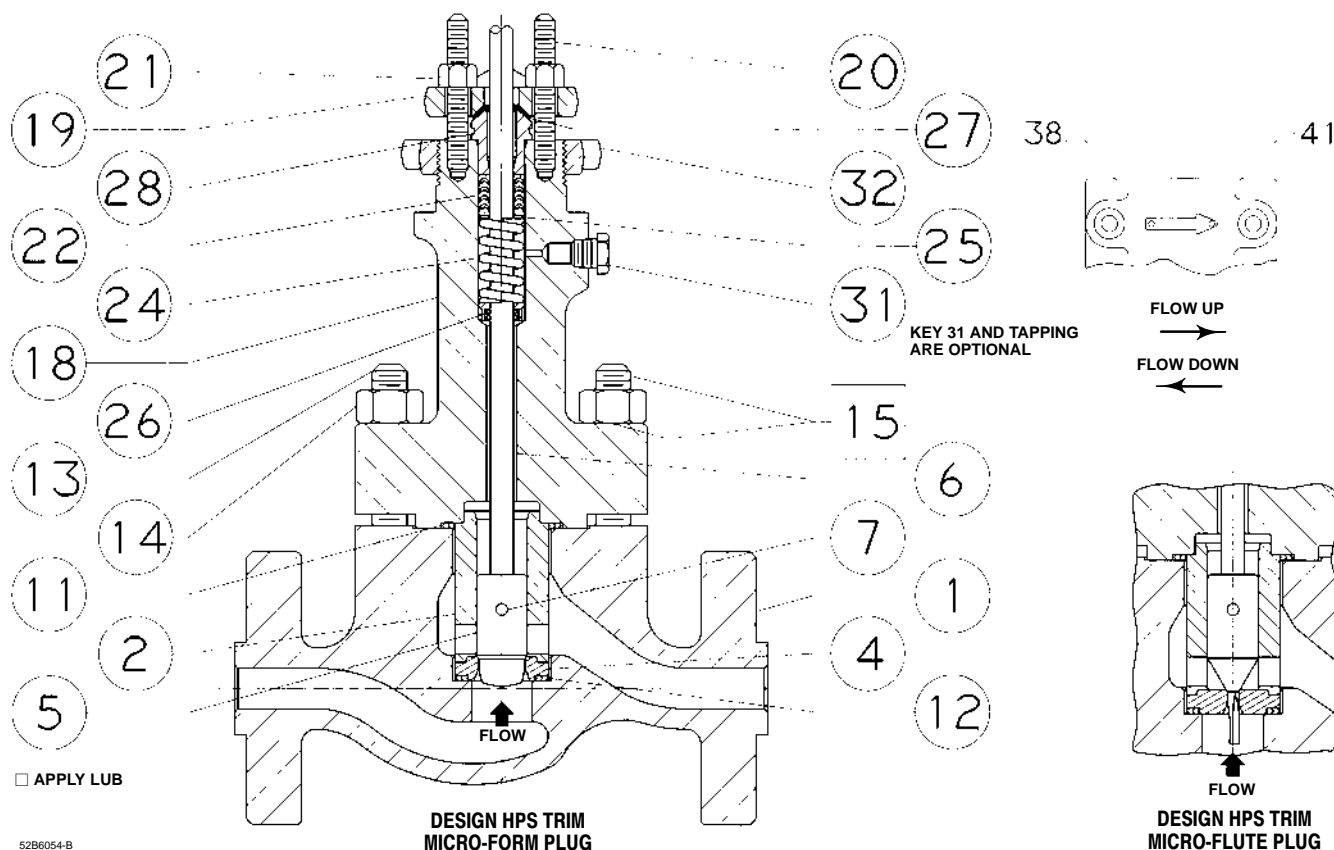


Figure 16. Size 1 Design HPS Valve

Key	Description	Part Number	Key	Description	Part Number
18	Bonnet---		39*	Piston Ring	See following table
	If you need a bonnet as a replacement part, order by valve size and stem diameter, serial number, and desired material.		40	Washer	
19	Packing Flange		41	Flow Arrow	
20	Stud Bolt		63*	Anti-Extrusion Ring	See following table
21	Hex Nut				
22*	Packing Set	See following table			
23*	Packing Ring	See following table			
24	Spring or Lantern Ring				
25	Washer, Special				
26*	Packing Box Ring	See following table			
27*	Upper Wiper	See following table			
28	Follower				
29	Stud Bolt				
30	Hex Nut				
31	Pipe Plug (optional)				
31	Lubricator (optional)				
31	Lubricator/Isolating Valve (optional)				
32	Yoke Locknut (optional)				
36	Baffle				
37	Retaining Ring				
38	Drive Screw				

C-seal Trim (figure 10)

2*	Cage	See following table
4*	Seat Ring	See following table
5*	Valve Plug/Retainer	See following table
6*	Valve Plug Stem, Nitronic 50	See following table
8*	Piston Ring, graphite (2 req'd)	See following table
64*	C-seal, Inconel	See following table

TSO Trim (figures 7, 8, and 9)

2*	Cage	See following table
4*	Seat Ring	See following table
5*	Plug/Stem Assembly	See following table
8*	Seal Ring	See following table
63*	Anti-Extrusion Ring	See following table
9*	Back Up Ring	See following table
10*	Retaining Ring	See following table

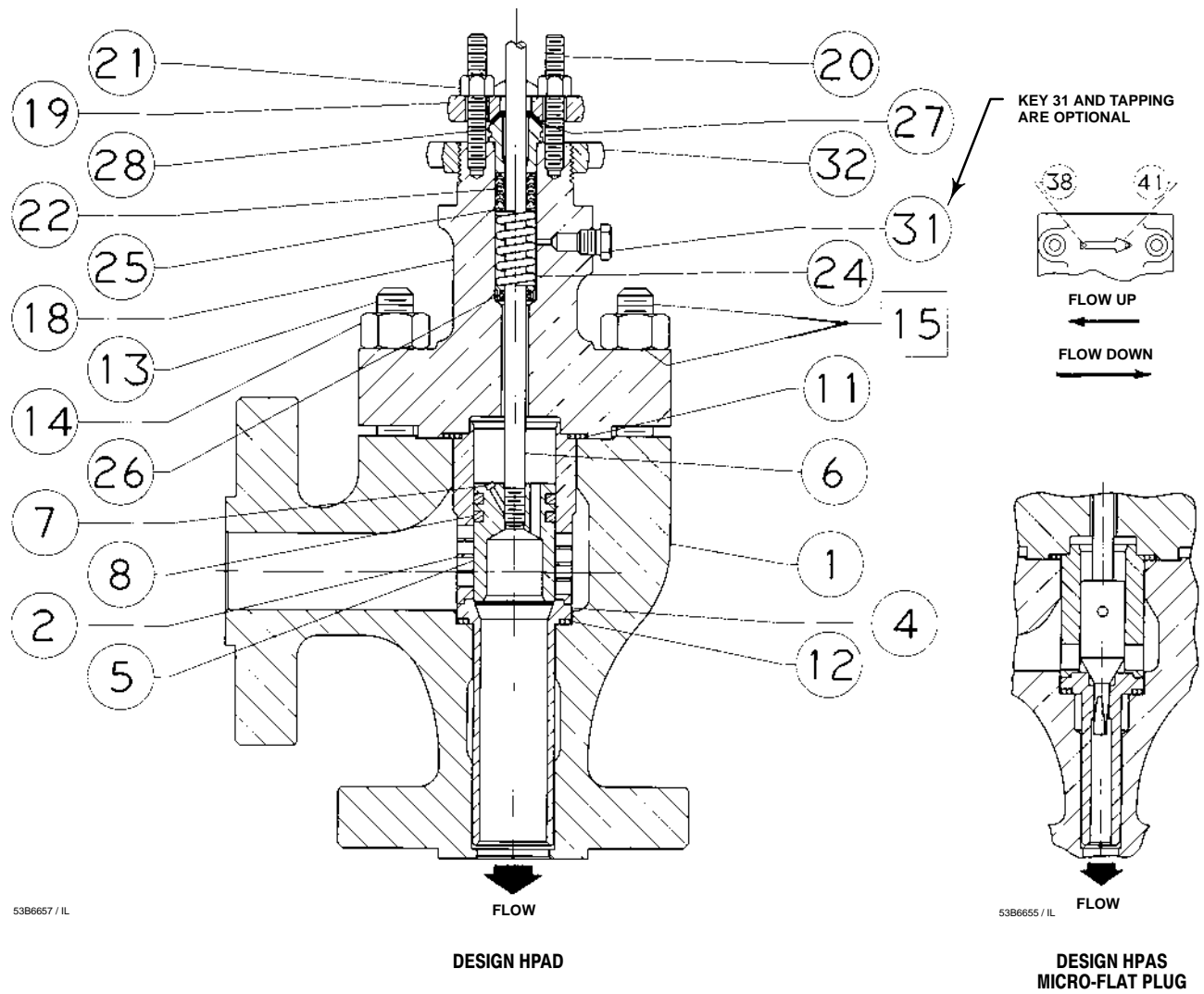
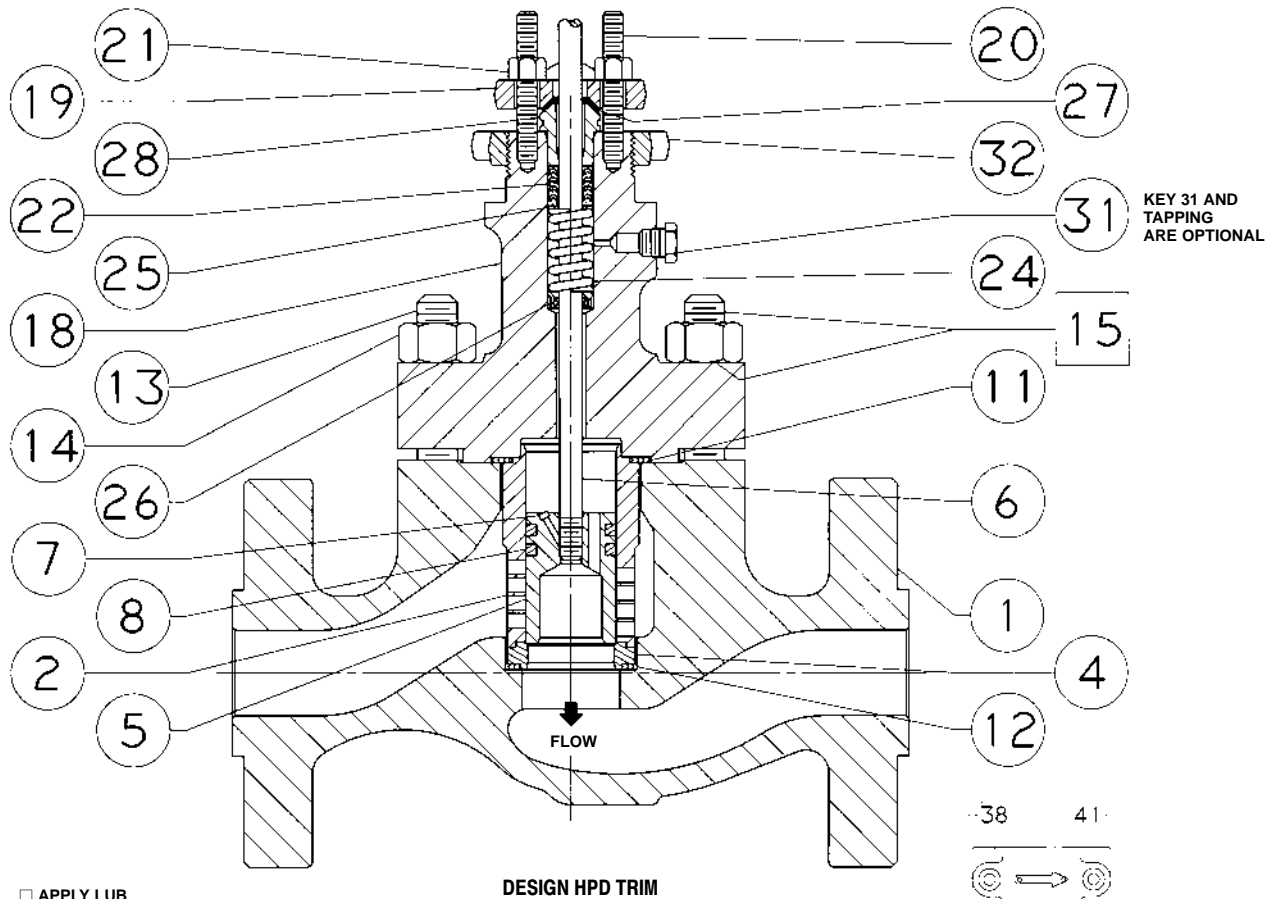
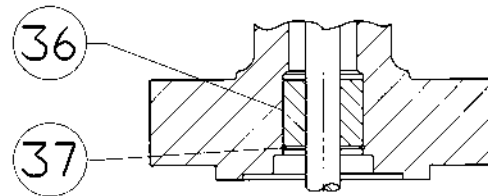
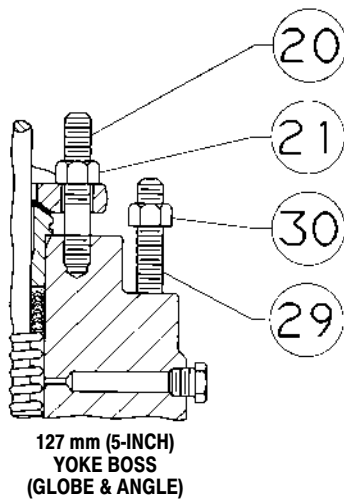


Figure 17. Size 2 HPAD Valve



□ APPLY LUB



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Figure 18. Size 2-6 Design HPD Valve

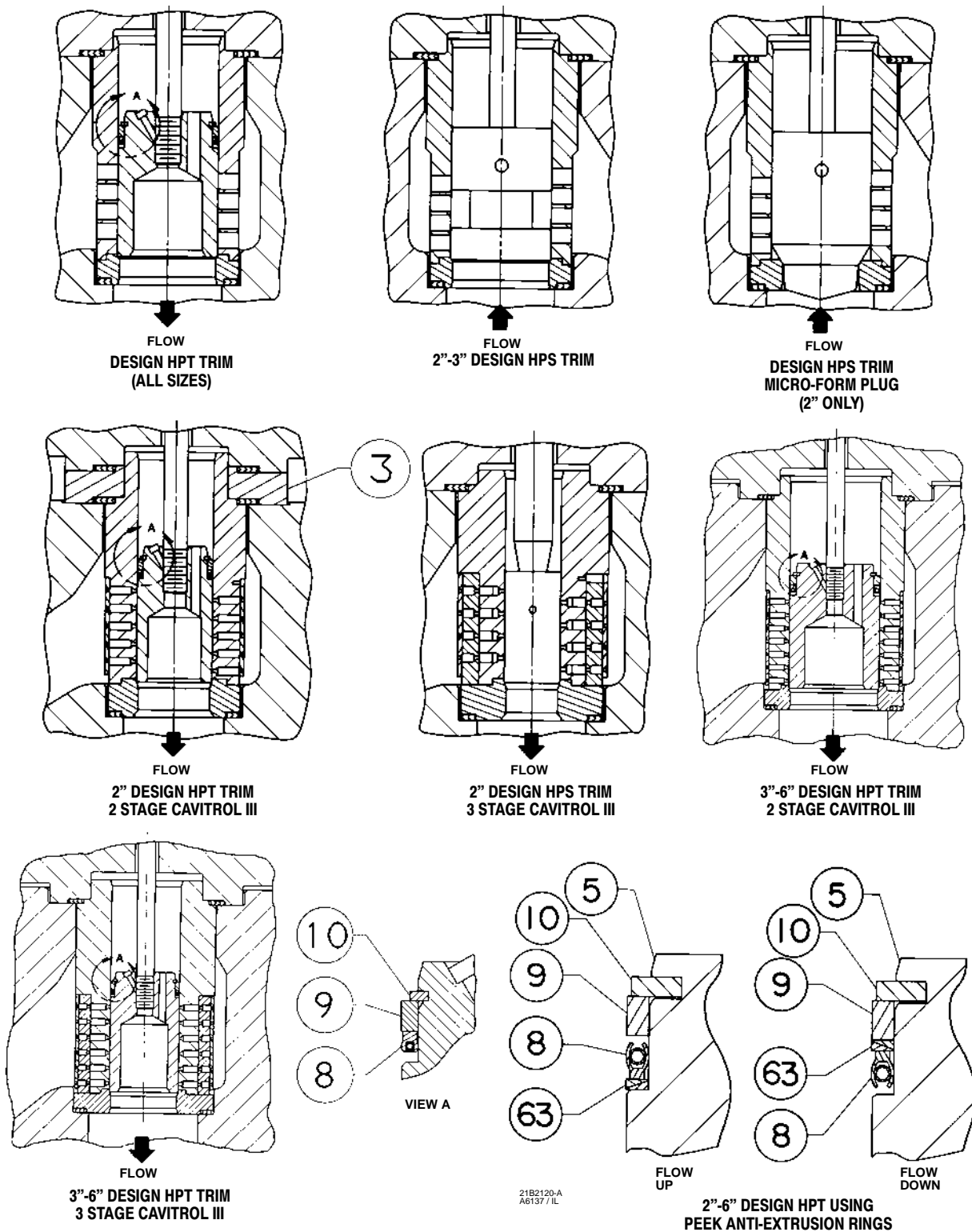
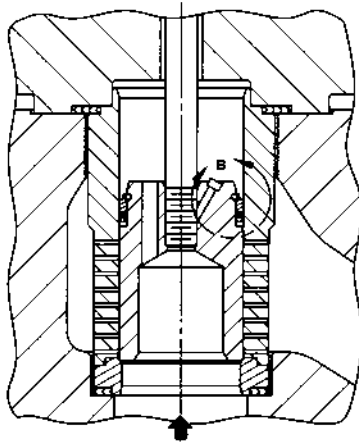
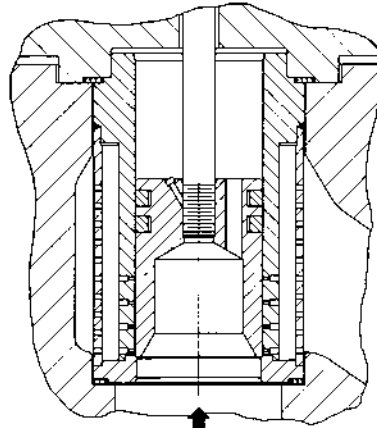


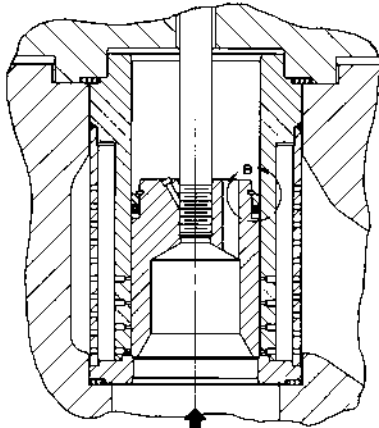
Figure 19. Size 2-6 Design HP Valve - Alternate Configurations



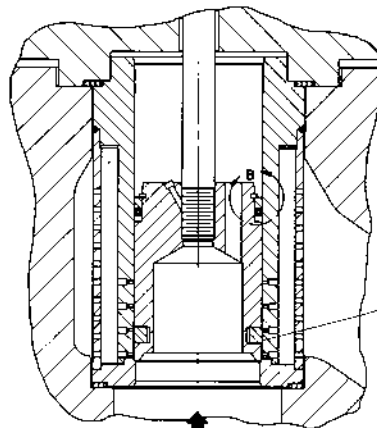
FLOW
DESIGN HPT TRIM WHISPER III,
AVAILABLE IN DESIGN HPD
(2"-6")
AND DESIGN HPS (2"-3")



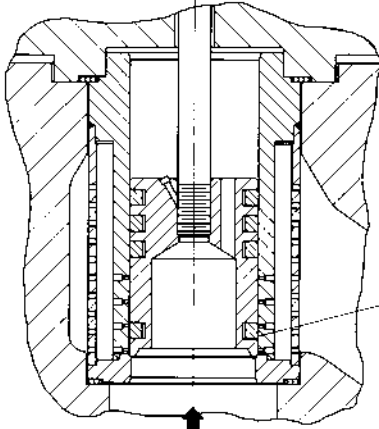
FLOW
4" DESIGN HPD TRIM
WHISPER III
LEVEL D



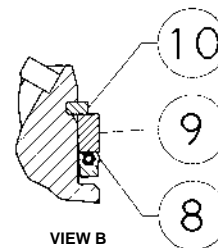
FLOW
4" DESIGN HPT TRIM WHISPER III
LEVEL D



FLOW
6" DESIGN HPT TRIM WHISPER III
LEVEL D



FLOW
6" DESIGN HPD TRIM WHISPER III
LEVEL D



VIEW B

52B6045-C / IL

Figure 19. Size 2-6 Design HP Valve - Alternate Configurations (Continued)

HP and HPA Valves

Keys 22*, 23*, 27*, 33*, 34*, and 35* Soft Packing Parts

PACKING ARRANGEMENT	KEY NUMBER	PACKING PART DESCRIPTION	VALVE STEM SIZE			
			12.7 mm (0.5 Inch)	19.1 mm (0.75 Inch)	25.4 mm (1-Inch)	31.8 mm (1.25 Inch)
PTFE	22	Packing set (1 req'd for single, 2 req'd for double) ⁽¹⁾ [includes keys 23, 33, 34, and 35]	1R290201012	1R290401012	1R290601012	1R290801012
	27	Upper Wiper	1J872706332	1J872806332	1J872906332	1J873006332
Low chloride graphite ribbon and filament, single	23	Graphite Ribbon Ring (2 req'd)	1V3802X0022	1V2396X0022	1U6768X0022	1V5666X0022
	23	Graphite Filament Ring [2 req'd for 12.7 mm (0.5 inch) stem; 3 req'd for all others]	1E3190X0222	1E3191X0282	1D7518X0132	1D7520X0162
Low chloride graphite ribbon and filament, double	23	Graphite Ribbon Ring (3 req'd)	1V3802X0222	1V2396X0022	1U6768X0022	1V5666X0022
	23	Graphite Filament Ring [4 req'd for 12.7 mm (0.5 inch) stem; 5 req'd for all others]	1E3190X0222	1E3191X0282	1D7518X0132	1D7520X0162
PTFE/composition, double	23	Packing Ring [10 req'd for 12.7 mm (0.5 inch) stem; 8 req'd for all others]	1E3199001042	1E319101042	1D7518X0012	1D7520X0012
	27	Upper Wiper	1J872706332	1J872806332	1J872906332	1J873006332

*Recommended spare part.

1. Key 22 for double construction contains one extra Lower Wiper for all stem sizes. Discard upon assembly.

Key 26* Packing Box Ring

PACKING TYPE	QUANTITY REQUIRED		VALVE STEM CONNECTION		MATERIAL
	Single Packing	Double Packing	mm	Inches	S31600 (316) Stainless Steel
PTFE V-Ring	1	1	12.7	0.5	1J873235072
	1	1	19.1	0.75	1J873335072
	1	1	25.4	1	1J873435072
	1	1	31.8	1.25	1J873535072
Low Chloride Graphite Ribbon and Filament	1	1	12.7	0.5	1J873235072
	1	1	19.1	0.75	1J873335072
	1	1	25.4	1	1J873435072
	1	1	31.8	1.25	1J873535072
PTFE/Composition	---	1	12.7	0.5	1J873235072
	---	1	19.1	0.75	1J873335072
	---	1	25.4	1	1J873435072
	---	1	31.8	1.25	1J873535072

Key 2* Cage for Valves Without Whisper Trim III Cage or Cavitrol III Trim

VALVE SIZE, INCHES	CAGE DESCRIPTION	TRAVEL		MATERIAL			
		mm	Inches	S17400 (17-4 SST) w/H1075 Heat Treatment	SA-182-F22 Ion Nitride	S31600 (316 Stainless Steel) Electrolyzed	NACE MR0175 S17400 H1150 DBL
1	Quick opening	29	1.125	22B6047X012	22B6047X022	22B6048X012	22B6047X032
2	Equal percentage Linear	29, 38	1.125, 1.5, 1.5	32B6028X012	32B6028X022	32B6029X012	32B6028X032
		38		32B6025X012	32B6025X022	32B6026X012	32B6025X032
3	Equal percentage Linear	38, 51	1.5, 2, 2	42B8240X012	42B8240X022	42B8241X012	42B8240X032
		51		42B8242X012	42B8242X022	42B8243X012	42B8242X032
4	Equal percentage Linear	38, 51	1.5, 2, 2	42B9320X012	42B9320X022	42B9321X012	42B9320X032
		51		42B9322X012	42B9322X022	42B9323X012	42B9322X032
6	Equal percentage Linear	64, 76	2.5, 3, 3	43B0261X012	43B0261X022	43B0080X012	43B0261X032
		76		43B0079X012	43B0079X022	43B0081X012	43B0079X032

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Key 2* Cage for Angle Valves with Restricted Port Equal Percentage Trim

VALVE RATING	VALVE SIZE, INCHES	PORT DIAMETER	TRAVEL		MATERIAL			
			mm	Inches	S17400 (17-4 SST) w/H1075 Heat Treatment	SA-182-F22 Ion Nitride	S31600 (316 Stainless Steel) Electrolyzed	NACE MR0175-90 S17400 H1150 DBL
Class 1500	1	0.75	19, 29	0.75, 1.125	23B6618X012	23B6618X022	23B6619X012	23B6618X032
	2	0.75	19, 29	0.75, 1.125	33B6642X012	33B66420X22	33B6643X012	33B6642X032
		1	19, 29	0.75, 1.125	33B6628X012	33B6628X022	31B2079X012	33B6628X032
		1.25	19, 29	0.75, 1.125	33B6631X012	33B6631X022	31B2080X012	33B6631X032
		1.5	29, 38	1.125, 1.5	32B4234X012	32B4234X022	31B2086X012	32B4234X032

Key 2* Cage or Cage and Baffle Assembly for Valves with Whisper Trim III Cage

VALVE RATING	VALVE SIZE, INCHES	CAGE DESCRIPTION	PORT DIAMETER		TRAVEL		MATERIAL		
			mm	Inches	mm	Inches	S17400 (17-4 Stainless Steel) with H1075 Heat Treatment	S17400 Stainless Steel with H1150 Heat Treatment For Sour Gas Service	F22 Ion Nitride
Class 1500	2	Level A1	47.6	1.875	51	2	32B6057X012	32B6057X032	32B6057X022
	3	Level A1	73.0	2.875	51	2	42B8244X012	42B8244X032	42B8244X022
		Level B1	73.0	2.875	51	2	42B8245X012	42B8245X032	42B8245X022
	4	Level A1	92.1	3.625	51	2	32B9324X012	32B9324X022	32B9324X032
		Level A3	92.1	3.625	51	2	32B9325X012	32B9325X022	32B9325X032
		Level B3	92.1	3.625	51	2	32B9326X012	32B9326X022	32B9326X032
		Level C3	92.1	3.625	51	2	32B9327X012	32B9327X022	32B9327X032
		Level D3 ⁽¹⁾	73.0	2.875	51	2	32B9328X012	32B9328X022	32B9328X032
	6	Level A1	136.5	5.375	76	3	43B0082X012	43B0082X022	43B0082X032
		Level B3	136.5	5.375	76	3	43B0083X012	43B0083X022	43B0083X032
		Level C3	136.5	5.375	76	3	43B0084X012	43B0084X022	43B0084X032
		Level D3 ⁽¹⁾	111.1	4.375	76	3	33B0085X012	33B0085X022	33B0085X032

1. Cage and baffle assembly.

Key 2* Cage Assembly for Design HPS, HPAS⁽¹⁾, HPT, or HPAT⁽¹⁾ Valves with Cavitrol III Trim

VALVE RATING	VALVE SIZE, INCHES	CAGE ASSEMBLY DESCRIPTION	PORT DIAMETER		TRAVEL		MATERIAL	
			mm	Inches	mm	Inches	S17400 (17-4 Stainless Steel) w/H1075 Heat Treatment	S17400 w/H1150 Heat Treatment for Sour Gas Service
Class 1500	1	Full 2-stage	22.2	0.875	38	1.5	32B8266X022	32B8266X012
	2	Full 2-stage	44.5	1.75	51	2	33B0160X012	33B0160X022
		Full 3-stage	25.4	1	51	2	32B6070X012	32B6070X022
	3	Full 2-stage	63.5	2.5	64	2.5	32B8522X012	32B8522X022
		Full 3-stage	47.6	1.875	64	2.5	32B8255X012	32B8255X022
	4	Full 2-stage	87.3	3.4375	76	3	32B9331X012	32B9331X022
		Full 3-stage	73	2.875	76	3	32B9334X012	32B9334X022
	6	Full 2-stage	133.4	5.25	102	4	33B0088X012	33B0088X022
		Full 3-stage	115.8	4.5625	102	4	33B0091X012	33B0091X022

1. 1- and 2-inch only.

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C-seal Parts for Design HPD Valve (Keys 2*, 5*, 4*, 64*, 8*, and 6*)

VALVE SIZE	PORT DIA	TRAVEL	TRIM	STEM DIAMETER		CHARACTER-ISTIC	CAGE	PLUG/ RETAINER	SEAT RING	C-seal	PISTON RING (2 req'd)	STEM
Inch	Inch	Inch		mm	Inch		Key 2	Key 5	Key 4	Key 64	Key 8	Key 6
3	2.875	2	201B	19.1	0.75	Linear	44B9820X012	27B1676X012	22B6095X012	24B3621X012	14B3620X012	1U3416X0042
						Equal %	47B1674X012					
			202	19.1	0.75	Linear	---	24B7070X012	22B6095X012	24B3621X012	14B3620X012	1U3416X0042
						Equal %	44B7068X012					
			208	19.1	0.75	Whisper III-A1	47B2276X012	24B7070X012	22B6095X012	24B3621X012	14B3620X012	1U3416X0042
						Whisper III-B1	48B0643X012					
			210	25.4	1	Linear	44B9820X012	24B9822X012	22B6095X012	24B3621X012	14B3620X012	1K7447X0042
						Equal %	47B1674X012					
4	3.625	2	201B	19.1	0.75	Linear	---	37B2274X012	22B9339X012	23B9198X012	14B5340X012	10A9265XV62
						Equal %	47B1672X012					
			202	19.1	0.75	Linear	44B3622X012	34B5342X022	22B9339X012	23B9198X012	14B5340X012	10A9265XV62
						Equal %	---					
				25.4	1	Linear	44B3622X012	34B5342X012	22B9339X012	23B9198X012	14B5340X012	11A3429XG52
						Equal %	---					
			203	25.4	1	Whisper III-A1	34B9836X012	34B9837X012	22B9339X012	23B9198X012	14B5340X012	11A3429XG52
			208	19.1	0.75	Whisper III-C3	34B5343X012	34B5342X022	22B9339X012	23B9198X012	14B5340X012	10A9265XV62
				25.4	1	Whisper III-A1	37B0194X012	34B5342X012	22B9339X012	23B9198X012	14B5340X012	11A3429XG52
			6	5.375	3	202	25.4	1	Equal %	43B9204X012	34B3619X012	23B0094X012
207	25.4	1				Whisper III-B3	47B3201X012	37B3203X012	23B0093X012			
208	25.4	1				Whisper III-A1	47B3208X012	34B3619X012				
201B	31.8	1.25				Linear	47B8742X012	37B8744X012	23B0094X012			
208	31.8	1.25				Whisper III-A1	47B3208X012	34B3619X022		10A6073X072		

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TSO Parts for Design HPS and HPT Valves (Keys 2*, 4*, and 5*)

VALVE SIZE	PORT DIA	TVL	TRIM	STEM DIAMETER		ACTUATOR GROUP	CHARACTER- ISTIC	CAGE	SEAT RING	PLUG/ STEM ASSY
Inch	Inch	Inch		mm	Inch			Key 2	Key 4	Key 5
2-In HPS	0.8125	2	810A	19.1	0.75	1	Cavitrol III 3-Stage	32B6070X012	37B9555X012	27B9559X022
			816					32B6070X012	38B1877X012	27B9559X032
3-In HPT	1.6875	2.5	810A	12.7	0.5	400	Cavitrol III 3-Stage	32B8255X012	27B6587X012	27B3115X022
			816					32B8255X022	27B6588X012	27B3115X032
			810A	19.1	0.75	1		32B8255X012	27B6587X012	27B3115X042
			816					32B8255X022	27B6588X012	27B3115X052
4-In HPT	2.6875	3	810A	19.1	0.75	1	Cavitrol III 3-Stage	32B9334X012	27B6596X012	27B6604X012
			816					32B9334X022	27B6597X012	27B6604X022
			810A	25.4	1	100 & 101		32B9334X012	27B6596X012	27B6604X032
			816					32B9334X022	27B6597X012	27B6604X042
6-In HPT	4.375	4	810A	19.1	0.75	401, 403 402	Cavitrol III 3-Stage	33B0091X012	38B2652X012	38B2647X012 38B2647X022
			816			401, 403 402		33B0091X022	38B2653X012	38B2647X052 38B2647X062
			810A	25.4	1	404 405, 406 407		33B0091X012	38B2652X012	38B2654X012 38B2654X022 38B2654X032
			816			404 405, 406 407		33B0091X022	38B2653X012	38B2654X072 38B2654X082 38B2654X092
6-In HPT	5.1875	2.5 & 3	812	19.1	0.75	1	Linear Equal %	43B0079X012 43B0261X012	38B2283X012	38B2274X012
			818			1	Linear Equal %	43B0079X032 43B0261X032	38B2284X012	38B2274X032
		2.5	812	25.4	1	100	Linear Equal %	43B0079X012 43B0261X012	38B2283X012	38B2275X012
						100	Linear Mod Equal %	43B0079X012 43B0261X012		38B2275X022
		3				101	Linear Mod Equal %	43B0079X012 43B0261X012		38B2275X022
		2.5	818	25.4	1	100	Linear Equal %	43B0079X032 43B0261X032	38B2284X012	38B2275X052
						100	Linear Mod Equal %	43B0079X032 43B0261X032		38B2275X062
						3	101	Linear Mod Equal %		43B0079X032 43B0261X032

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TSO Parts for Design HPS and HPT Valves (Keys 8*, 63*, 9*, and 10*)

VALVE SIZE	PORT DIA	TVL	TRIM	STEM DIAMETER		ACTUATOR GROUP	CHARACTER- ISTIC	SEAL RING	ANTI-EXT RING	BACKUP RING	RETAINING RING
Inch	Inch	Inch		mm	Inch			Key 8	Key 63	Key 9	Key 10
2-In HPS	0.8125	2	810A	19.1	0.75	1	Cavitrol III 3-Stage	---	---	---	---
			816							---	---
3-In HPT	1.6875	2.5	810A	12.7	0.5	400	Cavitrol III 3-Stage	10A4216X102	22B4694X012	10A4218X022	10A4220X012
			816							10A4218X012	10A4220X082
			810A	19.1	0.75	1				10A4218X022	10A4220X012
			816							10A4218X012	10A4220X082
4-In HPT	2.6875	3	810A	19.1	0.75	1	Cavitrol III 3-Stage	10A4215X102	22B2617X012	10A4217X012	10A4219X012
			816							10A4217X022	10A4219X052
			810A	25.4	1	100 & 101				10A4217X012	10A4219X012
			816							10A4217X022	10A4219X052
6-In HPT	4.375	4	810A	19.1	0.75	401, 403 402	Cavitrol III 3-Stage	17A4413X042	21B2141X012	17A4414X012	17A4415X042
			816			401, 403 402		17A4413X042	21B2141X012	17A4414X022	17A4415X032
			810A	25.4	1	404 405, 406 407		17A4413X042	21B2141X012	17A4414X012	17A4415X042
			816			404 405, 406 407		17A4413X042	21B2141X012	17A4414X022	17A4415X032
6-In HPT	5.1875	2.5 & 3	812	19.1	0.75	1	Linear Equal %	10A5411X102	21B9342X012	10A5409X012	10A5410X012
			818			1	Linear Equal %	10A5411X102	21B9342X012	10A5409X022	10A5410X052
		2.5	812	25.4	1	100	Linear Equal %	10A5411X102	21B9342X012	10A5409X012	10A5410X012
		3				100	Linear Mod Equal %				
		3				101	Linear Mod Equal %				
		2.5	818	25.4	1	100	Linear Equal %	10A5411X102	21B9342X012	10A5409X022	10A5410X052
		3				100	Linear Mod Equal %				
		3				101	Linear Mod Equal %				

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Key 4* Seat Ring for Constructions without Cavitrol III Cage

VALVE SIZE, INCHES	DESIGN	PORT DIAMETER		SEAT RING MATERIAL		
		mm	Inches	S41600 (416 SST)	S31600 (316 SST) CoCr-A Seat	S31600 CoCr-A Seat & Bore
1	Micro-Form, Micro-Flute	6.4	0.25	22B6020X012	---	22B6061X012
		9.5	0.375	22B6021X012	---	22B6062X012
		12.7	0.5	22B6022X012	---	22B6063X012
		19.1	0.75	22B6023X012	22B6064X012	---
		25.4	1	22B6019X012	22B6065X012	---
	HPAS	19.1	0.75	23B6626X012	23B6627X012	---
2	Micro-Form and Micro-Flute	6.4	0.25	23B0170X012	23B0171X012	---
		9.5	0.375	22B4186X012	22B4208X012	---
		12.7	0.5	23B0172X012	23B0173X012	---
		19.1	0.75	23B0174X012	23B0175X012	---
		25.4	1	23B0176X012	23B0177X012	---
		31.8	1.25	22B6000X012	22B6001X012	---
		38.1	1.5	22B6002X012	22B6003X012	---
	HPAS	19.1	0.75	23B6652X012	23B6653X012	---
		25.4	1	23B6629X012	22B4241X012	---
		31.8	1.25	23B6658X012	22B4242X012	---
		38.1	1.5	22B4235X012	22B4243X012	---
	HPD, HPT, HPS	47.6	1.875	22B6004X012	22B6005X012	---
3	All	73.0	2.875	22B6094X012	22B6095X012	---
4	HPD and HPT Whisper III Level A1, A3, B3, C3	92.1	3.625	22B9338X012	22B9339X012	---
	HPD and HPT Whisper III Level D3	73.0	2.875	22B9340X012	22B9341X012	---
6	HPD and HPT Whisper III Level A1, B3, C3	136.5	5.375	23B0093X012	23B0094X012	---
	HPD and HPT Whisper III Level D3	111.1	4.375	23B0095X012	23B0096X012	---

Key 4* Seat Ring for Valve with Cavitrol III Trim

VALVE RATING, CLASS	VALVE SIZE, INCHES	2-STAGE		3-STAGE	
		S44004 (440C SST) with Heat Treatment	S31600 (316 SST) CoCr-A	S44004 with Heat Treatment	S31600 CoCr-A
1500	1	22B8353X012	22B8354X012	---	---
	2	23B0163X012	23B0164X012	22B6068X012	22B6069X012
	3	22B6096X012	22B6097X012	22B6098X012	22B6099X012
	4	22B9342X012	22B9343X012	22B9344X012	22B9345X012
	6	23B0097X012	23B0098X012	23B0099X012	23B0100X012

HP and HPA Valves

Key 4* Seat and Liner for Butt weld End and Socket Weld End Angle Valves

VALVE RATING, CLASS	VALVE SIZE, INCHES	DESIGN	PORT DIAMETER		SEAT AND LINER MATERIAL	
			mm	Inches	S44004 (440C SST)	R30006 (Alloy 6)
1500	1	Micro-Flute	6.4	0.25	23B6623X012	23B6623X022
			9.5	0.375	23B6625X012	23B6625X022
			12.7	0.5	23B6624X012	23B6624X022
	2	Micro-Flute	6.4	0.25	23B6650X012	23B6650X022
			9.5	0.375	23B7141X012	23B7141X022
			12.7	0.5	23B6651X012	23B6651X022
		HPAS	19.1	0.75	23B6647X012	23B6647X022
			25.4	1	23B7143X012	23B7143X022
			31.8	1.25	23B7145X012	23B7145X022
			38.1	1.5	23B7147X012	23B7147X022
		HPAD, HPAT	47.6	1.875	23B6645X012	23B6645X022

Key 4* Seat and Liner for ANSI and DIN Flanged Angle Valves

VALVE RATING, CLASS	VALVE SIZE, INCHES	DESIGN	PORT DIAMETER		SEAT AND LINER MATERIAL	
			mm	Inches	S44004 (440C SST)	R30006 (Alloy 6)
1500	1	Micro-Flute	6.4	0.25	23B6620X012	23B6620X022
			9.5	0.375	23B6622X012	23B6622X022
			12.7	0.5	23B6621X012	23B6621X022
	2	Micro-Flute	6.4	0.25	23B6648X012	23B6648X022
			9.5	0.375	23B7140X012	23B7140X022
			12.7	0.5	23B6649X012	23B6649X022
		HPAS	19.1	0.75	23B6646X012	23B6646X022
			25.4	1	23B7142X012	23B7142X022
			31.8	1.25	23B7144X012	23B7144X022
			38.1	1.5	23B7146X012	23B7146X022
		HPAD, HPAT	47.6	1.875	23B6644X012	23B6644X022

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Key 5* Valve Plug for Design HPS and HPAS Valves with Micro-Form Plug

VALVE SIZE, INCHES	VALVE STEM CONNECTION		PORT DIAMETER		MATERIAL		
					Trim 201A S41600 (416 Stainless Steel)	Size 1 Trim 202, 203, 204, 210 Size 2 Trim 202 S31600 (316 Stainless Steel) CoCr-A Seat, Guide, and Contour	Size 2 Trim 203, 204, 210 S31600 (316 Stainless Steel) CoCr-A Seat, Guide, and Contour
	mm	Inches	mm	Inches			
1	12.7	0.5	6.4	0.25	16A5327X012	16A5404X012	---
			9.5	0.375	12B2696X052	19A6765X032	---
			12.7	0.5	16A5328X012	16A5405X012	---
			19.1	0.75	16A5329X012	16A5406X012	---
			25.4	1	16A5331X012	16A5408X012	---
	19.1	0.75	19.1	0.75	16A5330X012	16A5407X012	---
			25.4	1	16A5332X012	16A5409X012	---
2	12.7	0.5	6.4	0.25	23B0188X012	23B0165X012	23B0165X022
			12.7	0.5	10B3297X012	11B7697X012	11B7697X042
			19.1	0.75	19A5980X042	18A4133X012	18A4133X022
			25.4	1	23B0166X012	23B0167X012	23B0167X022
			31.8	1.25	18A1637X012	28A1638X052	28A1638X012
			38.1	1.5	16A5402X012	26A5410X052	26A5410X012
	19.1	0.75	19.1	0.75	23B0168X012	19A7924X032	19A7924X052
			25.4	1	18A4222X012	10B8013X012	10B8013X042
			31.8	1.25	18A1639X012	28A1640X132	28A1640X012
			38.1	1.5	16A5333X012	26A5411X122	26A5411X012
	25.4	1	25.4	1	23B0169X012	12B0079X012	12B0079X022
			31.8	1.25	18A1641X012	28A1642X062	28A1642X012
			38.1	1.5	16A5334X012	26A5412X072	26A5412X012

Key 5* Valve Plug for 1-Inch Design HPS and HPAS Valves with Micro-Flute Plug (Flow-Up Only)

VALVE RATING	PLUG STYLE	PORT DIAMETER		MATERIAL	
				Trim 201A S44004 (440C Stainless Steel) with Heat Treatment	Trim 202, 203, 204 S31600 (316 Stainless Steel) with Alloy 6 (CoCr-A) Seat, Guide, and Tip
		mm	Inches		
Class 1500	1 Flute	6.4	0.25	18A1643X012	17A8607X052
	2 Flutes	6.4	0.25	18A1644X012	18A1646X012
	3 Flutes	6.4	0.25	18A1645X012	17A8608X052
	3 Flutes	9.5	0.375	18A1647X012	18A1648X012
	3 Flutes	12.7	0.5	18A1649X012	18A1650X012

Key 5* Valve Plug for Design HPAS Valves with Micro-Flute Plug (Flow-Down Only)

VALVE RATING	VALVE SIZE, INCHES	PLUG STYLE	PORT DIAMETER		MATERIAL		
					Trim 201A S44004 (440C Stainless Steel) with Heat Treatment	Size 1 Trim 202, 203, 204 Size 2 Trim 202 S31600 (316 Stainless Steel) with Alloy 6 (CoCr-A) Seat, Guide, and Tip	Size 2 Trim 203, 204
			mm	Inches			
1500	1	1 Flute	6.4	0.25	18A1643X012	17A8607X052	---
			9.5	0.375	21B4245X012	21B4240X012	---
			12.7	0.5	21B4246X012	21B4243X012	---
		2 Flute	12.7	0.5	21B4244X012	21B4230X012	---
	2	1 Flute	6.4	0.25	21B4247X012	21B4254X012	21B4254X022
			9.5	0.375	21B4251X012	21B4255X012	21B4255X022
			12.7	0.5	21B4252X012	21B4259X012	21B4259X022
		2 Flute	12.7	0.5	22B5881X012	22B5882X012	22B5882X022

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Key 5* Valve Plug for Cavitrol III Trim

VALVE SIZE	VALVE DESIGN	CAGE ASSEMBLY DESCRIPTION	ACTUATOR GROUP	VALVE STEM CONNECTION		PORT DIAMETER		MATERIAL		
				mm	Inches	mm	Inches	S44004 (440C Stainless Steel) w/ Heat Treatment w/ S20910 Stem	S31600 (316 Stainless Steel) w/ CoCr-A Seat and Guide w/ S20910 Stem	S31600 w/ CoCr-A Seat and Guide w/ S31600 Stem
1	HPS, HPAS	2-stage	1	12.7	0.5	22.2	0.875	22B8351X022	22B8352X022	22B8351X042
			1	19.1	0.75	22.2	0.875	22B8351X032	22B8352X032	22B8351X052
2	HPT, HPAT	2-stage	1	12.7	0.5	44.5	1.75	37A2294X052	37A2295X102	37A2294X072
			1	19.1	0.75	44.5	1.75	37A2294X062	37A2295X112	37A2294X082
	HPS, HPAS	3-stage	1	19.1	0.75	25.1	1	22B6074X012	22B6075X012	22B6074X032
3	HPT	2-stage	400	12.7	0.5	63.5	2.5	37A4303X052	37A4306X032	37A4303X062
			1	19.1	0.75	63.5	2.5	37A4304X052	37A4307X042	37A4304X062
			100	25.4	1	63.5	2.5	37A4304X052	37A4308X052	37A4305X012
			101	25.4	1	63.5	2.5	37A4305X062	37A4308X062	37A4305X032
3	HPT	3-stage	400	12.7	0.5	47.6	1.875	37A4320X052	37A4322X042	37A4320X062
			1	19.1	0.75	47.6	1.875	37A4321X112	37A4323X102	37A4321X122
			100	25.4	1	47.6	1.875	37A4321X132	37A4323X112	37A4321X032
			101	25.4	1	47.6	1.875	37A4321X142	37A4323X122	37A4321X042
4	HPT	2-stage	1	19.1	0.75	87.3	3.4375	24A5259X092	24A5280X052	24A5259X062
			100, 101	25.4	1	87.3	3.4375	24A5260X072	24A5281X092	24A5260X062
		3-stage	1	19.1	0.75	73	2.875	38A0014X062	38A0016X062	38A0014X022
			100, 101	25.4	1	73	2.875	38A0015X032	38A0017X032	38A0015X022
6	HPT	2-stage	401, 403	19.1	0.75	133.4	5.25	37A4390X042	37A4393X042	37A4390X022
			402	19.1	0.75	133.4	5.25	37A4390X052	37A4393X052	37A4390X032
			404	25.4	1	133.4	5.25	37A4391X072	37A4394X052	37A4391X022
			405, 406	25.4	1	133.4	5.25	37A4391X082	37A4394X062	37A4391X032
			407	25.4	1	133.4	5.25	37A4391X092	37A4394X072	37A4391X042
			404	31.8	1.25	133.4	5.25	37A4392X052	37A4395X052	37A4392X022
			405, 406	31.8	1.25	133.4	5.25	37A4392X062	37A4395X062	37A4392X032
			407	31.8	1.25	133.4	5.25	37A4392X072	37A4395X072	37A4392X042
		3-stage	401, 403	19.1	0.75	115.8	4.5625	37A4407X042	37A4410X042	37A4407X022
			402	19.1	0.75	115.8	4.5625	37A4407X052	37A4410X052	37A4407X032
			404	25.4	1	115.8	4.5625	37A4408X062	37A4411X052	37A4408X092
			405, 406	25.4	1	115.8	4.5625	37A4408X072	37A4411X062	37A4408X032
			407	25.4	1	115.8	4.5625	37A4408X082	37A4411X072	37A4408X102
			404	31.8	1.25	115.8	4.5625	37A4409X052	37A4412X052	37A4409X022
			405, 406	31.8	1.25	115.8	4.5625	37A4409X062	37A4412X062	37A4409X082
			407	31.8	1.25	115.8	4.5625	37A4409X072	37A4412X072	37A4409X042

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Key 5* Valve Plug for a 2 to 6-Inch Class 1500 Globe Valve Without Micro-Form, Micro-Flute, or Cavitrol III Trim
Also for Use with a 2 to 3-Inch Globe Valve with a Whisper Trim III Cage

VALVE SIZE, INCHES	VALVE DESIGN	VALVE STEM CONNECTION		PORT DIAMETER		MATERIAL			
						Trim 201 and 207 Size 2 and 3 Trim 201 Size 4 and 6 S41600 (416 Stainless Steel)	Trim 202 and 208 Size 2 and 3 Trim 202 Size 4 and 6 S31600 (316 Stainless Steel) CoCr-A Seat/Guide	Trim 203 S31600 CoCr-A Seat/Guide	Trim 204 and 209, 210 Size 2 and 3 Trim 204, 210 Size 4 and 6 S31600
		mm	Inches	mm	Inches				
2	HPD	12.7	0.5	47.6	1.875	32B6006X012	32B6007X022	32B6007X012	32B6007X012
		19.1	0.75	47.6	1.875	32B6008X012	32B6008X022	32B6008X012	32B6008X012
	HPT	12.7	0.5	47.6	1.875	32B6010X012	---	32B6011X012	32B6011X012
		19.1	0.75	47.6	1.875	32B6012X012	---	32B6013X012	32B6013X012
	HPS	12.7	0.5	47.6	1.875	16A5344X012	36A5423X062	36A5423X012	36A5423X012
		19.1	0.75	47.6	1.875	16A5345X012	36A5424X082	36A5424X012	36A5424X012
3	HPD	25.4	1	47.6	1.875	16A5346X012	36A5425X042	36A5425X012	36A5425X012
		12.7	0.5	73	2.875	32B8246X012	32B8247X032	32B8247X012	32B8247X022
	HPT	19.1	0.75	73	2.875	32B8248X012	32B8249X032	32B8249X012	32B8249X022
		25.4	1	73	2.875	32B8250X012	32B8251X032	32B8251X012	32B8251X022
	HPS	12.7	0.5	73	2.875	36A5350X012	---	36A5429X012	36A5429X012
		19.1	0.75	73	2.875	36A5351X012	---	36A5430X012	36A5430X012
4	HPD	25.4	1	73	2.875	36A5352X012	---	36A5431X012	36A5431X012
		19.1	0.75	73	2.875	16A5354X012	36A5433X042	36A5433X012	36A5433X012
	HPT	25.4	1	73	2.875	16A5355X012	36A5434X062	36A5434X012	36A5434X012
		19.1	0.75	92.1	3.625	32B9346X012	32B9347X022	32B9347X012	32B9347X032
	HPS	25.4	1	92.1	3.625	32B9348X012	32B9349X022	32B9349X012	32B9349X032
		19.1	0.75	92.1	3.625	36A5358X012	---	36A5437X092	36A5437X132
6	HPD	25.4	1	92.1	3.625	36A5359X012	---	36A5438X062	36A5438X092
		19.1	0.75	136.5	5.375	36A5362X012	36A5441X092 ⁽¹⁾	36A5441X052	36A5441X092
		25.4	1	136.5	5.375	36A5363X012	36A5442X102 ⁽¹⁾	36A5442X042	36A5442X102
		31.8	1.25	136.5	5.375	36A5364X012	36A5442X112 ⁽²⁾	36A5443X042	36A5443X082
	HPT	50.8	2	136.5	5.375	39A6740X012	36A5443X082 ⁽¹⁾	36A5443X042	36A5443X082
		19.1	0.75	136.5	5.375	36A5365X012	36A5443X092 ⁽²⁾	36A5443X042	36A5443X082
		25.4	1	136.5	5.375	36A5366X012	38A6943X072 ⁽¹⁾	38A6943X042	38A6943X072
		31.8	1.25	136.5	5.375	36A5367X012	38A6943X082 ⁽²⁾	38A6943X042	38A6943X072
		50.8	2	136.5	5.375	30B2224X012	---	36A5444X012	36A5444X012
		19.1	0.75	136.5	5.375	36A5366X012	---	36A5445X012	36A5445X012
		25.4	1	136.5	5.375	36A5367X012	---	36A5446X012	36A5446X012
		50.8	2	136.5	5.375	30B2224X012	---	38A8300X012	38A8300X012

1. For -20° to 650°F (-29° to 343°C) temperature range (Trim 202).
2. For 500° to 1050°F (260° to 566°C) temperature range (Trim 202H).

Key 5* Valve Plug for a 2-Inch Class 1500 Angle Valve Without Micro-Form, Micro-Flute, Micro-Flat, or Cavitrol III Trim
Also for Use with a 2-Inch Angle Valve with a Whisper Trim III Cage

VALVE SIZE, INCHES	VALVE DESIGN	VALVE STEM CONNECTION		PORT DIAMETER		MATERIAL			
						Trim 201 Size 1 and 2 Trim 207 Size 2 Whisper III S41600 (416 SST)	Trim 202 Size 1 and 2 Trim 208 Size 2 Whisper III S31600 (316 SST) CoCr-A Seat/Guide	Trim 203 S31600 CoCr-A Seat/Guide	Trim 204 Size 1 and 2 Trim 209 Size 2 Whisper III S31600 CoCr-A Seat/Guide
		mm	Inches	mm	Inches				
2	HPAD	12.7	0.5	47.6	1.875	32B6006X012	32B6007X022	32B6007X012	32B6007X012
		19.1	0.75	47.6	1.875	32B6008X012	32B6008X022	32B6008X012	32B6008X012
	HPAT	12.7	0.5	47.6	1.875	32B6010X012	---	32B6011X012	32B6011X012
		19.1	0.75	47.6	1.875	32B6012X012	---	32B6013X012	32B6013X012
	HPAS	12.7	0.5	47.6	1.875	16A5344X012	36A5423X062	36A5423X012	36A5423X012
		19.1	0.75	47.6	1.875	16A5345X012	36A5424X082	36A5424X012	36A5424X012
3	HPAS	25.4	1	47.6	1.875	16A5346X012	36A5425X042	36A5425X012	36A5425X012

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Key 5* Valve Plug for a 1- to 2-Inch Class 1500 Angle Valve without Micro-Form, Micro-Flute, Micro-Flat, or Cavitrol III Trim
With Restricted Port Equal Percentage Cage, Flow Down Only

VALVE SIZE, INCHES	VALVE DESIGN	VALVE STEM CONNECTION		PORT DIAMETER		MATERIAL			
		mm	Inches	mm	Inches	Trim 201 S41600 (416 SST)	Trim 202 S31600 (316 SST) CoCr-A Seat/Guide	Trim 203 S31600 CoCr-A Seat/Guide	Trim 204 S31600 CoCr-A Seat/Guide
1	HPAS	19.1	0.75	19.1	0.75	13B6632X012	13B6633X012	13B6633X012	13B6633X012
2	HPAS	19.1	0.75	19.1	0.75	13B6660X012	13B6661X012	13B6661X012	13B6661X012
		19.1	0.75	25.4	1	23B6630X012	21B2095X012	21B2095X012	21B2095X012
		25.4	1	31.8	1.25	23B6659X012	21B2098X022	21B2098X012	21B2098X022
		25.4	1	38.1	1.5	22B4236X012	21B2099X022	21B2099X012	21B2099X022

Key 5* Valve Plug for 4- and 6-Inch Valves with Whisper III Trim

VALVE SIZE, INCHES	VALVE DESIGN	VALVE STEM CONNECTION		PORT DIAMETER		MATERIAL		
		mm	Inches	mm	Inches	Trim 207 Size 4 and 6 S41600 (416 Stainless Steel)	Trim 208 Size 4 and 6 S31600 (316 Stainless Steel) CoCr-A Seat/Guide	Trim 209 Size 4 and 6 S31600 CoCr-A Seat/Guide
4	HPD	19.1 25.4	0.75 1	92.1 92.1	3.625 3.625	32B9346X012 32B9348X012	32B9347X022 32B9349X022	32B9347X032 32B9349X032
		19.1 25.4	0.75 1	73 73	2.875 2.875	32B8248X012 32B8250X012	32B8249X032 32B8251X032	32B8249X022 32B8251X022
		19.1 25.4	0.75 1	92.1 92.1	3.625 3.625	36A5358X012 36A5359X012	--- ---	36A5437X132 36A5438X092
		19.1 25.4	0.75 1	73 73	2.875 2.875	36A5351X012 36A5352X012	--- ---	36A5430X012 36A5431X012
	HPT	25.4	1	136.5	5.375	36A5363X092	36A5442X112 ⁽¹⁾ 36A5442X122 ⁽²⁾	36A5442X112
		31.8	1.25	136.5	5.375	36A5364X052	36A5443X092 ⁽¹⁾ 36A5443X102 ⁽²⁾	36A5443X092
		25.4	1	111.1	4.375	39A9100X022	39A9104X152 ⁽¹⁾ 39A9104X162 ⁽²⁾	39A9104X152
		31.8	1.25	111.1	4.375	39A9102X022	39A9106X152 ⁽¹⁾ 39A9106X162 ⁽²⁾	39A9106X152
6	HPD	25.4 31.8	1 1.25	136.5 136.5	5.375 5.375	36A5366X072 36A5367X062	--- ---	36A5445X062 36A5446X032
		25.4 31.8	1 1.25	111.1 111.1	4.375 4.375	39A9101X022 39A9103X022	--- ---	39A9105X072 39A9107X072
		25.4 31.8	1 1.25	136.5 136.5	5.375 5.375	36A5366X072 36A5367X062	--- ---	36A5445X062 36A5446X032
		25.4 31.8	1 1.25	111.1 111.1	4.375 4.375	39A9101X022 39A9103X022	--- ---	39A9105X072 39A9107X072
	HPT	25.4 31.8	1 1.25	136.5 136.5	5.375 5.375	36A5366X072 36A5367X062	--- ---	36A5445X062 36A5446X032
		25.4 31.8	1 1.25	111.1 111.1	4.375 4.375	39A9101X022 39A9103X022	--- ---	39A9105X072 39A9107X072

1. For -29 to 343°C (-20 to 650°F) temperature range (Trim 208).

2. For 260 to 566°C (500 to 1050°F) temperature range (Trim 208H).

Key 5* Valve Plug for Design HPAS Valves with Micro-Flat Plug/Seat Ring

VALVE RATING	VALVE SIZE, INCHES	VALVE STEM CONNECTION		PORT DIAMETER		MATERIAL	
		mm	Inches	mm	Inches	Trim 201A S44004 (440C Stainless Steel)	Trim 202, 203, 204 S31600 (316 Stainless Steel) CoCr-A Seat, Guide, and Contour
Class 1500	1	12.7	0.5	9.5	0.375	23B0645X012	23B0646X012
				12.7	0.5	23B0647X012	23B0648X012
	2	19.1	0.75	19.1	0.75	23B0649X012	23B0650X012
		19.1	0.75	25.4	1	32B4237X012	32B4239X012

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Key 5* Valve Plug for Design HPAS Valves with Micro-Flat Plug/Seat and Liner

VALVE RATING	VALVE SIZE, INCHES	VALVE STEM CONNECTION		PORT DIAMETER PORT DIAMETER		MATERIAL	
						Trim 201 S44004 (440C Stainless Steel)	Trim 202, 203, 204 S31600 (316 Stainless Steel) CoCr-A Seat, Guide, and Contour
		mm	Inches	mm	Inches		
For ANSI and DIN Flanged Valves							
Class 1500	1	12.7	0.5	9.5 12.7	0.375 0.5	23B0645X022 23B0647X022	23B0646X022 23B0648X022
	2	19.1	0.75	25.4	1	32B4237X022	32B4239X022
For Butt Weld and Socket Weld Valves							
Class 1500	1	12.7	0.5	9.5 12.7	0.375 0.5	23B0645X032 23B0647X032	23B0646X032 23B0648X032
	2	19.1	0.75	25.4	1	32B4237X032	32B4239X032

Key 6* Valve Plug Stem for Class 1500 Standard and Whisper Valves with Whisper Trim III Cage

VALVE SIZE, INCHES	ACTUATOR GROUP	VALVE STEM CONNECTION		VALVE STEM TRAVEL		DESCRIPTION	MATERIAL			
		mm	Inches	mm	Inches		S20910 ⁽¹⁾ (For Standard Bonnet)	S20910 ⁽¹⁾ (Nitronic 50) (for Extension Style 1 Bonnet)	S31600 ⁽²⁾ (For Standard Bonnet)	S31600 ⁽²⁾ (For Extension Bonnet)
1	1	12.7	0.5	19.1	0.75	Micro-Form or Micro-Flute with 6.4 mm (0.25 inch) port	1N8210X0092	10A8840XAA2	1N821035162	10A8840X512
				19.1	0.75	Micro-Flute or Micro-Flat with 9.5 or 12.7 mm (0.375 or 0.5 inch) port	1N8210X0092	10A8840XAA2	1N821035162	10A8840X512
				19.1, 29	0.75, 1.125	Micro-Form with 12.7, 19.1 or 25.4 mm (0.5, 0.75, or 1-inch) port	10A8840XT82	1P6694X0092	10A8840XB42	1P669435162
		19.1	0.75	19.1, 29	0.75, 1.125	Micro-Form with 19.1 or 25.4 mm (0.75 or 1-inch) port	1K5878X0092	1L3841X0032	1K5878X0012	1L384135162
				19.1, 29	0.75, 1.125	HPAS with 19.1 mm (0.75 inch) port	16A4704X472	16A4704X522	16A4704X322	16A4704X532
2	1	12.7	0.5	19.1, 29, 38	0.75, 1.125, 1.5	Micro-Form, Micro-Flute HPD, HPAD, HPT, HPAT, HPS, HPAS	1N8210X0092	23B0035X052	1N821035162	23B0035X062
				19.1, 29, 38	0.75, 1.125, 1.5	Micro-Form, Micro-Flat HPD, HPAD, HPT, HPAT	1P6696X0032	1P6697X0142	1P6696X0012	1P669735162
		19.1	0.75	19.1, 29	0.75, 1.125	HPAS with 19.1 mm (0.75 inch) port	16A4704X462	16A4704X482	16A4704X042	16A4704X492
						HPAS with 25.4 mm (1-inch) port	16A4704X472	16A4704X502	16A4704X322	16A4704X512

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Key 6" Valve Plug Stem for Class 1500 Standard and Whisper Valves with Whisper Trim III Cage (Continued)

VALVE SIZE, INCHES	ACTUATOR GROUP	VALVE STEM CONNEC- TION		VALVE STEM TRAVEL		DESCRIPTION	MATERIAL			
		mm	Inches	mm	Inches		S20910 ⁽¹⁾ (For Standard Bonnet)	S20910 ⁽¹⁾ (Nitronic 50) (for Extension Style 1 Bonnet)	S31600 ⁽²⁾ (For Standard Bonnet)	S31600 ⁽²⁾ (For Extension Bonnet)
2	100	25.4	1	19	0.75	Micro-Form with 25.4 mm (1-inch) port	10A3282X222	11A3429XN82	10A3282X012	11A3429X152
						Micro-Form with 31.8 mm (1.25 inch) port	10A3282X222	11A3429XN82	10A3282X012	11A3429X152
						HPAS with 31.8 mm (1.25 inch) port	13A9206X302	13A9206X362	13A9206X312	13A9206X372
				29	1.125	Micro-Form with 25.4 mm (1-inch) port	11A3429XG52	1L1990X0022	11A3429X232	1L199035162
						Micro-Form with 31.8 mm (1.25 inch) port	11A3429XG52	1L1990X0022	11A3429X232	1L199035162
						Micro-Form with 38.1 mm (1.5 inch) port	11A3429XG52	1L1990X0022	11A3429X232	1L199035162
						HPAS with 31.8 mm (1.25 inch) port	13A9206X322	13A9206X382	13A9206X332	13A9206X392
						HPS, HPAS with 47.6 mm (1.875 inch) port	1K7783X0032	11A3429XN92	1K778335162	11A3429X922
						HPS, HPAS with 47.6 mm (1.875 inch) port	11A3429XG52	1L1990X0022	11A3429X232	1L199035162
				38	1.5	Micro-Form with 38.1 mm (1.5 inch) port	1L2687X0152	11A3429XL32	1L2687X0012	11A3429X452
						HPS, HPAS with 47.6 mm (1.875 inch) port	1L2687X0152	11A3429XL32	1L2687X0012	11A3429X452
	101	25.4	1	19, 29, 38	0.75, 1.125, 1.5	Micro-Form, HPS, HPAS with 38.1 mm (1.5) & 47.6 mm (1.875) port	1K7447X0042	1L9086X0032	1K744735162	1L9086X00A2
						HPAS with 31.8 mm (1.25 inch) port	13A9206X342	13A2906X402	13A9206X352	13A9206X412
3	1	12.7	0.5	38, 50.8	1.5, 2	HPD with 73 mm (2.875 inch) port	1U2179X0072	---	1U217935162	---
						HPT with 73 mm (2.875 inch) port	1U4369X0072	---	1U4369X0012	---
		19.1	0.75	38, 50.8	1.5, 2	HPD with 73 mm (2.875 inch) port	10A9265XV62	---	10A9265X122	---
						HPT with 73 mm (2.875 inch) port	1P6696X0032	---	1P6696X0012	---
						HPS with 73 mm (2.875 inch) port	10A9265XV72	---	10A9265X202	---
	100	25.4	1	38	1.5	HPD	1K7783X0032	---	1K778335162	---
						HPT	1L2687X0152	---	1L2687X0012	---
						HPS	1N3256X0052	---	1N325635162	---
				50.8	2	HPD	1L2687X0152	---	1L2687X0012	---
						HPT	1K9289X0102	---	1K928935162	---
						HPS	1N6682X0072	---	1N6682X0032	---
	101	25.4	1	38, 50.8	1.5, 2	HPD	1L1446X0052	---	1L144635162	---
						HPT	1K7447X0042	---	1K744735162	---
						HPS	1L2687X0152	---	1L2687X0012	---

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HP and HPA Valves

Key 6" Valve Plug Stem for Class 1500 Standard and Whisper Valves with Whisper Trim III Cage (Continued)

VALVE SIZE, INCHES	ACTUATOR GROUP	VALVE STEM CONNEC- TION		VALVE STEM TRAVEL		DESCRIPTION	MATERIAL	
		mm	Inches	mm	Inches		S20910 ⁽¹⁾ (For Standard Bonnet)	S31600 ⁽²⁾ (For Standard Bonnet)
4	1	19.1	0.75	38, 50.8	1.5, 2	HPD with 92.1 mm (3.625 inch) port ⁽³⁾	1L4001X0042	1L400135162
						HPD with 73 mm (2.875 inch) port ⁽⁴⁾	1L4001X0042	1L400135162
						HPT with 92.1 mm (3.625 inch) port ⁽³⁾	10A6088X052	10A6088X012
						HPT with 73 mm (2.875 inch) port ⁽⁴⁾	1K5879X0032	1K587935162
	100	25.4	1	38	1.5	HPD with 92.1 mm (3.625 inch) port ⁽³⁾	1K7891X0242	1K7891X0012
						HPD with 73 mm (2.875 inch) port ⁽⁴⁾	1L8776X0032	1L877635162
						HPT with 92.1 mm (3.625 inch) port ⁽³⁾	10A3282X222	10A3282X012
						HPT with 73 mm (2.875 inch) port ⁽⁴⁾	1N3256X0052	1N325635162
				50.8	2	HPD with 92.1 mm (3.625 inch) port ⁽³⁾	11A3429XG82	11A3429XN62
						HPD with 73 mm (2.875 inch) port ⁽⁴⁾	1N3256X0052	1N325635162
						HPT with 92.1 mm (3.625 inch) port ⁽³⁾	11A3429XG52	11A3429X232
						HPT with 73 mm (2.875 inch) port ⁽⁴⁾	1N6682X0072	1N6682X0032
	101	25.4	1	38, 50.8	1.5, 2	HPD with 92.1 mm (3.625 inch) port ⁽³⁾	11A3429XG52	11A3429X232
						HPD with 73 mm (2.875 inch) port ⁽⁴⁾	1K7783X0032	1K778335162
						HPT with 92.1 mm (3.625 inch) port ⁽³⁾	1P5164X0152	1P516435162
						HPT with 73 mm (2.875 inch) port ⁽⁴⁾	1L2687X0152	1L2687X0012
6	1	19.1	0.75	63.5, 76.2	2.5, 3	HPD with 136.5 mm (5.375 inch) port	1U5071X0042	1J507135162
						HPT with 136.5 mm (5.375 inch) port		
	100	25.4	1	63.5	2.5	HPD with 136.5 mm (5.375 inch) port ⁽³⁾	10A3282X222	10A3282X012
						HPD with 111.1 mm (4.375 inch) port ⁽⁴⁾	1K7783X0032	1K778335162
						HPT with 136.5 mm (5.375 inch) port ⁽³⁾	10A3282X222	10A3282X012
						HPT with 111.1 mm (4.375 inch) port ⁽⁴⁾	1K7783X0032	1K778335162
				76.2	3	HPD with 136.5 mm (5.375 inch) port ⁽³⁾	11A3429XG52	11A3429X232
						HPD with 111.1 mm (4.375 inch) port ⁽⁴⁾	1L2687X0152	1L2687X0012
						HPT with 136.5 mm (5.375 inch) port ⁽³⁾	11A3429XG52	11A3429X232
						HPT with 111.1 mm (4.375 inch) port ⁽⁴⁾	1L2687X0152	1L2687X0012

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Key 6* Valve Plug Stem for Class 1500 Standard and Whisper Valves with Whisper Trim III Cage (Continued)

VALVE SIZE, INCHES	ACTUATOR GROUP	VALVE STEM CONNEC- TION		VALVE STEM TRAVEL		DESCRIPTION	MATERIAL	
		mm	Inches	mm	Inches		S20910 ⁽¹⁾ (For Standard Bonnet)	S31600 ⁽²⁾ (For Standard Bonnet)
6	100	31.8	1.25	63.5	2.5	HPD with 136.5 mm (5.375 inch) port ⁽³⁾	1L2298X0202	1L2298X0012
						HPD with 111.1 mm (4.375 inch) port ⁽⁴⁾		
						HPT with 136.5 mm (5.375 inch) port ⁽³⁾		
						HPT with 111.1 mm (4.375 inch) port ⁽⁴⁾		
		76.2	3	63.5	2.5	HPD with 136.5 mm (5.375 inch) port ⁽³⁾	10A6073X072	10A6073X012
						HPD with 111.1 mm (4.375 inch) port ⁽⁴⁾		
						HPT with 136.5 mm (5.375 inch) port ⁽³⁾		
						HPT with 111.1 mm (4.375 inch) port ⁽⁴⁾		
	101	31.8 x 50.8	1.25 x 2	63.5	2.5	HPD with 136.5 mm (5.375 inch) port	29A5895X482	---
						HPT with 136.5 mm (5.375 inch) port		
						HPD with 136.5 mm (5.375 inch) port	29A5895X472	---
						HPT with 136.5 mm (5.375 inch) port		
		25.4	1	63.5, 76.2	2.5, 3	HPD with 136.5 mm (5.375 inch) port ⁽³⁾	11A3429XG52	11A3429X232
						HPD with 111.1 mm (4.375 inch) port ⁽⁴⁾	1L2687X0152	1L2687X0012
						HPT with 136.5 mm (5.375 inch) port ⁽³⁾	11A3429XG52	11A3429X232
						HPT with 111.1 mm (4.375 inch) port ⁽⁴⁾	1L2687X0152	1L2687X0012
		31.8	1.25	63.5, 76.2	2.5, 3	HPD with 136.5 mm (5.375 inch) port ⁽³⁾	10A6073X072	10A6073X012
						HPD with 111.1 mm (4.375 inch) port ⁽⁴⁾		
						HPT with 136.5 mm (5.375 inch) port ⁽³⁾		
						HPT with 111.1 mm (4.375 inch) port ⁽⁴⁾		
		31.8 x 50.8	1.25 x 2	63.5, 76.2	2.5, 3	HPD with 136.5 mm (5.375 inch) port	29A5895X472	---
						HPT with 136.5 mm (5.375 inch) port		

1. Manufactured in U.S.A.
2. Manufactured in Europe and Japan.
3. Standard trim and Whisper Trim III Levels A1, A3, B3, C3.
4. Whisper Trim III Level D3.

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HP and HPA Valves

Key 6* Valve Plug Stem for Design HP Class 2500 Standard and Whisper Valves with Whisper Trim III Cage

VALVE SIZE, INCHES	ACTUATOR GROUP	VALVE STEM CONNECTION		VALVE STEM TRAVEL		DESCRIPTION	MATERIAL
		mm	Inches	mm	Inches		S20910 (For Standard Bonnet)
1	1	12.7	0.5	19.1	0.75	Micro-Form or Micro-Flute with 6.4 mm (0.25-inch) port	1N8210X0092
				19.1	0.75	Micro-Flute with 9.5 or 12.7 mm (0.375 or 0.5 inch) port	1N8210X0092
				19.1, 29	0.75, 1.125	Micro-Form with 12.7, 19.1 or 25.4 mm (0.5, 0.75, or 1-inch) port	10A8840XT82
		19.1	0.75	19.1, 29	0.75, 1.125	Micro-Form with 19.1 or 25.4 mm (0.75 or 1-inch) port	10A9265XV62
2	1	12.7	0.5	19.1, 25.4, 29, 38	0.75, 1, 1.125, 1.5	Micro-Form HPD, HPT, HPS	1U2263X0082
		19.1	0.75	19.1, 25.4, 29, 38	0.75, 1, 1.125, 1.5	Micro-Form HPD, HPT	10A9265XV72

Key 7* Pin, 316 Stainless Steel (Globe Valve Body)

VALVE RATING, CLASS	VALVE SIZE, INCHES	DESIGN	STEM DIAMETER				
			12.7 mm (0.5 Inch)	19.1 mm (0.75 Inch)	25.4 mm (1-Inch)	31.8 mm (1.25 Inch)	31.8 x 50.8 mm (1.25 x 2-Inch)
1500	1	HPS	1B599635072	1C5093X0022	---	---	---
	2	HPS	1B599635072	1F723635072	1D269735072	---	---
		HPD, HPT	1V322735072	1V322735072	---	---	---
	3	HPS	---	1F723635072	1D269735072	---	---
		HPD, HPT	1V322735072	1V326035072	1V334035072	---	---
	4	HPD, HPT	---	1V326035072	1V334035072	---	---
	6	HPD, HPT	---	1V326035072	1V334035072	1V334035072	15A4000X012

Key 7* Pin, 316 Stainless Steel (Angle Valve Body)

VALVE RATING, CLASS	VALVE SIZE, INCHES	DESIGN	PORT SIZE	STEM DIAMETER		
				12.7 mm (0.5 Inch)	19.1 mm (0.75 Inch)	25.4 mm (1-Inch)
1500	1	Micro-Form	0.25, 1.5	1B599635072	---	---
			0.75, 1	1B599635072	1C5093X0022	---
		Micro-Flute	All	1B599635072	---	---
		Micro-Flat	0.375, 0.5	1B599635072	---	---
			0.75	---	1C5093X0022	---
	2	HPAS	0.75	---	1B627035072	---
		Micro-Form	0.25, 1.5	1B599635072	---	---
			0.75	1B599635072	1F723635072	---
			1, 1.25, 1.5	1B599635072	1F723635072	1D269735072
		Micro-Flute	All	1B599635072	---	---
		Micro-Flat	1	---	1F723635072	---
			0.75	---	1B627035072	---
		HPAS	1	---	1B599635072	---
			1.25	---	---	1B813635072
			1.5	---	---	1K249735072
			1.875	1B599635072	1F723635072	1D269735072
		HPAD, HPAT	1.875	1V322735072	1V322735072	---

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Key 8* Graphite Piston Ring for Design HPD (2- to 6-Inch) and HPAD (2-inch) Only

VALVE SIZE, INCHES	QUANTITY	PORT DIAMETER		CLASS 1500	
		mm	Inches	-253°C to 426°C (-425°F to 800°F)	427°C to 537°C (801°F to 1000°F)
2	2	47.6	1.875	1U2216X0012	1U2216X0022
3	2	73.0	2.875	1U2300X0012	1U2300X0022
4	2	73.0	2.875	1U2300X0012	1U2300X0022
	2	92.1	3.625	16A5482X012	16A5482X022
6	4	111.1	4.375	1U2392X0012	1U2392X0022
	3	136.5	5.375	11A9727X022	11A9727X032

Key 8* Seal Ring and Key 39* Graphite Piston Ring for Design HPT (2- to 6-inch) and HPAT (2-inch only) without Cavitrol III Trim, Hastelloy with Glass and Moly-Filled PTFE

VALVE SIZE, INCHES	PORT DIAMETER		KEY 8 SEAL RING	KEY 39 PISTON RING
	mm	Inches	Valve Body Rating Class 1500	
2	47.6	1.875	10A4216X012	---
3	73.0	2.875	10A4215X012	---
4	73.0	2.875	10A4215X012	---
	92.1	3.625	16A5485X012	---
6 Without Whisper Trim III	111.1	4.375	10A4223X012	---
	136.5	5.375	10A5411X022	---
6 With Whisper Trim III	111.1	4.375	10A4223X012	1U2392X0012 ⁽¹⁾
	136.5	5.375	10A5411X022	---

1. For use only with Whisper Trim III Level D with 111.1 mm (4.375 inch) port.

Key 8* Seal Ring for Cavitrol III Trim Only,
Hastelloy with Glass and Moly-Filled PTFE

VALVE SIZE, INCHES	2-STAGE	3-STAGE
2	17A2296X012	---
3	17A4309X012	10A4216X012
4	10A5351X022	10A4215X012
6	17A4396X012	17A4413X012

Key 9* Back-Up Ring for All Design HPT (2- to 6-inch) and HPAT (2-inch only) Valves Except Those with Cavitrol III Trim

VALVE SIZE, INCHES	PORT DIAMETER		MATERIAL	
	mm	Inches	S31600 (316 SST)	S41600 (416 SST)
2	47.6	1.875	10A4218X012	10A4218X022
3	73.0	2.875	10A4217X022	10A4217X012
4	73.0	2.875	10A4217X022	10A4217X012
	92.1	3.625	16A5483X022	16A5483X012
6	111.1	4.375	10A4224X022	10A4224X012
	136.5	5.375	10A5409X022	10A5409X012

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HP and HPA Valves

Key 9* Back-Up Ring for Design HPT (2- to 6-inch) and HPAT (2-inch only) Valves with Cavitrol III Trim

VALVE SIZE, INCHES	PORT DIAMETER		MATERIAL	
	mm	Inches	S41600 (416 SST)	S31600 (316 SST)
2 (2-Stage)	44.5	1.75	13A8520X012	13A8520X022
3 (2-Stage)	63.5	2.5	17A4310X012	17A4310X022
3 (3-Stage)	47.6	1.875	10A4218X022	10A4218X012
4 (2-Stage)	87.3	3.4375	10A5349X012	10A5349X022
4 (3-Stage)	73.0	2.875	10A4217X012	10A4217X022
6 (2-Stage)	133.4	5.25	17A4397X012	17A4397X022
6 (3-Stage)	115.8	4.5625	17A4414X012	17A4414X022

Keys 5*, 8*, 9*, 10*, and 63* Design HPT Above 232°C (450°F) Using PEEK⁽¹⁾ Anti-Extrusion Rings

VALVE SIZE, INCHES	TRIM	PORT DIAMETER		KEY 63	KEY 8	KEY 9	KEY 10	KEY 5	STEM CONNECTOR DIAMETER	
				Anti-Extrusion Ring	Seal Ring	Back-Up Ring	Retaining Ring	Anti-Extrusion Valve Plug		
		mm	Inches	PEEK	N10276/PTFE	S41600	S30200	S41600	mm	Inches
2	Std, Whisper III	47.6	1.875	22B4694X012	10A4216X032	10A4218X022	10A4220X012	31B2146X012	12.7	0.5
				22B4694X012	10A4216X032	10A4218X022	10A4220X012	31B2147X012	19.1	0.75
3	Std, Whisper III	73.0	2.875	22B2617X012	10A4215X032	10A4217X012	10A4219X012	31B2148X012	12.7	0.5
				22B2617X012	10A4215X032	10A4217X012	10A4219X012	31B2149X012	19.1	0.75
				22B2617X012	10A4215X032	10A4217X012	10A4219X012	31B2150X012	25.4	1
4	Std, Whisper III A,B,C	92.1	3.625	21B2115X012	16A5485X062	16A5483X012	16A5484X012	31B2151X012	19.1	0.75
				21B2115X012	16A5485X062	16A5483X012	16A5484X012	31B2152X012	25.4	1
4	Whisper III D	73.0	2.875	22B2617X012	10A4215X032	10A4217X012	10A4219X012	31B2149X012	19.1	0.75
				22B2617X012	10A4215X032	10A4217X012	10A4219X012	31B2150X012	25.4	1
6	Std, Whisper III A,B,C	136.5	5.375	21B9342X012	10A5411X032	10A5409X012	10A5410X012	31B2153X012	19.1	0.75
				21B9342X012	10A5411X032	10A5409X012	10A5410X012	31B2154X012	25.4	1
				21B9342X012	10A5411X032	10A5409X012	10A5410X012	31B2154X022	25.4	1
				21B9342X012	10A5411X032	10A5409X012	10A5410X012	31B2155X012	31.8	1.25
				21B9342X012	10A5411X032	10A5409X012	10A5410X012	31B2155X022	31.8	1.25
				21B9342X012	10A5411X032	10A5409X012	10A5410X012	31B2156X012	50.8	2
6	Whisper III D	111.1	4.375	21B9341X012	10A4223X032	10A4224X012	10A4225X012	31B2134X022	25.4	1
				21B9341X012	10A4223X032	10A4224X012	10A4225X012	31B2135X022	31.8	1.25

1. PolyEtherEtherKetone.

Gasket Set* (Includes Key 11 Bonnet Gasket and Key 12 Seat Ring Gasket)⁽¹⁾

VALVE RATING, CLASS	VALVE SIZE, INCHES	MATERIAL	
		N06600 (Inconel 600)/Graphite	N07750 (Inconel X750)/Graphite
1500 Globe and Angle Valves	1 (std)	12B7100X012	12B7100X022
	2 (std)	12B7100X032	12B7100X042
	2 (Cavitrol III, 2-Stage)	12B7100X072	---
	3 (std)	12B7100X052	12B7100X062
	4 (std)	12B7100X082	---
	6 (std)	12B7100X112	---
2500 Globe and Angle Valves	1 (std)	---	12B7100X122
	2 (std)	---	12B7100X132
	2 (Cavitrol III, 2-Stage)	---	12B7100X142

1. Gaskets should always be replaced as sets, not separately.

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Type 657 Diaphragm Actuator Sizes 30-70 and 87

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Introduction

Scope of Manual

This instruction manual provides information on installation, adjustment, maintenance, and parts ordering for the Type 657 actuator in sizes 30



W2174-2/IL

Figure 1. Type 657 or 657-4 Actuator Mounted on an easy-e® Valve

through 70 and size 87. The Type 657-4 actuator in sizes 70 and 87 is also covered. Refer to separate instruction manuals for information about the valve positioner and other accessories used with these actuators.

No person may install, operate, or maintain a Type 657 actuator without first • being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance, and • carefully reading and understanding the contents of this manual. If you have any questions about these instructions, contact your Fisher sales office before proceeding.



657 Actuator (30-70 and 87)

Table 1. Specifications

SPECIFICATION ⁽¹⁾		ACTUATOR SIZE								
		30	34	40	45	46	50	60	70 ⁽¹⁾	87 ⁽¹⁾
Nominal Effective Area	cm ²	297	445	445	677	1006	677	1006	1419	1419
	Inch ²	46	69	69	105	156	105	156	220	220
Yoke Boss Diameters	mm	54	54	71	71	71	90	90	90	127
	Inches	2.125	2.125	2.8125	2.8125	2.8125	3.5625	3.5625	3.5625	5
Acceptable Valve Stem Diameters	mm	9.5	9.5	12.7	12.7	12.7	19.1	19.1	19.1	25.4
	Inches	0.375	0.375	0.5	0.5	0.5	0.75	0.75	0.75	1
Maximum Allowable Output Thrust ⁽⁴⁾	N	10230	10230	12010	25131	33582	25131	30246	39142	39142
	Lb	2300	2300	2700	5650	7550	5650	6800	8800	8800
Maximum Travel ⁽²⁾	mm	19	29	38	51	51	51	51	76 ⁽³⁾	76 ⁽³⁾
	Inches	0.75	1.125	1.5	2	2	2	2	3 ⁽³⁾	3 ⁽³⁾
Maximum Casing Pressure for Actuator Sizing ⁽⁴⁾	Bar	8.6	4.5	4.5	3.4	2.8	3.4	2.8	3.8	3.8
	Psig	125	65	65	50	40	50	40	55	55
Maximum Diaphragm Casing Pressure ⁽⁴⁾⁽⁵⁾	Bar	9.6	5.2	5.2	4.1	3.4	4.1	3.4	4.5	4.5
	Psig	140	75	75	60	50	60	50	65	65
Material Temperature Capabilities	°C	Nitrile Elastomers: -40 to 82°C, Silicone Elastomers: -54 to 149°C, Fluoroelastomers: -18 to 149°C								
	°F	Nitrile Elastomers: -40 to 180°F, Silicone Elastomers: -65 to 300°F, Fluoroelastomers: 0 to 300°F								
Pressure Connections (female)	0.25 In. NPT	X	X	X	X	X	X	X	---	---
	0.5 In. NPT	---	---	---	---	---	---	---	X	X
Approximate Weights	kg	16	22	23	37	49	42	53	107	116
	Lb	36	48	51	82	107	92	116	235	255

1. These values also apply to the Type 657-4 actuator construction.
2. Actuator travel may be less than the value listed after connecting the actuator to the valve.
3. Maximum travel for Type 657-4 is 102 mm (4 inches).
4. Normal operating diaphragm pressure must not exceed maximum diaphragm casing pressure and must not produce a force on the actuator stem greater than the maximum allowable output thrust or the maximum allowable valve stem load. Contact your Fisher sales office with questions concerning maximum allowable valve stem load.
5. This maximum casing pressure is not to be used for normal operating pressure. Its purpose is to allow for typical regulator supply settings and/or relief valve tolerances.

Description

The Type 657 actuator (figure 1) and the Type 657-4 actuator are direct-acting, spring-opposed diaphragm actuators. They provide automatic operation of control valve body assemblies. The Type 657 actuator offers 76 mm (3 inches) maximum actuator travel. The Type 657-4 actuator provides 102 mm (4 inches) maximum actuator travel. Both actuators position the valve plug in response to varying pneumatic loading pressure on the actuator diaphragm. Figure 2 shows the operation of these actuators.

A Type 657 or 657-4 actuator can be equipped with either a top-mounted or a side-mounted handwheel assembly. A top-mounted handwheel assembly is used as an adjustable up travel stop to limit actuator travel in the up direction (see figure 2). A side-mounted handwheel assembly is usually used as an auxiliary manual actuator. Adjustable casing-mounted up or down travel stops are also available for this actuator.

Note

If repeated or daily manual operation is expected, the actuator should be equipped with a side-mounted handwheel rather than a casing-mounted travel stop or top-mounted handwheel.

The side-mounted handwheel is designed for more frequent use as a manual operator.

Note

Fisher does not assume responsibility for the selection, use, or maintenance of any product. Responsibility for proper selection, use, and maintenance of any Fisher product remains solely with the purchaser and end-user.

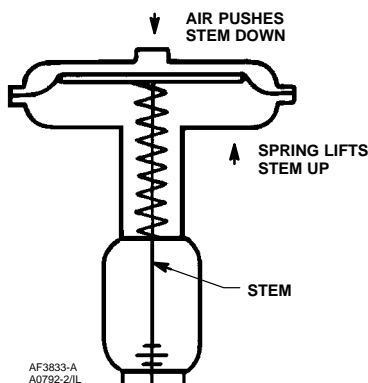


Figure 2. Schematic of Type 657 and 657-4 Actuators

Specifications

Refer to table 1 for Specifications of the Type 657 and 657-4 actuators. See the actuator nameplate for specific information about your actuator.

Installation

Key number locations are shown in figures 6, 7, and 8, unless otherwise indicated. Also, refer to figure 3 for location of parts.



WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid parts damage or personal injury, do not use an operating pressure that exceeds the Maximum Diaphragm Casing Pressure (table 1) or produces a force on the actuator stem greater than the Maximum Allowable Output Thrust (table 1) or the maximum allowable valve stem load. (Contact your Fisher sales office with questions concerning maximum allowable valve stem load.)

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the **WARNING**

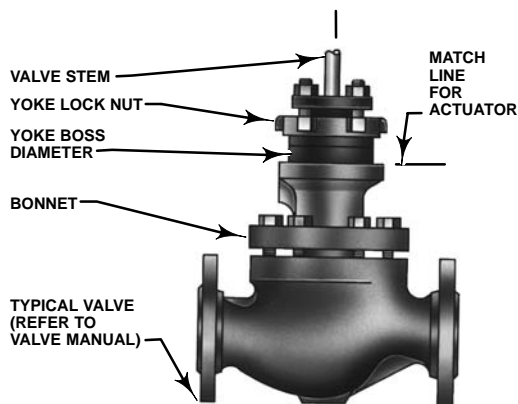
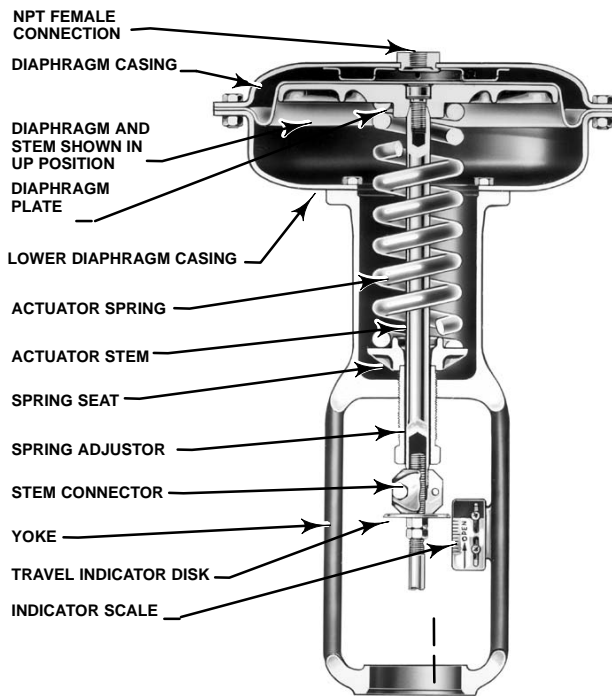


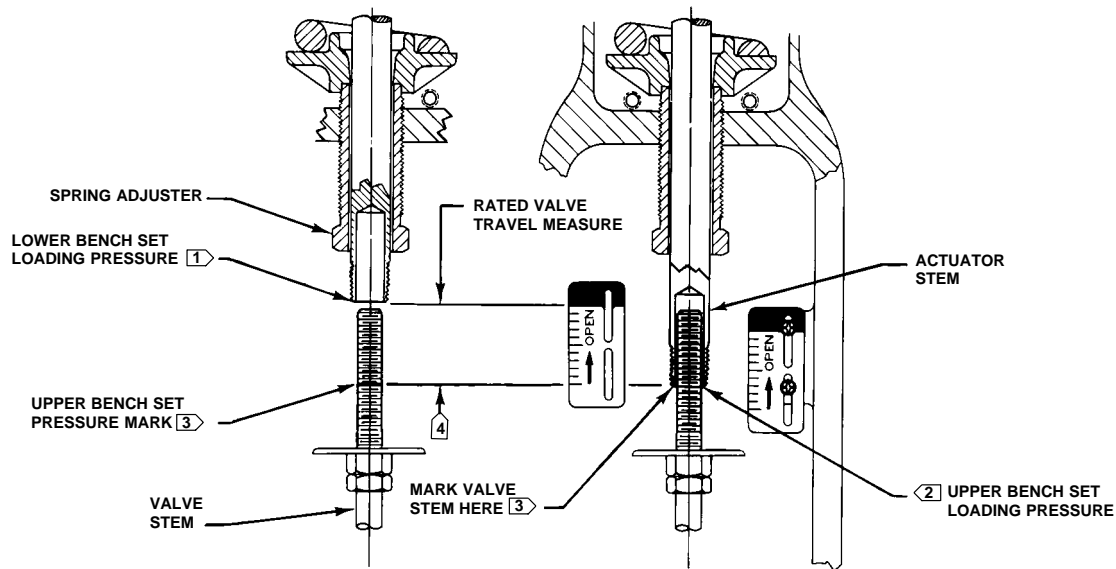
Figure 3. Actuator Mounting Components for Size 30 through 70 Actuators

at the beginning of the Maintenance section in this instruction manual.

- **Valve/Actuator Assembly:** If the actuator and valve are shipped together as a control valve assembly, it has been adjusted at the factory, and may be installed in the pipeline. After installing the valve in the pipeline, refer to the Loading Connection procedures.

- **Actuator Mounting:** If the actuator is shipped separately or the actuator has been removed from the valve, it is necessary to mount the actuator on the valve before placing the valve in the pipeline. Refer to the actuator mounting procedures before placing the valve in service. You may perform the

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NOTES:

- [1] THE LOWER PSIG LOADING PRESSURE (MARKED ON NAMEPLATE) WHERE THE FIRST MOVEMENT OF ACTUATOR STEM IS DETECTED.
- [2] THE UPPER PSIG LOADING PRESSURE EXTEND ACTUATOR STEM.
- [3] MARK THIS POINT WITH TAPE OR A MARKER.
- [4] MEASURE DISTANCE OF TRAVEL. IT SHOULD EQUAL THE TRAVEL SPAN SHOWN ON THE TRAVEL INDICATOR SCALE.

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Figure 4. Bench Set Adjustment

Bench Set Spring Adjustment procedures in this section to confirm that the adjustment has not changed since it was shipped from the factory.

- **Positioner:** If a positioner is installed, or is to be installed on the actuator, refer to the positioner instruction manual for installation. During the adjustment procedures, it will be necessary to provide a temporary loading pressure to the actuator diaphragm.

Mounting the Actuator on the Valve

The Type 657 actuator spring loading pushes the actuator stem up towards the actuator diaphragm (see figure 2). This spring action moves the stem away from the valve while installing the actuator.

CAUTION

If the valve stem is allowed to remain in the up position (towards the actuator) during mounting, it can interfere with the actuator mounting, possibly damage valve stem threads or bend the valve stem. Be sure the valve stem is pushed down (into the

valve body), away from the actuator while mounting.

Provide a temporary method of applying diaphragm loading pressure to the diaphragm to extend the actuator stem during bench set spring adjustments.

1. Provide a vise or some other method of supporting the valve and the weight of the actuator during assembly. For direct or reverse acting valves, push the valve stem down away from the actuator while mounting the actuator.

2. Screw the stem locknuts all the way onto the valve stem. With the concave side of the travel indicator disk (key 14) facing the valve, install the travel indicator disk on the valve stem. (Note: The travel indicator disk is not used with size 87 actuators.)

3. Lift or hoist the actuator onto the valve bonnet:

- a. **For size 87 actuators,** insert the cap screws and tighten the hex nuts, securing the actuator to the bonnet.

- b. **For all other size actuators,** screw the yoke locknut onto the valve bonnet and tighten the locknut. (Note: On small size actuators, it may be necessary to remove the indicator disk and re-install it while lowering the actuator on to the

valve because the disk will not go through the actuator yoke opening).

4. Do **not** connect the actuator stem to the valve stem at this time. Whenever the actuator is installed on the valve, Fisher recommends performing the Bench Set Spring Adjustment procedure to verify that the actuator is still adjusted correctly.

Discussion of Bench Set

The bench set pressure range is used to adjust the initial compression of the actuator spring with the valve-actuator assembly "on the bench." The correct initial compression is important for the proper functioning of the valve-actuator assembly when it is put into service and the proper actuator diaphragm operating pressure is applied.

The bench set range is established with the assumption that there is no packing friction. When attempting to adjust the spring in the field, it is very difficult to ensure that there is no friction being applied by "loose" packing.

Accurate adjustment to the bench set range can be made during the actuator mounting process by making the adjustment before the actuator is connected to the valve (see the Bench Set Spring Adjustment Procedure).

If you are attempting to adjust the bench set range after the actuator is connected to the valve and the packing tightened, you must take friction into account. Make the spring adjustment such that full actuator travel occurs at the bench set range (a) plus the friction force divided by the effective diaphragm area with increasing diaphragm pressure or (b) minus the friction force divided by the effective diaphragm area with decreasing diaphragm pressure.

For an assembled valve-actuator assembly, the valve friction may be determined by following the procedure described below:

1. Install a pressure gauge in the actuator loading pressure line that connects to the actuator diaphragm casing.

Note

Steps 2 and 4 require that you read and record the pressure shown on the pressure gauge.

2. Increase the actuator diaphragm pressure and read the diaphragm pressure as the actuator reaches its mid-travel position.

3. Increase the actuator diaphragm pressure until the actuator is at a travel position greater than its mid-travel position.

4. Decrease the actuator diaphragm pressure and read the diaphragm pressure as the actuator reaches its mid-travel position.

The difference between the two diaphragm pressure readings is the change in the diaphragm pressure required to overcome the friction forces in the two directions of travel.

5. Calculate the actual friction force:

$$\text{Friction Force, pounds} = 0.5 \left(\begin{array}{c} \text{Difference} \\ \text{in pressure} \\ \text{readings, psig} \end{array} \right) \times \left(\begin{array}{c} \text{Effective} \\ \text{diaphragm area,} \\ \text{inches}^2 \end{array} \right)$$

Refer to table 1 for the effective diaphragm area.

When determining valve friction, you can make diaphragm pressure readings at a travel position other than mid-travel if you desire. If you take readings at zero or at the full travel position, take extra care to ensure that the readings are taken when the travel just begins or just stops at the position selected.

It is difficult to rotate the spring adjustor (key 12, figure 6, 7, and 8) when the full actuator loading pressure is applied to the actuator. Release the actuator loading pressure before adjusting. Then re-apply loading pressure to check the adjustment.

Bench Set Spring Adjustment

The term "bench set" means that the actuator is **not** connected to the valve, or to any other unbalanced loads. Ensure that the actuator stem is at the top of its travel as shown in figure 4. (Note: Some spring compression is required to move the diaphragm to the **top** of its travel.) The bench set steps provided are the same for direct or reverse acting valves.



WARNING

When moving the actuator stem with diaphragm loading pressure use caution to keep hands and tools out of the actuator stem travel path. Personal injury and/or property damage is possible if something is caught between the actuator stem and other control valve assembly parts.

Also, provide a certified pressure gauge suitable to accurately read the diaphragm pressure from 0

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through the upper bench set pressure marked on the nameplate. Apply loading pressure to the diaphragm.

Stroke the actuator a few times to ensure that the pressure gauge is working correctly, and that the actuator is functioning properly. It is important to be sure that the actuator assembly is **not** binding or producing any loading friction on the actuator stem movement.

1. If not already accomplished, provide a temporary means of applying an adjustable loading pressure to the actuator during bench set adjustments.
2. Set the diaphragm loading pressure at 0 psig. Then, slowly raise the pressure from 0 psig towards the lower bench set pressure while checking for the first movement of the actuator stem. The actuator stem should show movement at the lower bench set pressure. If movement occurs before or after the lower pressure is reached, adjust the spring adjuster (see figure 4) into or out of the yoke until the actuator stem's movement is **first** detected at the lower bench set pressure.
3. Be sure the spring adjuster is adjusted to meet the requirements of step 2 above.
4. Apply the upper bench set loading pressure to the diaphragm. This pressure extends the actuator stem down towards the valve. (Note: the actuator stem may slide over the valve stem as shown in figure 4.) At the end of the actuator stem, use a marker or a piece of tape to mark the valve stem (see figure 4). (Note: If the actuator stem does not pass over the valve stem provide a method to mark this point of stem travel.)
5. Slowly decrease the diaphragm loading pressure until the lower bench set pressure is applied. Measure the distance between the marker or tape on the valve stem to the end of the actuator stem. The distance should match the travel span shown on the travel indicator scale (key 18). If the span of travel is correct, bench set is complete. Proceed to the Installing the Stem Connector Assembly subsection.
6. If the travel span is **not** correct, a wrong or damaged spring has been installed in the actuator. To obtain the correct spring sizing information, refer to Fisher Catalog 14, Actuator Sizing and Sample Calculation sections to determine the correct spring selection for your application. Or, contact your Fisher sales office for assistance. After replacing the spring, repeat the steps above.

Installing the Stem Connector Assembly

When installing the stem connector assembly (key 26), the actuator and valve stem threads should engage the threads of the stem connector by the distance of the diameter of the stem.

Note

Replacement stem connectors are an assembly of two stem connector halves, cap screws, and a spacer between the connector halves.

Remove the spacer and discard, if present, before clamping the actuator and valve stems together.

1. If necessary, push the valve stem down so that it is touching the seat ring on direct acting valves. For reverse acting valves, push the stem down to the open position.

If necessary, screw the valve stem locknuts down, away from the connector location. For all actuators except size 87, ensure that the travel indicator disk (key 14) is located on top of the locknuts.

2. Slowly increase the diaphragm pressure to the upper bench set pressure. This should be the same pressure used in the bench set steps, and it is marked on the nameplate.

3. Place the stem connector half with the threaded holes, approximately half way between the actuator and valve stems. Refer to figures 6, 7, and 8 to help locate the connector position.

Be sure that the actuator and valve stem threads are engaging the threads of the stem connector by the distance of one diameter of the stem.

CAUTION

Incomplete engagement of either the valve stem or actuator stem in the stem connector can result in stripped threads or improper operation. Be sure that the length of each stem clamped in the stem connector is equal to or greater than one diameter of that stem. Damage to threads on either stem or in the stem connector can cause the parts to be replaced prematurely.

4. Install the other half of the stem connector and insert the cap screws and tighten them. If installing a positioner, also attach the feedback bracket at the same time.

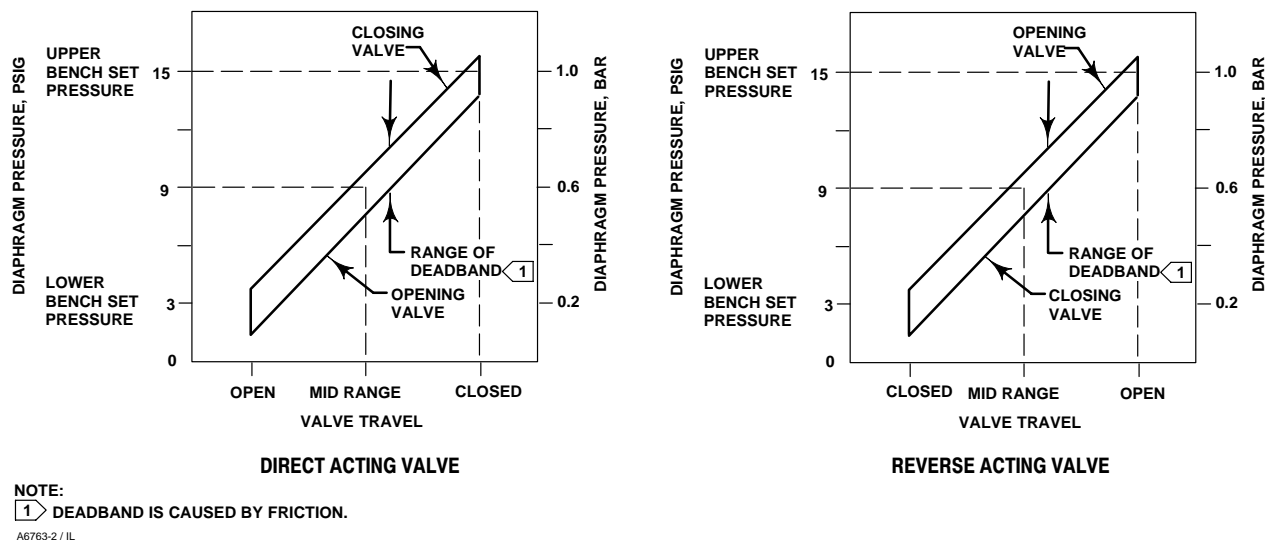


Figure 5. Typical Valve Response to Deadband

5. Screw the valve stem locknuts up until the indicator disk contacts the bottom of the stem connector, or for size 87 actuators, the stem connector. Do not overtighten the locknuts.

6. Slowly decrease and then increase pressure several times stroking the valve from the lower bench set pressure to the upper pressure.

Be sure that the valve is in closed position (up or down, depending on valve action). Loosen the screws on the travel scale, and align it with the travel indicator disk or stem connector. Stroke the valve full travel to ensure that the travel matches the valve travel on the travel indicator plate. If valve travel is not correct, repeat the stem connector procedure.

Note

For push-down-to-close valves, the valve plug seat is the limit for downward travel and the actuator up-stop is the limit for upward (away from the valve) movement. For push-down-to-open valves, the actuator down stop is the limit for downward movement, and the valve seat is the limit for upward (away from the valve) movement.

Deadband Measurement

Deadband is caused by packing friction, unbalanced forces, and other factors in the control valve

assembly. Deadband is the range a measured signal can vary without initiating a response from the actuator (see figure 5). Each actuator spring has a fixed spring rate (force). You have verified that the right spring was installed in the actuator by completing the Bench Set Spring Adjustment steps.

Deadband is one factor that affects the control valve assembly operation during automatic loop control. The control loop tolerance for deadband varies widely depending on the loop response. Some common symptoms of the deadband being too wide are no movement, a "jump" movement, or oscillating movements of the actuator during automatic loop control. The following steps are provided to determine the span of deadband. The percent of deadband is helpful in troubleshooting problems with the process control loop.

1. Start at a pressure near the lower bench set pressure, slowly increase pressure until the valve is approximately at mid-travel. Note this pressure reading.
2. Slowly decrease pressure until movement of the valve stem is detected, and note this pressure.
3. The difference between these two pressures is deadband, in psi.
4. Calculate the percent of deadband by:

$$\text{Deadband} = \frac{\text{Deadband, psi}}{\text{Bench Set Span, psi}} = \text{nn}\%$$

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Loading Connection

The loading pressure connections are made at the factory if the valve, actuator, and positioner come as a unit. Keep the length of tubing or piping as short as possible to avoid transmission lag in the control signal. If a volume booster, valve positioner or other accessory is used, be sure that it is properly connected to the actuator. Refer to the positioner instruction manual or other manuals as necessary.

For actuators shipped separately or whenever the actuator pressure connections are installed, use the following steps:

1. Connect the loading pressure piping to the NPT female connection in the top of the diaphragm casing.
2. For sizes 70 and 87 actuators, if necessary, remove the 0.25 inch NPT bushing if a 0.5 inch NPT female connection is needed to increase connection size. The connection can be made with either piping or tubing.
3. Cycle the actuator several times to be sure that the valve stem travel is correct when the correct pressure ranges are applied to the diaphragm.
4. If valve stem travel appears to be incorrect, refer to the Bench Set Spring Adjustment procedures at the beginning of this section. Do not place the valve in service if it is not reacting correctly to diaphragm loading pressure changes.

Maintenance

Actuator parts are subject to normal wear and must be inspected and replaced when necessary. The frequency of inspection and replacement depends on the severity of service conditions.



WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power,

or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.

- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.

- Vent the power actuator loading pressure and relieve any actuator spring precompression.

- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline.* Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.

- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Actuator Maintenance

This procedure describes how the actuator can be completely disassembled and assembled. When inspection or repairs are required, disassemble only those parts necessary to accomplish the job; then, start the assembly at the appropriate step.

Key numbers refer to figures 6, 7, or 8 unless otherwise indicated. Figure 6 shows the sizes 30 through 60 actuators, figure 7 illustrates the sizes 70 actuator, and figure 8 shows the size 87 actuator.

Actuator Disassembly

1. Bypass the control valve. Reduce the loading pressure to atmospheric, and remove the tubing or piping from the upper diaphragm casing (key 1).



WARNING

To avoid personal injury from the precompressed spring force thrusting the upper diaphragm casing (key 1) away from the actuator, relieve spring

compression (step 2, below), and carefully remove casing cap screws (key 22) (step 4, below).

2. Thread the spring adjuster (key 12) out of the yoke (key 9) until all spring compression is relieved.
3. If required, remove the actuator from the valve body by separating the stem connector (key 26) and removing the yoke locknut or, for the size 87 actuator, the stud bolt nuts. Separate the stem connector by loosening the stem nuts (keys 15 and 16) and unscrewing the two cap screws.
4. Remove the diaphragm casing cap screws and nuts (keys 22 and 23), then lift off the upper diaphragm casing (key 1).
5. Remove the actuator diaphragm (key 2).
6. Remove the diaphragm plate, actuator stem, and cap screw (keys 4, 10 and 3) as an assembly. This assembly can be broken down further, if required, by removing the cap screw (key 3).
7. Remove the actuator spring (key 6) and the spring seat (key 11).
8. If required, remove the lower diaphragm casing (key 5) from the yoke (key 9) by loosening the cap screws (key 8) that hold it in place.
9. If required, remove the spring adjuster (key 12) by unscrewing it from the yoke (key 9).

Actuator Assembly

1. Coat the threads and the spring seat bearing surface of the spring adjuster (key 12) with lubricant (key 241 or equivalent), and thread the spring adjuster into the yoke (key 9). Place the spring seat (key 11) in the yoke on the spring adjuster and turn the spring adjuster to ensure that threads are properly engaged.
2. Position the lower diaphragm casing (key 5) on the yoke (key 9), and fasten the parts together by installing and evenly tightening the cap screws (key 8).
3. Set the actuator spring (key 6) squarely onto the spring seat (key 11).
4. If the diaphragm plate and actuator stem (keys 4 and 10) are separate, fasten them together using the cap screw and washer (keys 3 and 25). Coat the cap screw threads with Lubriplate Mag-1 or equivalent (key 241). Tighten the cap screw (key 3) to 41 N•m (30 lbf•ft) torque for size 30 actuators, 54 N•m (40 lbf•ft) torque for size 34 and 40 actuators, or 149 N•m (110 lbf•ft) torque for size 45 to 87 actuators. Slide the actuator stem and diaphragm plate (keys 10 and 4) into the yoke (key 9) so that the actuator

spring (key 6) fits squarely between the diaphragm plate and the spring seat (key 11). Then slide the diaphragm rod through the spring adjuster (key 12).

5. Place the diaphragm (key 2) pattern-side up on the diaphragm plate (key 4). Align the holes in the diaphragm and the lower diaphragm casing (key 5).
6. Position the upper diaphragm casing (key 1) on the diaphragm (key 2) and align the holes.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30-70 and 87 actuators.

CAUTION

Over-tightening the diaphragm casing cap screws and nuts (keys 22 and 23) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

7. Insert the cap screws (key 22), and tighten the hex nuts (key 23) in the following manner. The first four hex nuts tightened should be diametrically opposed and 90 degrees apart. Tighten these four hex nuts to 13 N•m (10 lbf•ft).
8. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
9. Repeat this procedure by tightening four hex nuts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
10. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
11. After the last hex nut is tightened to 27 N•m (20 lbf•ft), all of the hex nuts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
12. Once completed, no more tightening is recommended.

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13. Mount the actuator on the valve by following the procedures in the Installation section.

Top-Mounted Handwheel Assembly

A top-mounted handwheel assembly (figures 9 and 10) is usually used as an adjustable casing-mounted up travel stop to limit full retraction of the actuator stem. Turning the handwheel clockwise moves the the handwheel stem (key 133, figures 9 and 10) down, compressing the spring.

Instructions are given below for complete disassembly and assembly of the top-mounted handwheel assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

Key numbers refer to figure 9 (sizes 30 through 60) and figure 10 (sizes 70 and 87), unless otherwise indicated.

Disassembly for Top-Mounted Handwheel

1. Turn the handwheel (key 51) counter-clockwise so that the handwheel assembly is not causing any spring compression.
2. Bypass the control valve, reduce loading pressure to atmospheric, and remove the tubing or piping from the upper handjack body (key 142, figures 9 or 10).



WARNING

To avoid personal injury from the precompressed spring force thrusting the upper diaphragm casing (key 1) away from the actuator, thread the spring adjuster (key 12) out of the yoke until all spring compression is relieved, then carefully remove casing cap screws (key 22).

3. Remove the diaphragm casing cap screws and nuts (keys 22 and 23, figures 6, 7, or 8), and lift off the upper diaphragm casing and handwheel assembly.
4. If necessary, the handwheel assembly can be separated from the diaphragm casing by removing the cap screws (key 141). This may be necessary to replace the O-ring (key 139), or for ease of handling.
5. Loosen the travel stop locknut (key 137), and turn the handwheel (key 51) counter-clockwise. Remove

the cotter pin and stop nut (keys 247 and 54), then lift off the handwheel.

6. Unscrew the travel stop locknut (key 137) from the handwheel stem (key 133), and turn the stem out of the bottom of the body (key 142). A screwdriver slot is provided on the top of the stem for this purpose.

7. Replace the O-ring (key 138) in the body (key 142).

8. **For a handwheel assembly used on sizes 30 through 60 actuators**, complete the disassembly by driving out the groove pin (key 140, figure 9) and sliding the pusher plate (key 135, figure 9) off the stem.

For a handwheel assembly used on a sizes 70 or 87 actuator, complete the disassembly by unscrewing the retaining screw (key 174, figure 10) and removing the thrust bearing and pusher plate (keys 175 and 135, figure 10). Because the retaining screw (key 174) has left-hand threads, turn clockwise to loosen.

Assembly for Top-Mounted Handwheel

1. **For a handwheel assembly used on sizes 30 through 60 actuators**, coat the end of the handwheel stem (key 133, figure 9) with lubricant (key 244 or equivalent). Slide the pusher plate (key 135, figure 9), onto the stem, and drive in the groove pin (key 140, figure 9) to lock the pieces together.

For a handwheel assembly used on a sizes 70 or 87 actuator, pack the thrust bearing (key 175, figure 10) with lubricant (key 244 or equivalent). Place the thrust bearing in the pusher plate (key 135, figure 10), slide the two parts onto the handwheel stem (key 133). Coat the retaining screw threads with sealant (key 242 or equivalent). Insert and tighten the retaining screw (key 174, figure 10).

2. Coat the O-ring (key 138) with lubricant (key 241 or equivalent), and insert the O-ring in the body (key 142).

3. Coat the threads of the handwheel stem (key 133) with lubricant (key 244 or equivalent). Screw the stem into the body (key 142).

4. Thread the travel stop locknut (key 137) onto the handwheel stem (key 133).

5. Place the handwheel (key 51), and the stop nut (key 54) on the handwheel stem (key 133). Tighten the hex nut to fasten the parts together. Secure the nut with the cotter pin (key 247).

6. If the body (key 142) was separated from the upper diaphragm casing (key 1, figures 6, 7, or 8), lubricate the O-ring (key 139) with lubricant (key 241

or equivalent), and place the O-ring in the body. Align the holes in the diaphragm casing and the body, insert the cap screws (key 141), and tighten them evenly following a crisscross pattern to ensure a proper seal.

7. Position the upper diaphragm casing (key 1) on the diaphragm (key 2) and align the holes.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30-70 and 87 actuators.

CAUTION

Over-tightening the diaphragm casing cap screws and nuts (keys 22 and 23) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

8. Insert the cap screws (key 22), and tighten the hex nuts (key 23) in the following manner. The first four hex nuts tightened should be diametrically opposed and 90 degrees apart. Tighten these four hex nuts to 13 N•m (10 lbf•ft).
9. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
10. Repeat this procedure by tightening four hex nuts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
11. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
12. After the last hex nut is tightened to 27 N•m (20 lbf•ft), all of the hex nuts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.

13. Once completed, no more tightening is recommended.

14. Mount the actuator on the valve following the procedures in the Installation section.

Side-Mounted Handwheel for Sizes 34 through 60 Actuators

A side-mounted handwheel assembly (figures 11 and 12) is normally used as a manual actuator for sizes 34 through 60 actuators. Turning the handwheel counter-clockwise past the neutral position opens the valve. Two levers (key 146, figure 11) on a handwheel assembly operate the valve by moving the valve stem.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then begin the assembly at the appropriate step.

Disassembly for Side-Mounted Handwheel (Size 34-60)

1. If desired, the handwheel assembly can be removed from the actuator yoke. To do this, remove the hex nuts (keys 147 and 170) from the U-bolts (keys 166 and 143) that hold the assembly to the yoke.
2. Remove the retaining ring (key 154) and drive out the lever pivot pin (key 153).
3. Two screws (key 156) hold the right- and left-hand levers (key 146) together. Remove the screw from the top of the levers so that the levers will drop down out of the assembly. Disassemble further, if necessary, by removing the other screw.
4. Remove the screw (key 161) and pointer mounting bolt (key 159, not shown) located behind pointer (key 160).
5. Remove the stop nut (key 54), lockwasher (key 150), and washer (key 149). Then remove the handwheel (key 51), being careful not to lose the small ball (key 55) and spring (key 56).
6. Loosen the locking set screw (key 168, not shown). Then, using a suitable tool, unscrew the bearing retainer (key 136).
7. Pull the handwheel screw assembly (key 145) out of the handwheel body. The operating nut (key 132) will come out with the screw. Also remove the bushing (key 151).
8. If required, remove the two ball bearings (key 152), one from the bearing retainer and the other from the handwheel body.

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Assembly for Side-Mounted Handwheel (Size 34-60)

1. Pack the ball bearings (key 152) with lubricant (key 244 or equivalent). Insert one bearing and the bushing (key 151) in the handwheel body (key 142) as shown in figure 11 or 12. The bushing is not used in a handwheel assembly for sizes 45 through 60 actuators.
2. Coat the handwheel screw assembly (key 145) threads with lubricant (key 244 or equivalent), and thread the operating nut (key 132) onto the screw. Slide the second ball bearing (key 152) onto the screw, and insert the end of the screw into either the bushing (key 151), as shown in figure 11, or into the bearing.
3. Thread the bearing retainer (key 136) into the body (key 142). Completely tighten the bearing retainer, and then loosen it one-quarter turn. Tighten the set screw (key 168, not shown) to hold the bearing retainer in place.
4. Coat the groove in the handwheel body (key 142) with lubricant (key 241 or equivalent). Insert the spring (key 56) and ball (key 55) into the handwheel (key 51). Holding the ball and spring in the handwheel, put the handwheel, the washer (key 149), the lockwasher (key 150), and the stop nut (key 54) on the end of the handwheel screw (key 145). Tighten the stop nut.
5. Position the pointer mounting bolt (key 159, not shown) and pointer (key 160) as shown in figure 11 or 12. Insert and tighten the screw (key 161).
6. Assemble the two levers (key 146) with the cap screws (key 156) for handwheel assemblies for sizes 45, 50, and 60 actuators, or with the machine screws (key 156) for handwheel assemblies on sizes 34 and 40 actuators.
7. If the handwheel assembly was removed from the yoke (key 9, figures 6, 7, or 8), remount the handjack assembly to the yoke using the dowel pins for alignment. Position the U-bolts (keys 166 and 143) on the yoke, and hand-tighten the hex nuts (keys 170 and 147) to hold the handwheel assembly in position. Cap screws (key 163) should be tight against the yoke legs to provide stability. Tighten nuts (key 144). Finish tightening the U-bolt nuts to 163 N•m [120 lbf•ft] (key 170) and 41 N•m [30 lbf•ft] (key 147). Be sure the handwheel assembly remains flat against the mounting pad and perpendicular to the yoke.
8. Position the levers (key 146) as shown in figure 11 or 12. Insert the lever pivot pin (key 153), and

snap the retaining ring (key 154) onto the lever pivot pin.

Side-Mounted Handwheel for Sizes 70 and 87 Actuators

A side-mounted handwheel assembly (figure 13) is usually used as a manual actuator for sizes 70 and 87 actuators. Turning the handwheel counter-clockwise past the neutral position opens the valve body. A pair of sleeves (keys 34 and 46, figure 13) operates the valve by moving the valve stem.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; and then begin the assembly at the appropriate step.

Key numbers refer to figures 7 or 8, and 11.

Disassembly for Side-Mounted Handwheel (Size 70 & 87)

1. Bypass the control valve, reduce loading pressure to atmospheric, and remove the tubing or piping from the upper diaphragm casing (key 1).
2. Remove cover band (key 60), and relieve spring compression by turning the spring adjuster (key 12) counter-clockwise.
3. Remove the cap screws and casing screws and nuts (keys 22 and 23), lift off the upper diaphragm casing (key 1), and remove the diaphragm (key 2).
4. Remove the cap screw (key 3) and the washer (key 25), then take off the diaphragm plate (key 4).
5. Remove the actuator spring (key 6), the upper sleeve (key 34), and the spring seat (key 11) from the yoke cylinder. This exposes the needle bearing and races (keys 37 and 38).
6. Separate the halves of the stem connector assembly (key 26) by removing the two cap screws. Remove the actuator stem (key 10).
7. Remove the travel indicator (key 14).
8. Turn the handwheel to raise the lower sleeve (key 46) until it is free of the worm gear (key 44). Lift out the lower sleeve and the key (key 47). DO NOT move the neutral indicator scale (key 59).
9. Loosen two set screws (key 40), then unscrew the bearing retainer flange (key 39) and the attached spring adjuster (key 12), using a suitable tool in the open neck of the flange. Take out the gear and two needle bearings (key 42), one on each side of the gear.

10. Remove the spring adjuster (key 12) from the bearing retainer flange (key 39). If desired, the worm shaft (key 45) and associated parts can be disassembled to replace or lubricate them. To do so, first remove the stop nut (key 54) and the handwheel (key 51). Do not lose the small ball (key 55) and spring (key 56).

11. Loosen the two set screws (key 41), and unscrew the front and back retainers (keys 48 and 49). The ball bearings (key 50) will come out with the retainers. Remove the worm shaft (key 45).

Assembly for Side-Mounted Handwheel (Size 70 & 87)

1. The front and back retainers (keys 48 and 49) each have a slot in their threads for a set screw (key 41). Pack the ball bearings (key 50) with lubricant (key 244 or equivalent), and insert one ball bearing in the back retainer (key 49) as shown in figure 13.

2. Thread the back retainer and ball bearing (keys 49 and 50) into the yoke (key 9). Align the slot in the bearing retainer with the set screw hole in the yoke, insert the set screw (key 41), and tighten it.

3. Coat the worm shaft (key 45) threads with lubricant (key 244 or equivalent), and slide the shaft into the yoke so that the end of the shaft fits snugly into the back retainer (key 49).

4. Insert the bearing in the front retainer (key 48), and thread the retainer and ball bearing into the yoke (key 9). Align the slot in the retainer with the hole in the yoke, insert the set screw (key 41), and tighten it.

5. Put the spring and ball (keys 56 and 55) in the handwheel (key 51). Slide the handwheel onto the worm shaft (key 45). Thread the stop nut (key 54) onto the shaft.

6. Pack the two needle bearings (key 42) and coat the worm gear (key 44) threads with lubricant (key 244 or equivalent). Insert the key (key 47), the bearings, and the gear in the yoke (key 9) as shown in figure 13.

7. Slots are cut in the threads of the bearing retainer flange (key 39). Thread the flange into the yoke (key 9) so that the slots and the holes for the set screws (key 40) align. Insert the screws, and tighten them.

8. The lower sleeve (key 46) has milled slots in one end. Coat the sleeve threads with lubricant (key 241 or equivalent), then slide the end of the lower sleeve with the milled slots into the bearing retainer flange (key 39).

9. Turn the handwheel (key 51), and feed the sleeve through the gear so that the slot in the lower sleeve (key 46) engages the key (key 47) in the yoke (key 9). Continue turning the handwheel until the lower sleeve protrudes 93.7 mm (3.69 inches) below the surface of the yoke. The pin in the side of the lower sleeve should line up with the extension on the neutral indicator.

10. Slide the square end of the actuator stem (key 10) through the lower sleeve (key 46) so the stem contacts the valve stem. Clamp both stems in the two halves of the stem connector (key 26). The stem connector should not be closer than 0.125 inches (3.2mm) to the lower sleeve when the actuator stem is in the retracted position. This adjustment will provide approximately 3.2 mm (0.125 inches) of free travel of the lower sleeve in either direction for manual operation. Fasten the stem connector halves together with the cap screws.

11. Pack the needle bearing and race (keys 37 and 38) with lubricant (key 241 or equivalent), and slide the bearing onto the spring adjuster (key 12).

12. Put the spring seat and actuator spring (keys 11 and 6) in the yoke (key 9). Slide the upper sleeve (key 34) onto the actuator stem (key 10).

13. Put the diaphragm plate and washer (keys 4 and 25) on the actuator stem (key 10). Insert and tighten the cap screw (key 3) to fasten the parts together.

14. Place the diaphragm (key 2) pattern-side up on the diaphragm plate (key 4). Align the holes in the diaphragm and the lower diaphragm casing (key 5).

15. Position the upper diaphragm casing (key 1) on the diaphragm (key 2) and align the holes.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30-70 and 87 actuators.

CAUTION

Over-tightening the diaphragm casing cap screws and nuts (keys 22 and 23) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

16. Insert the cap screws (key 22), and tighten the hex nuts (key 23) in the following manner. The first four hex nuts tightened should be diametrically opposed and 90 degrees apart. Tighten these four hex nuts to 13 N•m (10 lbf•ft).
17. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
18. Repeat this procedure by tightening four hex nuts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
19. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
20. After the last hex nut is tightened to 27 N•m (20 lbf•ft), all of the hex nuts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
21. Once completed, no more tightening is recommended.
22. Mount the actuator on the valve following the procedures in the Installation section.
23. Return the actuator to service after completing the Loading Connection procedure in the Installation section and the procedures in the Adjustments section.

Casing-Mounted Adjustable Travel Stops

Note

If repeated or daily manual operation is expected, the actuator should be equipped with a manual top-mounted or side-mounted handwheel. Refer to the Top-Mounted Handwheel and Side-Mounted Handwheel sections of this instruction manual.

The casing-mounted adjustable up travel stop (figures 14 or 15) limits the actuator stroke in the upward direction. To adjust, first relieve actuator loading pressure before removing the travel stop cap (key 187, figure 14 or 15). Loosen the travel stop nut

(key 137). Then turn the travel stop stem (key 133) clockwise into the diaphragm case to move the actuator stem downward (or counter-clockwise to move the stem upward). Finally, tighten the travel stop nut and replace the travel stop cap.

The adjustable down travel stop (figure 16) limits the actuator stroke in the downward direction. To adjust, first relieve actuator loading pressure before removing the travel stop cap (key 187). Then loosen the jam nut and adjust the stop nut (keys 189 and 54) either down on the stem to limit travel, or up on the stem to allow more travel. Lock the jam nut against the stop nut, then replace the closing cap.

Instructions are given below for disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

Key numbers are shown in figures 14, 15, and 16.

Disassembly for Casing-Mounted Travel Stop

1. Bypass the control valve. Reduce the loading pressure to atmospheric, and remove the tubing or piping from the connection in the body (key 142).



WARNING

To avoid personal injury from the precompressed spring force thrusting the upper diaphragm casing (key 1) away from the actuator, relieve spring compression (steps 2 and 3, below), and carefully remove casing cap screws (key 22) (step 4, below).

2. Thread the spring adjuster (key 12) out of the yoke (key 9) until all spring compression is relieved.

Casing-Mounted Adjustable Up Travel Stops

1. Remove the travel stop cap (key 187) and loosen the travel stop nut (key 137). Rotate the travel stop stem (key 133) counter-clockwise until the travel stop assembly is no longer compressing the spring.
2. Remove the upper diaphragm casing (key 1, figures 6, 7, or 8) as outlined in the Maintenance section.
3. Remove the cap screws (keys 141) and separate the travel stop assembly from the upper casing.
4. Remove and inspect the O-rings (keys 138 and 139); replace if necessary.
5. **For sizes 30 through 60**, drive out the groove pin (key 140), and slide the pusher plate (key 135) off the travel stop stem (key 133).

For sizes 70 and 87, remove the retaining screw (key 174) to inspect the thrust bearing (key 175).

Casing-Mounted Adjustable Down Travel Stops

1. Remove the travel stop cap (key 187). Unscrew the jam nut and stop nut (keys 189 and 54) until the travel stop assembly is no longer compressing the spring. Remove the jam nut and stop nut.
2. Remove the upper diaphragm casing (key 1, figures 6, 7, or 8) as outlined in the Maintenance section.
3. Remove the cap screws (keys 141) and separate the travel stop assembly from the upper casing.
4. Remove and inspect the O-ring (keys 139); replace if necessary.
5. Loosen the stop nut (key 54), then unscrew the travel stop stem (key 133) out of the actuator stem. The lower diaphragm plate can now be removed.

Assembly for Casing-Mounted Travel Stop

1. Reassemble the up or down travel stop in the reverse order of the disassembly steps, being sure to apply lubricant as shown by the lubrication boxes (key 241) in figures 6, 7, 8, 14, 15, or 16, as appropriate.
2. Readjust the travel stop to obtain the appropriate restriction by following the adjustment procedures presented in the introductory portion of the Casing-Mounted Adjustable Travel Stops section. Return the unit to operation.

Note

Fisher does not assume responsibility for the selection, use, or maintenance of any product. Responsibility for proper selection, use, and maintenance of any Fisher product remains solely with the purchaser and end-user.

Parts Ordering

Each actuator has a serial number stamped on the nameplate. Always mention this number when corresponding with your Fisher sales office regarding technical information or replacement parts. Also, reference the complete 11-character part number of each needed part as found in the following Parts List.

Note

Use only genuine Fisher replacement parts. Components that are not supplied by Fisher should not, under any circumstances, be used in any Fisher valve, because they will void your warranty, might adversely affect the performance of the valve, and might jeopardize worker and workplace safety.

Parts Kits

Key	Description	Part Number
-----	-------------	-------------

Kits for Side-Mounted Handwheels

Retrofit kit includes parts to add a side-mounted handwheel.

Size 34 push down to close	30A8778X0A2
Size 34 push down to open	30A8778X0B2
Size 40 push down to close	30A8778X0C2
Size 40 push down to open	30A8778X0D2
Size 45 & 46 push down to close	40A8779X0A2
Size 40 & 60 push down to open	40A8779X0B2
Size 50 & 60 push down to close	40A8779X0C2
Size 50 & 60 push down to open	40A8779X0D2

Kits for Top-Mounted Handwheels

Retrofit kit includes parts to add a top-mounted handwheel. Kit 1 includes the handwheel assembly only. Kit 2 includes kit 1 and a new diaphragm case that is required to mount the handwheel assembly.

KIT 1	
Size 30	28A1205X012
Sizes 34 & 40	28A1205X022
Sizes 45, 50, & 60	28A1205X032
Sizes 70 & 87	CV8010X0032
KIT 2	
Size 30	28A1205X042
Sizes 34 & 40	28A1205X052
Sizes 45 & 50	28A1205X062
Sizes 46 & 60	28A1205X072
Sizes 70 & 87	CV8010X0042

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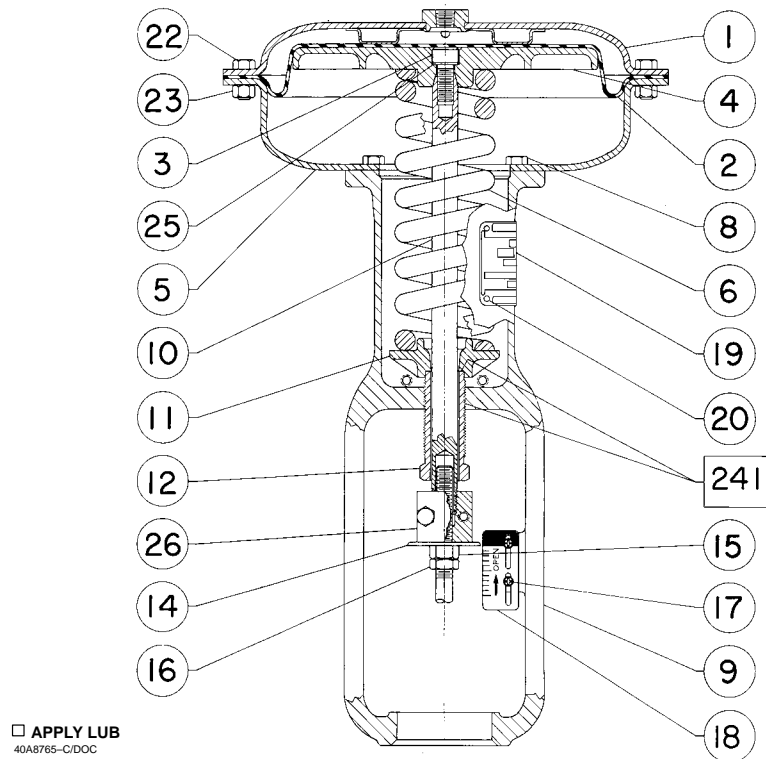


Figure 6. Type 657 Actuator Sizes 30 through 60

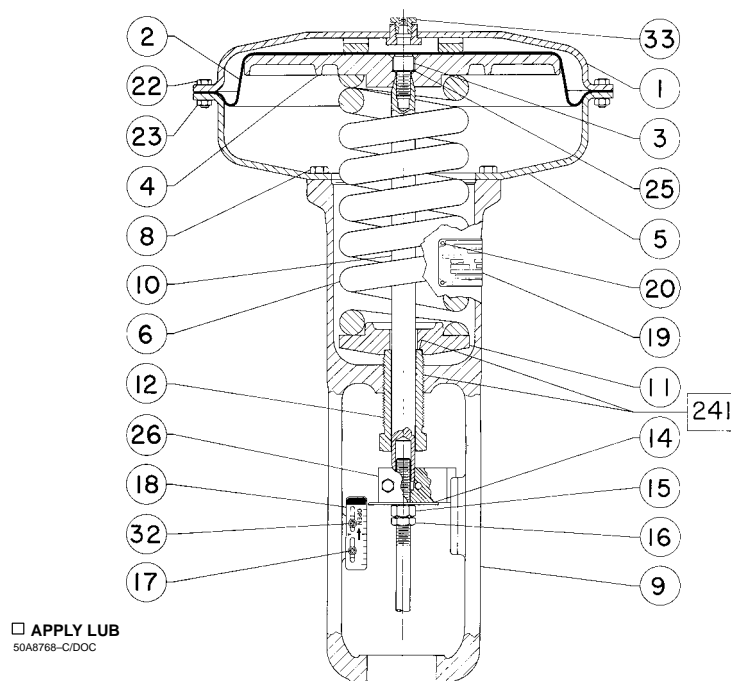


Figure 7. Type 657 Size 70 Actuator

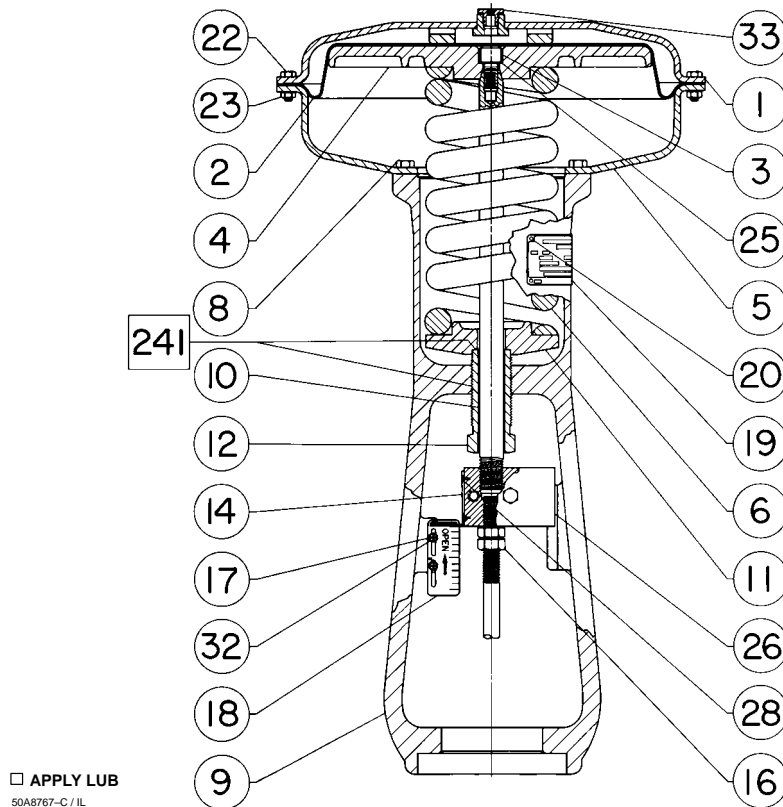


Figure 8. Type 657 Size 87 Actuator

Parts List

Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your Fisher sales office.

Actuator Assembly (figures 6, 7, or 8)

Key	Description	Part Number	Key	Description	Part Number
1	Upper Diaphragm Casing		3	Cap Screw	
2*	Diaphragm		4	Diaphragm Plate	
	Molded nitrile/nylon		5	Lower Diaphragm Casing	
	Standard construction		6	Actuator Spring	
	Size 30	2E791902202	7	Travel Stop Cap Screw	
	Sizes 34 & 40	2E670002202	8	Cap Screw	
	Sizes 45 & 50	2E859502202	9	Yoke	
	Sizes 46 & 60	2E859702202	10	Actuator Stem	
	Sizes 70 & 87	2N126902202	11	Spring Seat	
	With down travel stop (style 2)		12	Spring Adjuster	
	Size 30	2E800002202	13	Lower Diaphragm Plate	
	Sizes 34 & 40	2E669902202	14	Travel Indicator Disk, SST	
	Sizes 45 & 50	2E859602202	15	Stem Nut	
	Sizes 46 & 60	2E859802202	16	Stem Jam Nut	
	Sizes 70 & 87	2N130902202	17	Self-Tapping Screw	
	Molded silicone/polyester		18	Travel Indicator Scale	
	Standard Construction		19	Nameplate, SST	12B6508X0A2
	Size 30	18B2713X082	20	Drive Screw	
	Sizes 34 & 40	18B2713X092	22	Cap Screw	
	Sizes 45 & 50	18B2713X102	23	Hex Nut	

See following table

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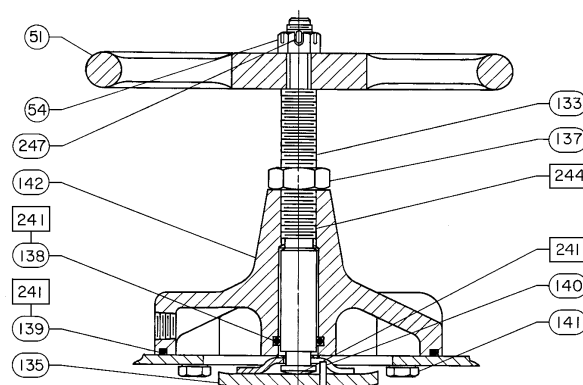
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Key	Description	Part Number
24	Twin Speed Nut	
25	Washer	
26	Stem Connector Assy, Steel Zn Pl	
	Sizes 30 & 34	18A1243X012
	Size 34 with side mtd handwheel	1F659225142
	Size 40	18A1668X012
	Size 40 with side mtd handwheel	1F659125142
	Sizes 45 & 46	18A1671X012
	Sizes 45 & 46 w/ side mtd handwheel (SST,Stl)	2F1678000A2
	Sizes 50 & 60	18A1672X012
	Sizes 50 & 60 w/ side mtd handwheel (SST,Stl)	2F1672000A2
	Size 70	18A1675X012
	with side mtd handwheel	18A1678X012
	with PMV positioner	18A1845X012
	657-4 with 4 in. max. travel (SST,Stl)	21A8254X012
	Size 87 (SST,Stl)	21A7469X012
	Size 87 with side mtd handwheel	18A1825X012
28	Screw	
29	Yoke Extension	
30	Indicator Adaptor	
31	Machine Screw	
32	Washer	
33	Pipe Bushing	
61	Nameplate	
73	Cap Screw	
238	Warning label	
241	Lubricant, Lubriplate Mag-1 or equivalent (not furnished with the actuator)	
249	Caution nameplate	

Top Mounted Handwheel (figure 9 or 10)

51	Handwheel	
54	Stop Nut	
133	Handwheel Stem, brass	
134	Washer	
135	Pusher Plate	
137	Casing-Mounted Travel Stop Locknut	
138*	O-Ring, nitrile	
	Sizes 30, 34, & 40	1D237506992
	Sizes 45, 46, 50, & 60	1B885506992
	Sizes 70 & 87	1C415706992
139*	O-Ring, nitrile	
	Sizes 30, 34, & 40	1D267306992
	Sizes 45, 46, 50, & 60	1D547106992
	Sizes 70 & 87	1D269106992
140	Groove Pin	
141	Cap Screw	
142	Body	
169	Grease Fitting	
174	Retaining Screw	
175	Thrust Bearing	
176	Thrust Race	
241	Lubricant, Lubriplate Mag-1 or equivalent (not furnished with actuator)	
242	Sealant, Loctite or equivalent (not furnished with handwheel)	
244	Lubricant, Anti-Seize Lub-3 Never-Seez or equivalent (not furnished with handwheel)	
246	Spacer	
247	Cotter Pin	

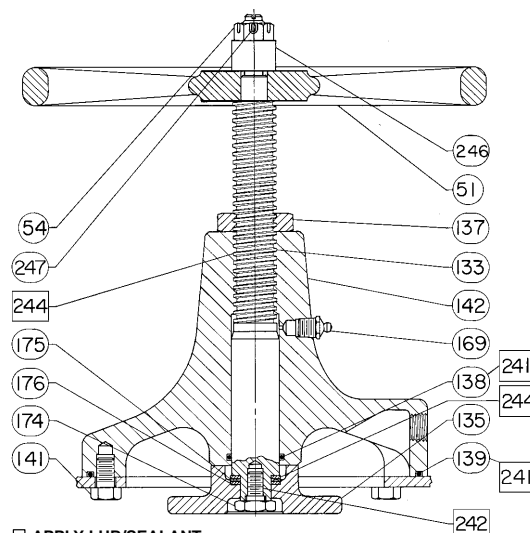


□ APPLY LUB/SEALANT

NOTES:
THE TOP MOUNTED HANDWHEEL IS NOT DESIGNED
FOR USE UNDER HEAVY LOAD OR FOR FREQUENT USE.

28A1205-D / IL

Figure 9. Top-Mounted Handwheel Assembly for Size 30 through 60 Actuators



□ APPLY LUB/SEALANT

NOTES:
THE TOP MOUNTED HANDWHEEL IS NOT DESIGNED
FOR USE UNDER HEAVY LOAD OR FOR FREQUENT USE.

CV8010-G / IL

Figure 10. Top-Mounted Handwheel Assembly for Sizes 70 through 87 Actuators

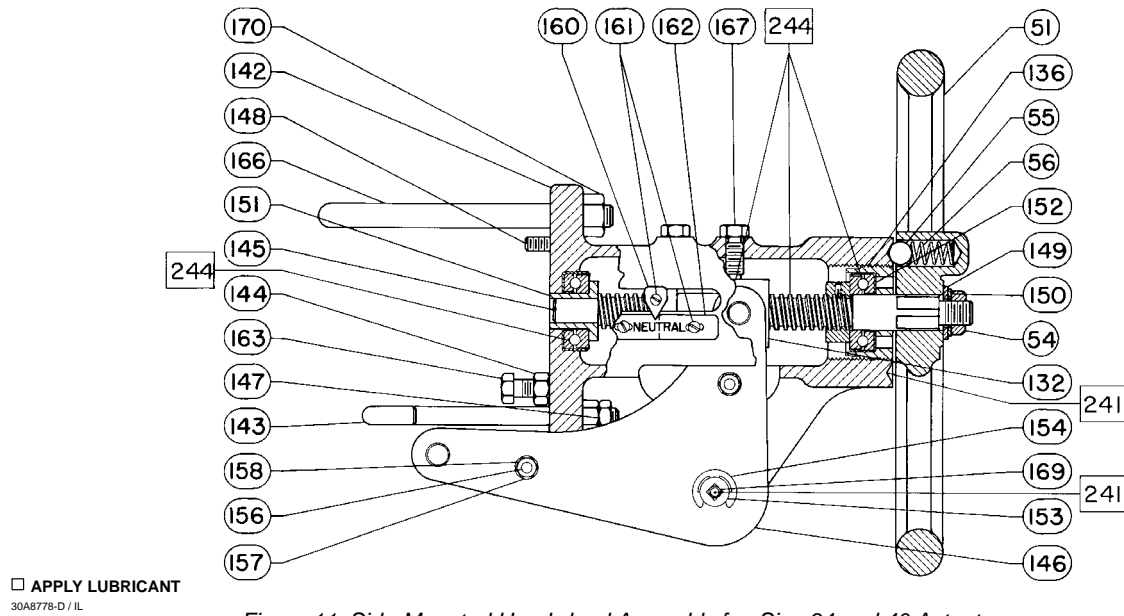


Figure 11. Side-Mounted Handwheel Assembly for Size 34 and 40 Actuators

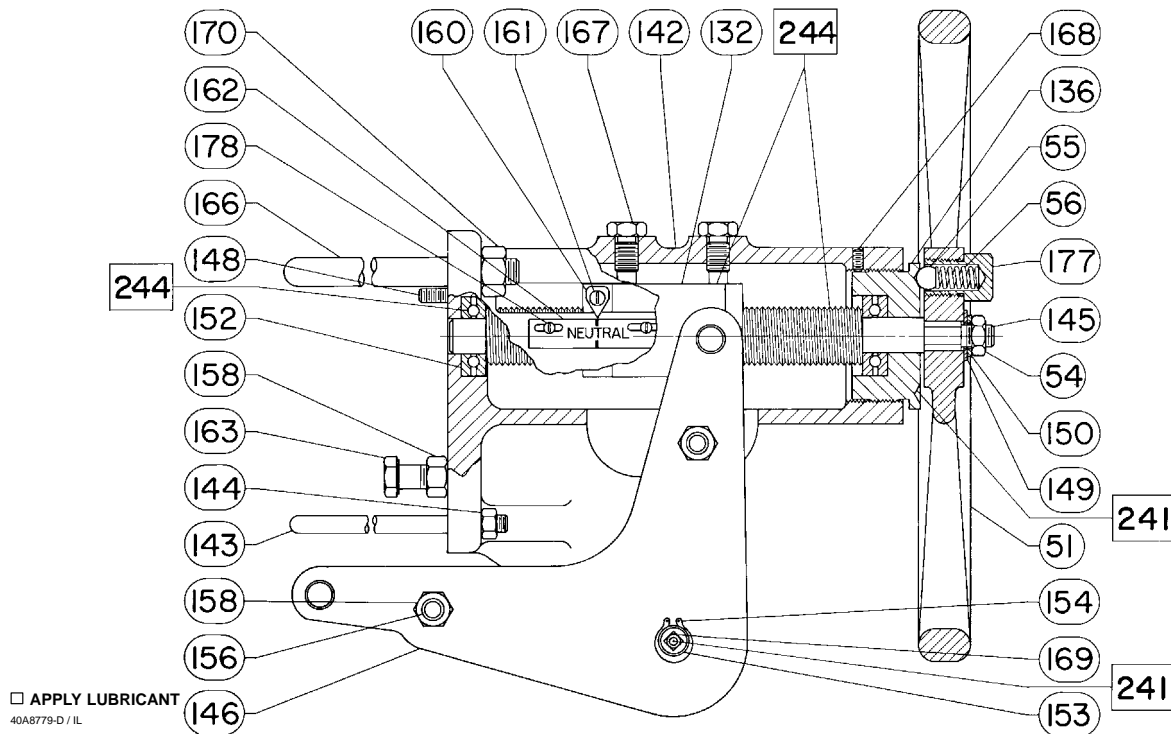


Figure 12. Side-Mounted Handwheel Assembly for Size 45 and 60 Actuators

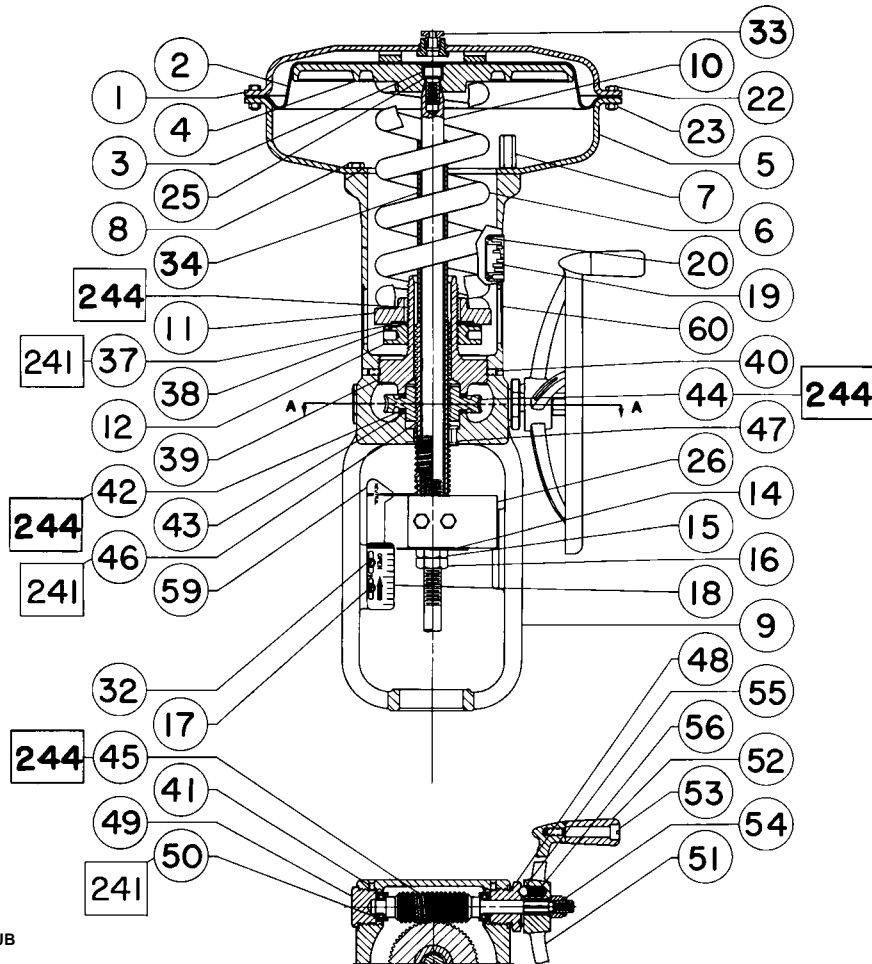
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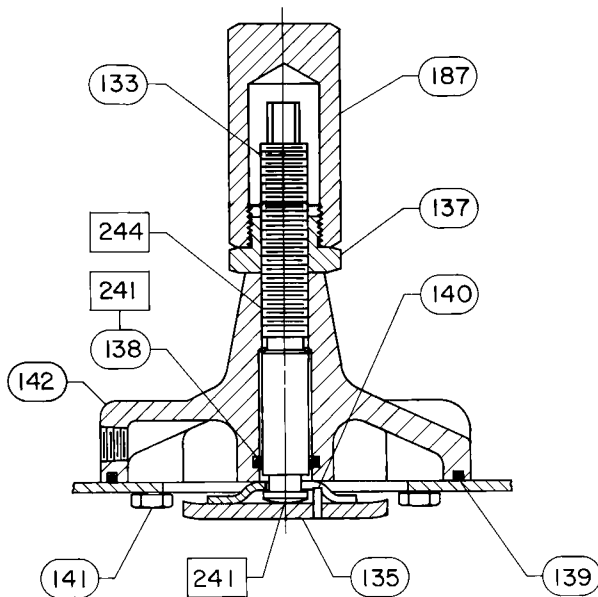
Key	Description	Part Number	Key	Description	Part Number
Side-Mounted Handwheel (figure 11, 12, or 13)			143	U-Bolt	
34	Upper Sleeve		144	Hex Nut, pl steel	
37	Needle Bearing		145	Handwheel Screw	
38	Needle Bearing Race		146	Lever & Pin Ass'y	
39	Bearing Retainer Flange		147	Hex Jam Nut	
40	Set Screw		148	Dowel Pin	
41	Set Screw		149	Washer	
42	Needle Bearing		150	Lockwasher	
43	Needle Bearing Race		151	Bushing	
44	Worm Gear		152	Ball Bearing	
45	Worm Shaft		153	Lever Pivot Pin	
46	Lower Sleeve		154	Retaining Ring	
47	Key		155	Lever Spacer	
48	Front Retainer		156	Screw	
49	Back Retainer		157	Lockwasher	
50	Ball Bearing		158	Hex Nut	
51	Handwheel		159	Pointer Mounting Bolt	
52	Handgrip		160	Pointer	
53	Handgrip Bolt		161	Screw	
54	Stop Nut		162	Indicator Plate	
55	Ball		163	Cap Screw	
56	Spring		166	U-Bolt	
59	Handwheel Indicator		167	Guide Bolt	
60	Cover Band Ass'y		168	Set Screw	
61	Grease Fitting		169	Grease Fitting	
132	Operating Nut		170	Hex Nut	
136	Bearing Retainer		177	Spring Cap	
142	Handwheel Body		178	Machine Screw	
			241	Lubricant, Lubriplate Mag-1 or equivalent (not furnished with handwheel)	
			244	Lubricant, Anti-Seize Lub-3 Never-Seez or equivalent (not furnished with handwheel)	



SECTION A-A

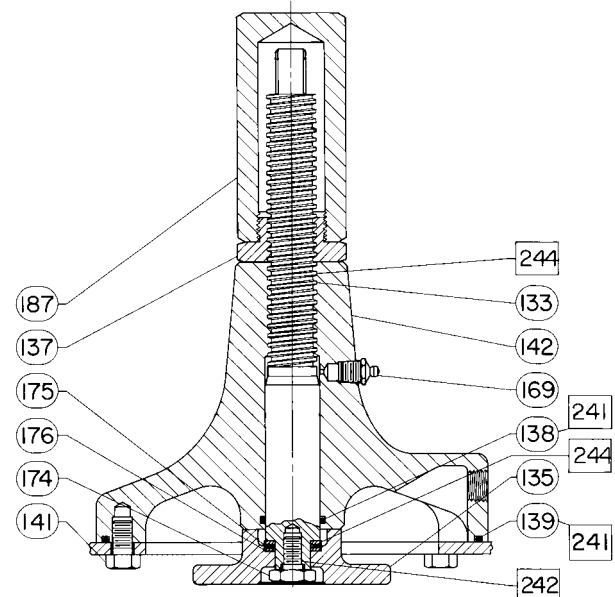
Figure 13. Type 657 Size 70 and 87 Actuators with Side-Mounted Handwheel

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□ APPLY LUBRICANT
28A1206-C / IL

Figure 14. Casing-Mounted Adjustable Up Travel Stop for Sizes 30 through 60 Actuators (Style 1)



□ APPLY LUB/SEALANT
CV8057-E / IL

Figure 15. Casing-Mounted Adjustable Up Travel Stop for Sizes 70 and 87 Actuators (Style 1)

Key Description Part Number

Casing-Mounted Adjustable Up Travel Stops (figures 14 or 15)

133	Travel Stop Stem	
135	Pusher Plate	
137	Travel Stop Nut	
138*	O-Ring, nitrile	
	Sizes 30, 34, & 40	1D237506992
	Sizes 45, 46, 50, & 60	1B885506992
	Sizes 70 & 87	1C415706992
139*	O-Ring, nitrile	
	Sizes 30, 34, & 40	1D267306992
	Sizes 45, 46, 50, & 60	1D547106992
	Sizes 70 & 87	1D269106992

Key Description Part Number

140	Groove Pin	
141	Cap Screw	
142	Body	
169	Grease Fitting	
174	Retaining Screw	
175	Thrust Bearing	
176	Thrust Bearing Race	
187	Travel Stop Cap	
241	Lubricant, Lubriplate Mag-1 or equivalent (not furnished with travel stop)	
244	Lubricant, Anti-Seize Lub-3 Never-Seez or equivalent (not furnished with handwheel)	

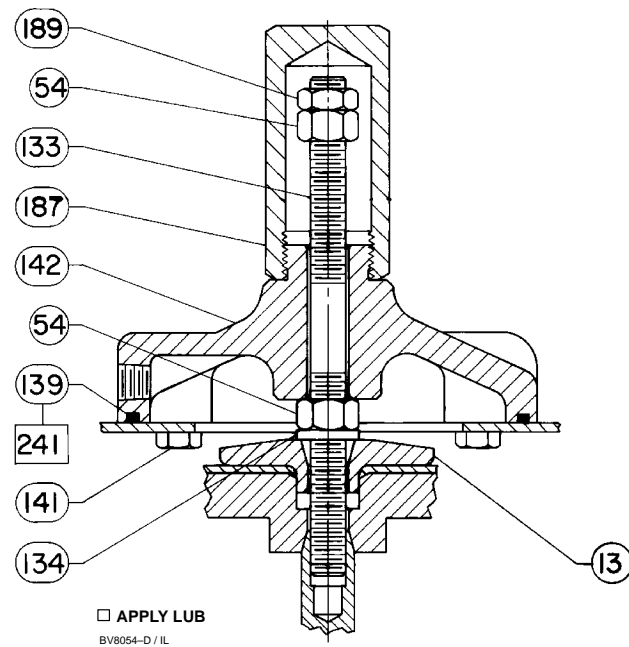


Figure 16. Casing-Mounted Adjustable Down Travel Stop for Size 30 and 40 Actuators (Style 2)

Key	Description	Part Number
-----	-------------	-------------

Casing-Mounted Adjustable Down Travel Stop (figure 16)

54	Stop Nut	
133	Travel Stop Stem	
134	Washer	
139*	O-Ring, nitrile	
	Sizes 30, 34, & 40	1D267306992
	Sizes 45, 46, 50, & 60	1D547106992
	Sizes 70 & 87	1D269106992
141	Cap Screw	
142	Body	
187	Travel Stop Cap	
189	Jam Nut	
241	Lubricant, Lubriplate Mag-1 or equivalent (not furnished with travel stop)	

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Key 6 Actuator Spring

ACTUATOR SIZE	DIAPHRAGM PRESSURE RANGE		TRAVEL, mm (INCHES)					
	Bar	Psig	11 (0.4375)	16 (0.625)	19 (0.75)	29 (1.125)	38 (1.5)	51 (2)
30	0.2-1.0	3-15	1E795327082 Light Blue (1260)	1E795520792 Brown (885)	1E792327092 Dark Gray (735)	---	---	---
	0.4-2.0	6-30	1E795627082 White (2520)	1E795427082 Light Gray (1770)	1E79247082 Light Green (1470)	---	---	---
34 ⁽¹⁾ & 40	0.2-1.0	3-15	1E805127082 Aluminum (1840)	1E804927082 Yellow (1327)	1E805827082 White (1100)	1E805327092 Dark Gray (736)	1E805627092 Dark Green (550)	---
	0.4-2.0	6-30	1E805027082 Purple (3780)	1E804827082 Light Blue (2650)	1E805227082 Orange (2210)	1E805527082 Dark Blue (1470)	1E805827082 White (1100)	---
45 & 50	0.2-1.0	3-15	---	1E826727082 Tan (2080)	1E826227082 Light Green (1670)	1E826127082 Dark Gray (1120)	1E826627082 Orange (840)	1E826927082 Dark Green (630)
	0.4-2.0	6-30	---	1E825627082 Purple (4160)	1E825527082 Aluminum & Red (3320)	1E826427082 Light Gray (2240)	1E826227082 Light Green (1670)	1E826527082 Red (1260)
46 & 60	0.2-1.0	3-15	---	1E825827082 Yellow (2770)	1E825727082 Brown (2500)	1E826227082 Light Green (1670)	1E826527082 Red (1260)	1E827027082 Aluminum & Dark Blue (935)
	0.4-2.0	6-30	---	---	1E826027082 Bronze (5000)	1E825527082 Aluminum & Red (3320)	1E825727082 Brown (2500)	1E826327082 Aluminum & Dark Green (1870)
			19 (0.75)	29 (1.125)	38 (1.5)	51 (2)	76 (3)	102 (4)
70 & 87	0.2-1.0	3-15	1N127927082 Red (3360)	1N719327082 White (2240)	1N128727082 Yellow (1680)	1N128427082 Light Green (1260)	1N128627082 Dark Gray (840)	---
	0.4-2.0	6-30	---	1N128127082 Brown (4475)	1N127927082 Red (3360)	1N128527082 Light Blue (2520)	1N128727082 Yellow (1680)	1R676027082 ⁽²⁾ Black (860)

1. 29 mm (1.125 inch) and 38 mm (1.5 inch) travels available in size 40 only.
2. Diaphragm pressure range for this spring & travel combination is 0.2-2.0 bar (3-30 psig).

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Emerson Process Management

Fisher

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Singapore 128461

www.Fisher.com



EMERSON
Process Management

ROTARY SCREW COMPRESSOR PILOT VALVES

ISSUED: 3-22-82

HCPN
63140

APPLICATION: TYPES CP AND CP-2

Types CP and CP-2 are frequently used as pilot valves in Rotary Screw compressors to control receiver pressure or compressor discharge pressure. The pilot valve, supplied with air pressure from the receiver regulates the air pressure to a cylinder or diaphragm which positions the control device in the compressor suction line and/or positions the speed control on engine-driven units. One additional use for the pilot is to maintain proper circulation of the lube oil in the compressor. Use of the types CP and CP-2 significantly contribute to considerable savings in energy. Additionally they lead to quieter compressor operation and reduced wear.

PRINCIPLE OF OPERATION:

The type CP and Type CP-2 provide a regulated output pressure that increases at a pre-determined rate as the receiver pressure or compressor discharge pressure increases above the desired pressure setting of the pilot. The pilot is provided to increase, in straight line fashion, on a ratio of 1 to 1, 2 to 1, 3 to 1; or whatever ratio or differential control is required for proper functioning of the compressor. For example, assume the pilot is to start to open when receiver pressure reaches 100 psi; further assume that the pilot is operating with a 2 to 1 ratio. At this point the pilot output pressure is 0 psi. On 10 psi increase the pilot will provide a controlled discharge pressure from 0 to 20 psi as compressor pressure increases from 100 psi to 110 psi. (See graph on reverse)

CONSTRUCTION:

Type CP and Type CP-2 have bronze body and spring chamber, stainless steel seats, phosphor bronze diaphragm, durable gaskets. Type CP-2 has a larger seat for increased capacity. Type CP is available in 1/4" pipe size with either side inlet - side outlet or side inlet - bottom outlet. Type CP-2 is available in 1/4" or 3/8" sizes with either side inlet - side outlet or side inlet - bottom outlet. All connections are threaded female.

TYPE CP ADJUSTMENT RANGES (PSI)				
2-25	15-65	40-100	75-175	100-250

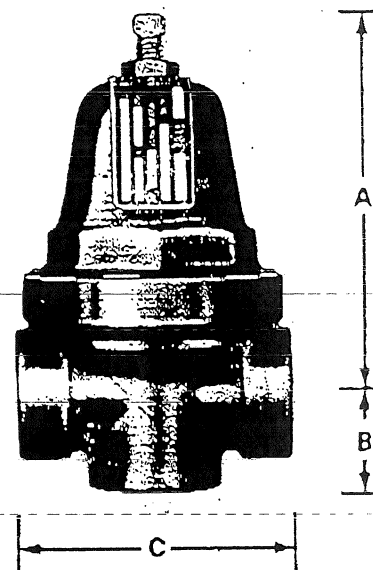
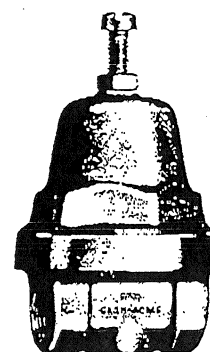
TYPE CP-2 ADJUSTMENT RANGES (PSI)					
0-30	31-50	51-80	81-150	151-250	200-400

DIMENSIONS:

TYPE	SIZE (INCHES)	CONNECTIONS	DIMENSIONS (INCHES)			SHIP. WT. (Pounds)
			A	B	C	
CP	1/4"	side inlet; side or bottom outlet	3 1/2	1 1/2	2 1/2	1 1/2
CP-2	1/4"	side inlet; side or bottom outlet	4 1/2	1 1/2	2 1/2	2 1/2
CP-2	3/8"	side inlet; side or bottom outlet	4 1/2	1 1/2	2 1/2	2 1/2

HOW TO ORDER:

Cash-Acme Types CP and CP-2 Pilots are suitable for adaption to specialized compressor designs. For application of these valves in a special design or along the more standard applications discussed in this bulletin, please contact the Industrial/OEM Sales Department at the address below.



A. W. CASH VALVE MFG. CORP.
WABASH AT MORGAN



DECATUR, ILLINOIS 62525
TELEPHONE 217/422-8574

HCPN
63140

TYPICAL INSTALLATION SCHEMATIC:

In order to provide a better idea of how the Type CP and Type CP-2 are used we have provided the system schematic at right. This is intended to represent a "typical" application, and, as such, is greatly simplified. For your specific application requirements, please consult the Industrial/OEM Sales Department at the factory.

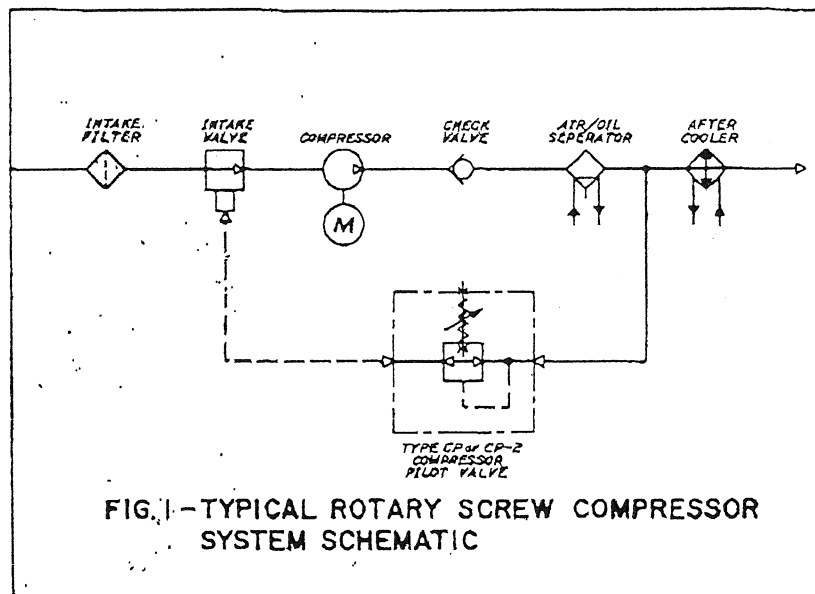
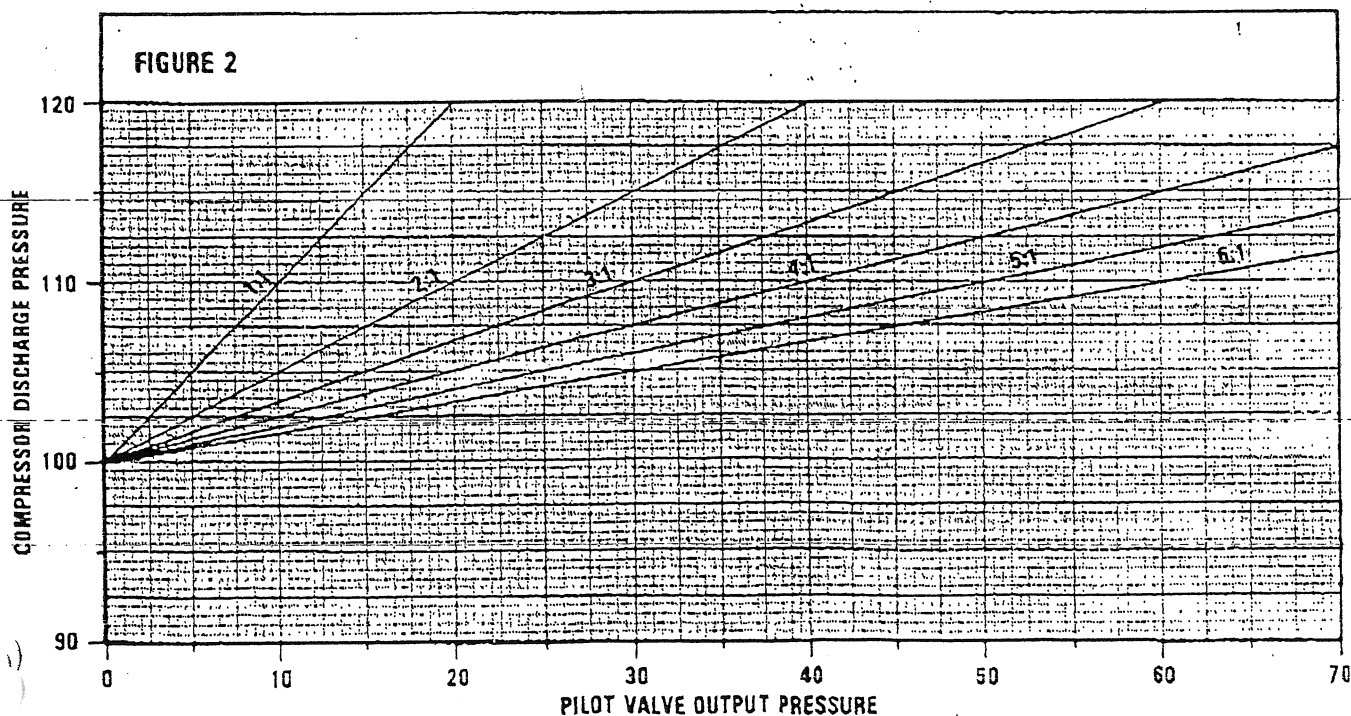


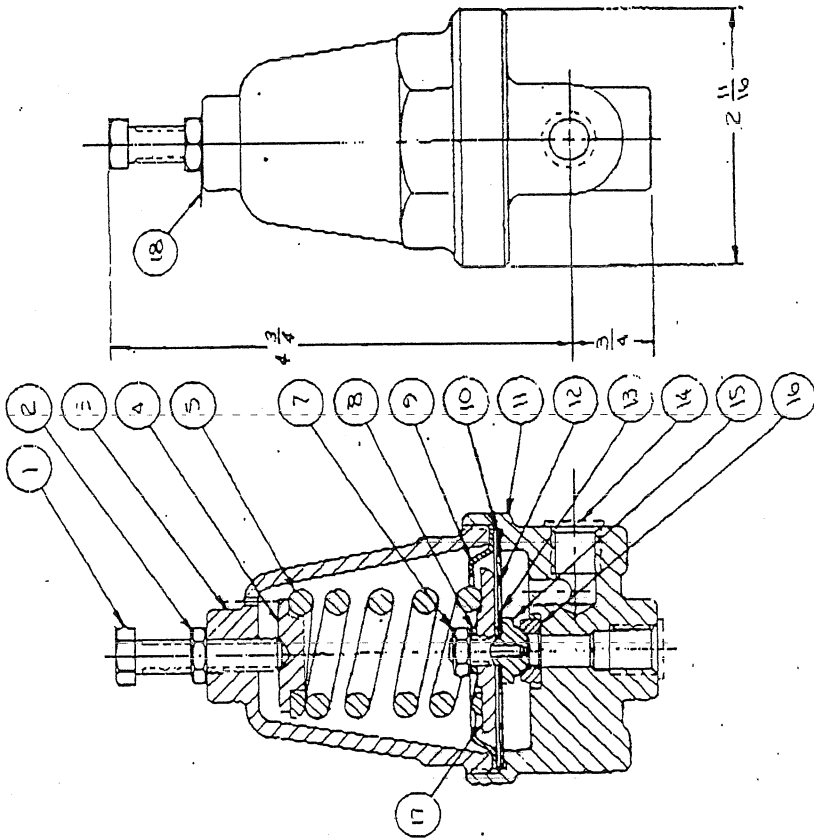
FIG. 1 - TYPICAL ROTARY SCREW COMPRESSOR SYSTEM SCHEMATIC

PERFORMANCE GRAPH:

The graph below illustrates the linear output of the Types CP and CP-2 valves for a given set point and a variety of ratios. The graph is given in .5 psi increments.



LIST OF MATERIALS				NO. 15360	
REF. NO.	NO. REQ'D	PART NO.	DESCRIPTION	MATERIAL	
1	1	15441	ADJUSTING SCREW	18-8 SST	
2	1	1629	LOCK NUT	STEEL	
3	1	15361	SPRING CHAMBER	BRASS	
4	1	14586	SPRING BUTTON	302 SST	
5	1	14272	ADJUSTING SPRING	302 SST	
7	1	1353	NUT	STEEL	
8	1	B226	LOCK WASHER	STEEL	
9	1	B243	DIAPHRAGM STOP	BRASS	
10	1	2295	DIAPHRAGM GASKET	ARAMID FIBRE	
11	1	B234	BODY	BRASS	
12	5	76586	DIAPHRAGM	BRONZE	
13	1	2153	BALL SEAT GASKET	ARAMID FIBRE	
14	2	7078	SHIPPING PLUG	PLASTIC	
15	1	9588	BALL SEAT	303 SST	
16	1	B231	SEAT RING	303 SST	
17	1	12094	PRESSURE PLATE	BRASS	
18	1	B353	NAME TAG	ALUMINUM	



- NOTES
1. DIMENSIONS ARE APPROXIMATE.
 2. SEE ED2855 FOR MARKING INSTRUCTIONS.
 3. SEE ED-3053 FOR ASSEMBLY & TEST INSTRUCTIONS.

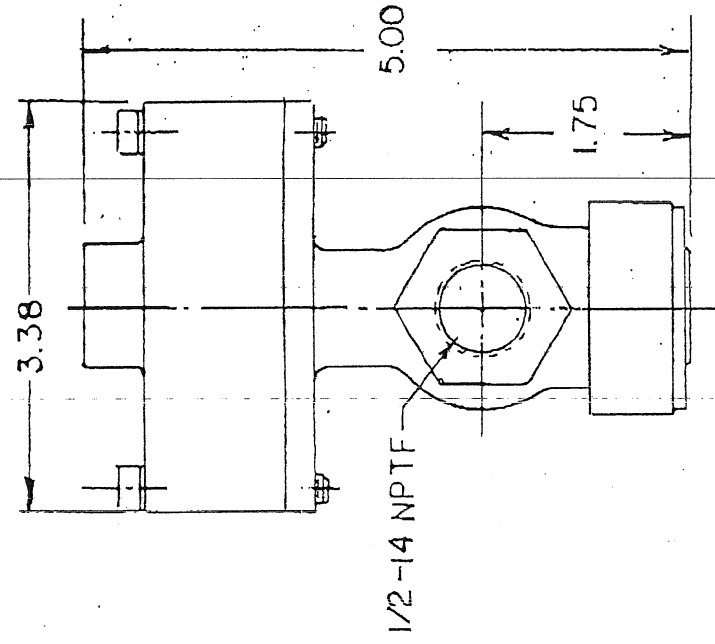
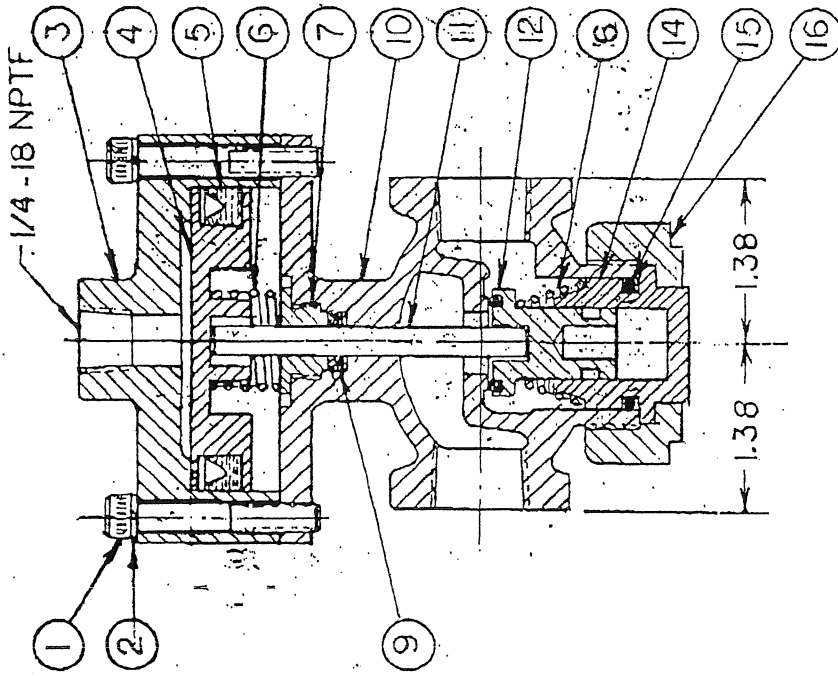
HCPNI
63140

MATERIAL		SCALE 1:1	
PART NAME		DRAWN G.S.	
DIFFERENTIAL PILOT VALVE ASSEMBLY		CHK'D. KR	
		APP'D. KR	
		RELEASED 6-1978	
		DATE C-12-78	
		SIZE 1/4"	
		TYPE CP-2	
		NO. 15360	

The Following Standards Apply Unless Specified Otherwise		CHANGE	
ASME Y14.5-1994		WAS	
ANSI Z39.1-1967		WAS	
ASME Y14.19-1990		WAS	
ASME Y14.25-1990		WAS	
ASME Y14.37-1990		WAS	
ASME Y14.41-1990		WAS	
ASME Y14.42-1990		WAS	
ASME Y14.43-1990		WAS	
ASME Y14.44-1990		WAS	
ASME Y14.45-1990		WAS	
ASME Y14.46-1990		WAS	
ASME Y14.47-1990		WAS	
ASME Y14.48-1990		WAS	
ASME Y14.49-1990		WAS	
ASME Y14.50-1990		WAS	
ASME Y14.51-1990		WAS	
ASME Y14.52-1990		WAS	
ASME Y14.53-1990		WAS	
ASME Y14.54-1990		WAS	
ASME Y14.55-1990		WAS	
ASME Y14.56-1990		WAS	
ASME Y14.57-1990		WAS	
ASME Y14.58-1990		WAS	
ASME Y14.59-1990		WAS	
ASME Y14.60-1990		WAS	
ASME Y14.61-1990		WAS	
ASME Y14.62-1990		WAS	
ASME Y14.63-1990		WAS	
ASME Y14.64-1990		WAS	
ASME Y14.65-1990		WAS	
ASME Y14.66-1990		WAS	
ASME Y14.67-1990		WAS	
ASME Y14.68-1990		WAS	
ASME Y14.69-1990		WAS	
ASME Y14.70-1990		WAS	
ASME Y14.71-1990		WAS	
ASME Y14.72-1990		WAS	
ASME Y14.73-1990		WAS	
ASME Y14.74-1990		WAS	
ASME Y14.75-1990		WAS	
ASME Y14.76-1990		WAS	
ASME Y14.77-1990		WAS	
ASME Y14.78-1990		WAS	
ASME Y14.79-1990		WAS	
ASME Y14.80-1990		WAS	
ASME Y14.81-1990		WAS	
ASME Y14.82-1990		WAS	
ASME Y14.83-1990		WAS	
ASME Y14.84-1990		WAS	
ASME Y14.85-1990		WAS	
ASME Y14.86-1990		WAS	
ASME Y14.87-1990		WAS	
ASME Y14.88-1990		WAS	
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ASME Y14.90-1990		WAS	
ASME Y14.91-1990		WAS	
ASME Y14.92-1990		WAS	
ASME Y14.93-1990		WAS	
ASME Y14.94-1990		WAS	
ASME Y14.95-1990		WAS	
ASME Y14.96-1990		WAS	
ASME Y14.97-1990		WAS	
ASME Y14.98-1990		WAS	
ASME Y14.99-1990		WAS	
ASME Y15.00-1990		WAS	

8353 WAS 1564, ADDED SEE ED2855

324508



PARTS LEGEND
ASSEMBLY
SERVICE
REPAIR KIT
BUNAN 20-1691
VITON
500 PSIG

REVISION		PREV. REV. OMITTED		I 1-4-86; ECL-049		DHW HAS R 512 - REDRAWN		REL		K 12/11/85; ECL-1016		ITEM 9 WAS 7.51RL REL													
Lexair, Inc. LEXINGTON, KENTUCKY												DRAWN RRL		CHECKED ✓		APPROVED EJA		SHEET NO. 1-4-86		SHEETS					
1/2" 2WAY POPPET VALVE - N.C. PILOT OPERATED (8-1 RATIO)												PC NO. 324508		MADE FROM		DHW		B 324508		SCALE		APPROX. WT.			
MATERIAL SPEC.												FINISHED		AS CAST		DEC. 01		DEC. 005		FRACTIONAL		ANGLES		PROCESS SPEC.	
												2.015		1.000		2.010		1/16"		1/2"					

MACALISTER
859-255-5001

HCPN
60938

BILL OF MATERIAL

10/01/92

ORIGINAL

324508-26

1/2, DPG, N/C, 2-1, VITON

5324508

PC 59

R/K 20-1972

HCPN

60938

PART NUMBER	QTY/UNIT	DESCRIPTION	DRAWING NUM	ITEM #
01-0026	4.00	SCREW, SHC, 1/4-20 X 1 3/4	A01-2020	01
01-0501	4.00	WASHER, LOCK, 1/4	A01-0500	02
04-09-212	1.00	O-RING, VITON	A04-09-XXX	15
06-0065	1.00	O-RING, VITON	A06-0060	05
07-0076	1.00	POLYSEAL, VITON	A07-0076	09
20-0067	1.00	NUT, HEX, 1 7/16-12	A20-0067	16
20-0068	1.00	GUIDE, POPPET	A20-0068	14
20-0134	1.00	NUT, GLAND	A20-0134	07
20-0185	1.00	BOOY, 1/2	320-0185	10
20-0986	1.00	POPPET ASSY, VITON	A20-0986	12
20-1329	2.00	SPRING, PILOT	A20-1329	06
20-1624	1.00	PIR, ACTUATING, 1/4	520-1624	11
21-0043	1.00	PISTON	B21-0043	04
21-0054	1.00	CAP, PILOT	B21-0054	03



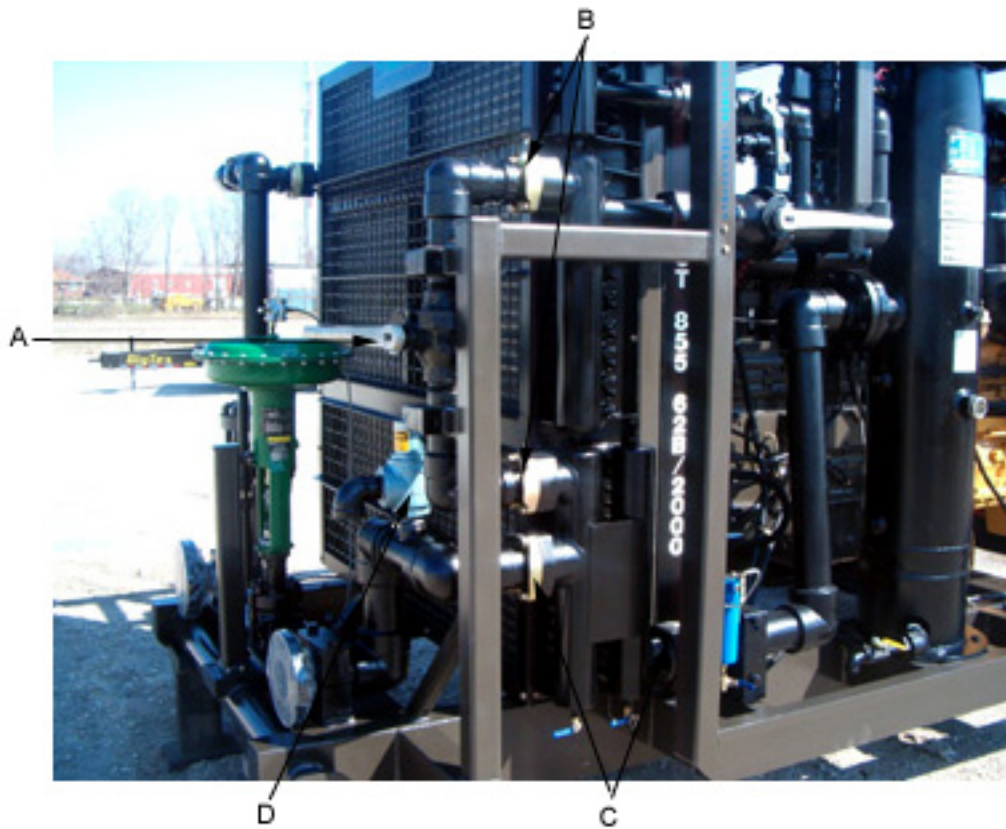
Item	Part Number	Description	Qty
A	62430-02	Coolant Gauge	1
B	62430-01	Tachometer	1
C	62430	Murphy Powerview 100	1
D	63336	0-600 PSIG Gauge	1
E	63337	0-1500 PSIG Gauge	1
F	63458	0-3000 PSIG Gauge	1
G	61312-04	3 Position Center Momentary Switch	1
H	62070	Push Button Switch	1
I	61312-01	3 Position Right Momentary Switch	1
J	62072	2 Position Selector Switch	1
K	62750	Green Lens	1
L	60328	Tattle Tale Relay	2
M	61938	0-100 psig Switch gage	1
N	61344	440°F Switch gage	2
O	62430-03	0-100 psig Gauge	1
P	61883	160° F Switch Gauge	1
Q	61798	Fuel Level Gauge	1
R	63277	Exhaust Temperature Gauge	1



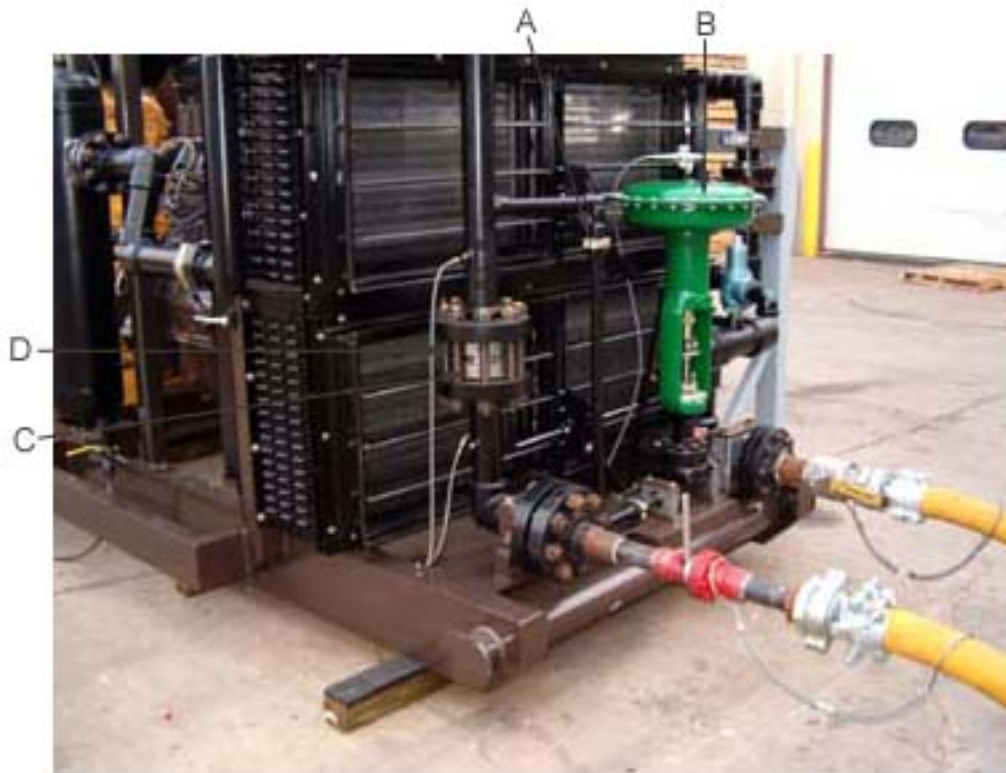
Item	Part Number	Description	Qty
A	62489	E-Stop Button	1
B	61312-03	Contact Block	8
C	62078	Light Unit	1
D	61581	Lamp	1
E	63259	20 amp Circuit Breaker	1
F	62215	15 amp Circuit Breaker	2



Item	Part Number	Description	Qty
A	62127	Pressure Switch	1
B	60667	0-3000 PSIG Gauge	1



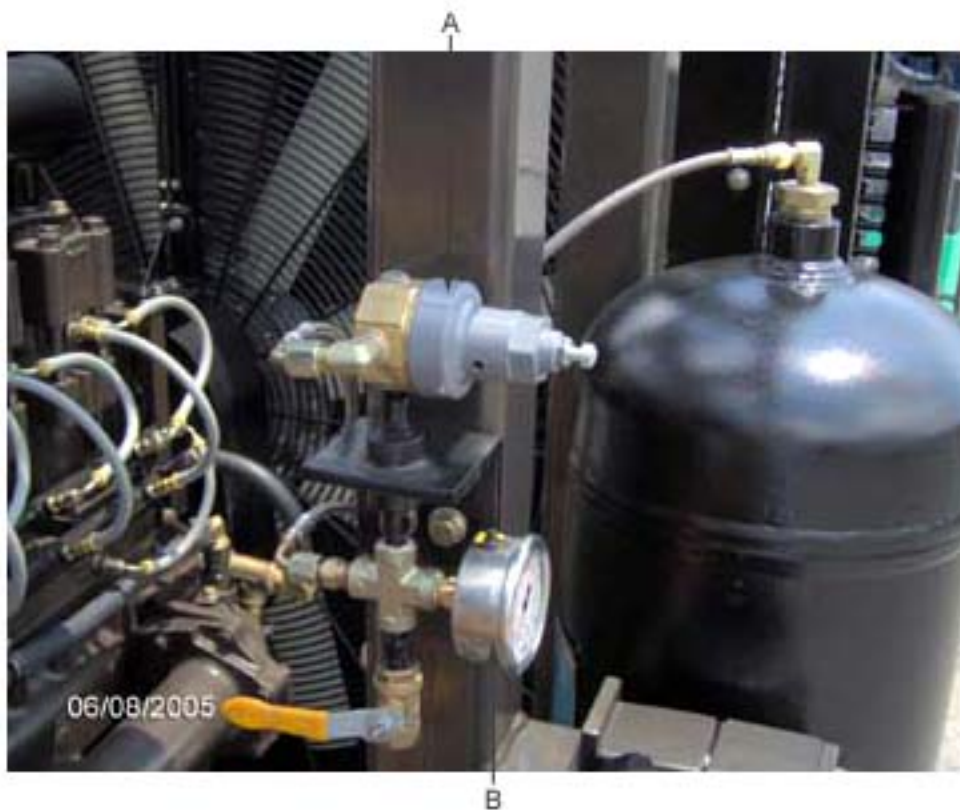
Item	Part Number	Description	Qty
A	63838	3" NPT Ball Valve	1
B	62208-01	2-237 O-Ring	2
C	61354	2-245 O-Ring	2
D	63622	450 PSIG Safety Relief Valve	1



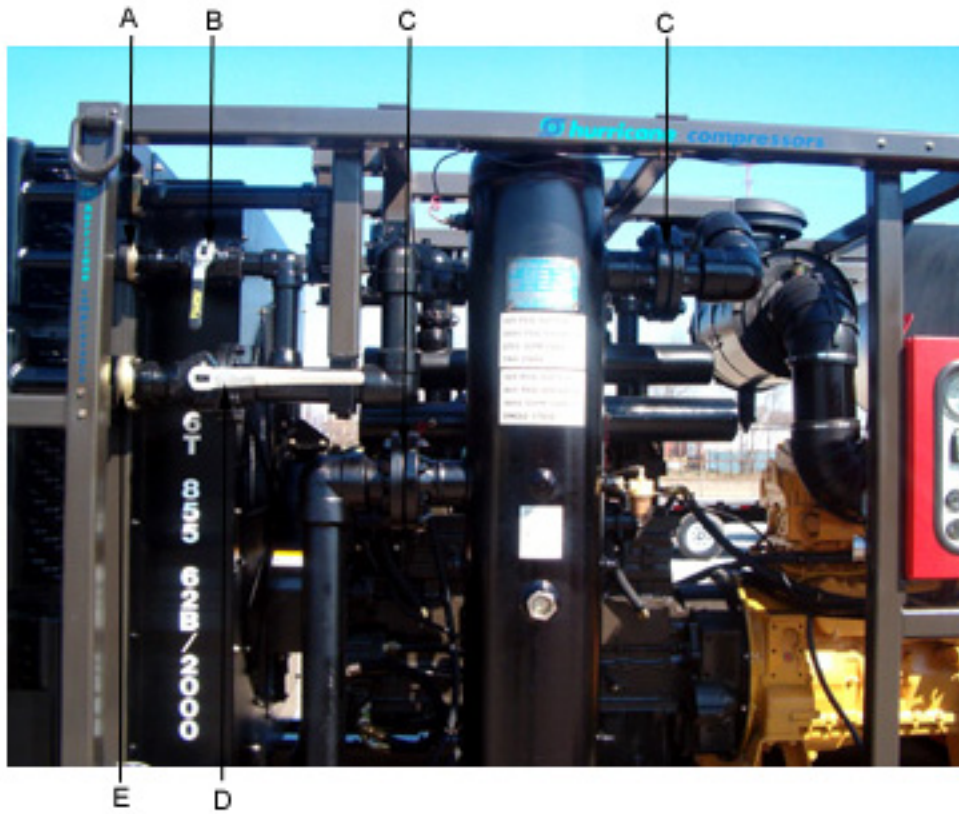
Item	Part Number	Description	Qty
A	30252	2-219 O-Ring	2
B	63834	Fisher Unload Valve	1
C	63688	3" Ansi Gasket	2
D	62742	Check Valve	1



Item	Part Number	Description	Qty
A	63140	Back Pressure Regulator	1
B	63869-01	Water Separator Element	1
C	60938	Pilot Operated Valve	1
D	63801	Oil Pressure Regulation Valve	1
E	60782	½" Air Muffler	1



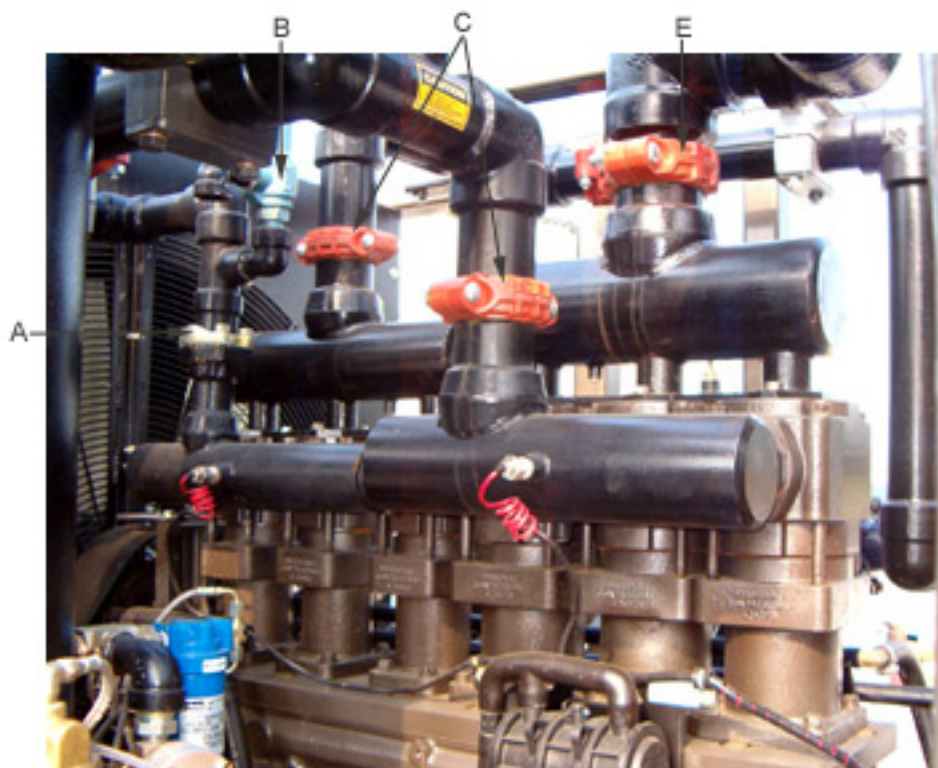
Item	Part Number	Description	Qty
A	62512	Regulator	1
B	61853	0-100 PSIG Gauge	1



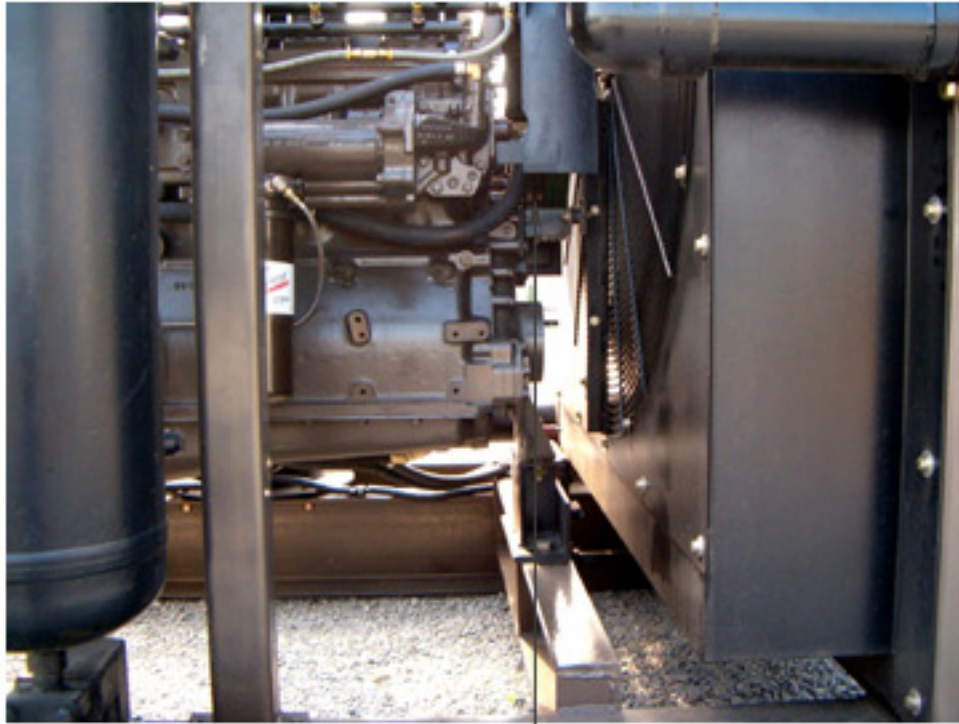
Item	Part Number	Description	Qty
A	62917	2-228 O-Ring	2
B	63837	2" NPT Ball Valve	1
C	63685	4" Ansi Flange Gasket	2
D	63838	3" NPT Ball Valve	1
E	62208-01	2-237 O-Ring	1



Item	Part Number	Description	Qty
A	63686	3" Ansi Flange Gasket	2
B	62208-01	2-237 O-Ring	1



Item	Part Number	Description	Qty
A	62917	2-228 O-Ring	1
B	63624	2500 psig Safety Relief Valve	1
C	90798	3" Victaulic Coupling Gasket	2
D	91297-01	4" Victaulic Coupling Gasket	1



A

Item	Part Number	Description	Qty
A	63762	9520 HD Belt	3

SINGLE-LEVEL BILL OF MATERIALS REPORT

GrimmerSchmidt/Hurricane Com

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE: 1

BILL	REVISION	OPTN	TYPE	U/M	DESCRIPTION		
10186	000 (CURRENT)	BASE	STANDARD	EACH	BOOSTER, 6T-855-62B/2000(2700)		
LAST USED: 06/08/07		YIELD%: 100.000%		MAX LOT SIZE: 0			
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND#
21795	*	STD	1.00	EACH	0.000%	ENGINE GROUP 6T-855-62B C-18	
21408	*	STD	1.00	EACH	0.000%	PUMPER GROUP, 6T-855-62B/2000	
21512	*	STD	1.00	EACH	0.000%	COUPLING GROUP, 6T-855-62B/150	
21413	*	STD	1.00	EACH	0.000%	FUEL GROUP, 6T-855-62B/2000	
21414	*	STD	1.00	EACH	0.000%	AIR CLEANER GROUP 6T-855-62B/2	
21415	*	STD	1.00	EACH	0.000%	EXH GROUP 6T-855-62B/2000	
21827	*	STD	1.00	EACH	0.000%	PIPING GROUP SUCTION, 6T-855-6	
21825	*	STD	1.00	EACH	0.000%	PIPING GROUP, 1ST 6T-855 LARIA	
21826	*	STD	1.00	EACH	0.000%	PIPING GROUP 2ND, 6T-855-62B/2	
21420	*	STD	1.00	EACH	0.000%	FINISH GROUP 6T-855-62B/2000	
21421	*	STD	1.00	EACH	0.000%	COOLANT CONNECT GROUP, 6T-855-	
10186-03			0.00	EACH	0.000%	ILLUS INSTALLATION 6T-855-62B/	
21684			0.00	EACH	0.000%	ILLUS PIPING 6T-855 LARIAT	
21424	*	STD	1.00	EACH	0.000%	KIT AUTOUNLOAD 6T-855-62B/2000	
21682	*	STD	1.00	EACH	0.000%	PIPING GROUP STAGING, 1ST LARI	
21683	*	STD	1.00	EACH	0.000%	PIPING GROUP STAGING 2ND, LARI	
21524	*	STD	1.00	EACH	0.000%	CRANK CASE VENT GROUP, 6T-855-	
21830	*	STD	1.00	EACH	0.000%	PIPING GROUP UNLOAD, 6T-855-62	
21511	*	STD	1.00	EACH	0.000%	COOLING GROUP, ASME CODED 6T-8	
21811	*	STD	1.00	EACH	0.000%	FRAME GROUP, 6T-855-62B/2000	
21412	*	STD	1.00	EACH	0.000%	INST/CTRL GRP 6T-855-62B/2000	
10186-02	*	STD	1.00	EACH	0.000%	OPTION LOUVERS 6T-855-62B/2000	
10169-02	*	STD	1.00	EACH	0.000%	OPTION 6T-855-62B FLANGES SUCT	
10186-01	*	STD	0.00	EACH	0.000%	SPARE PARTS 6T-855-62B/2000(27	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION		OPTN	TYPE	U/M	DESCRIPTION	
21795	000	(CURRENT)	BASE	STANDARD	EACH	ENGINE GROUP 6T-855-62B C-18	
LAST USED:		06/01/07	YIELD%:		100.000%	MAX LOT SIZE:	0
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FINI
64020			1.00	EACH	0.000%	ENGINE CAT C18 T3 630HP IOPU	
51146-01			1.00	EACH	0.000%	HEAT SHIELD 6T-855	
51146-02			1.00	EACH	0.000%	HEAT SHIELD BRKT 6T-855	
63753			1.00	EACH	0.000%	CAPLUG RP-10 (5/8-18)	
60563			1.00	EA	0.000%	VALVE BALL 1/2 NPT FEMALE	
90707			1.00	EA	0.000%	NIPL 1/2 NPTM HEX CS	
122-66396			1.00	EACH	0.000%	L 1/2 90 STREET YELLOW DICHROM	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION	OPTN	TYPE	U/M	DESCRIPTION		
21408	000 (CURRENT)	BASE	STANDARD	EACH	PUMPER GROUP, 6T-855-62B/2000		
LAST USED: 06/01/07		YIELD%: 100.000%		MAX LOT SIZE: 0			
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
62728			1.00	EACH	0.000%	ENGINE CUM 855 PUMPER	
40013			12.00	EA	0.000%	PLATE LOCK	
80099			12.00	EA	0.000%	NUT 3/8-16 HEX GRADE 8	
80418			14.00	EACH	0.000%	HHCS 11/16-16 X 3-1/2" GR 8	
42405			1.00	EACH	0.000%	BASEPLATE 6T-855-62B	
42406			1.00	EACH	0.000%	GSKT BASEPLATE 6T-855-62B	
61869			3.00	EA	0.000%	O-RING 2-161 VITON 90 DURO	
42407	*	STD	3.00	EACH	0.000%	CYL 1ST STAGE W/ LINER 6T-855-	
41138			3.00	EA	0.000%	VALVE COMPR	
62739			15.00	EACH	0.000%	RING 3.000 COMPR CI PS TF WIDE	
41079			3.00	EA	0.000%	RING 3.00DIA 3PC OIL	
80109			24.00	EA	0.000%	WASHER 1/2 PLN SPLIT LOCK	
80180			24.00	EA	0.000%	HHCS 1/2-13 X 1-3/4 GR.8	
42408	*	STD	3.00	EACH	0.000%	CYL 2ND STAGE W/ LINER 6T-855-	
62420			18.00	EACH	0.000%	RING 2.000 COMPR CI PS TF WIDE	
62284			3.00	EA	0.000%	RING 2.00DIA OIL (3PC)	
62439			3.00	EACH	0.000%	VALVE, COMPR 1ST STAGE	
80242			12.00	EA	0.000%	HHCS 5/8-11 X 7-1/2 LG GR8	
80110			24.00	EA	0.000%	WASHER 5/8 SPLIT LOCK GR 8	
42374	*	STD	3.00	EACH	0.000%	HEAD 1ST & 2ND STG 6T-414-62	
60051			3.00	EA	0.000%	O-RING 2-035 VITON 90 DURO	
61392			6.00	EA	0.000%	O-RING 2-043 VITON 90 DURO	
63580			3.00	EACH	0.000%	O-RING 2-156 VITON 90 DURO	
80417			12.00	EACH	0.000%	HHCS 5/8-11 X 9 " LG GR 8	
42411	*	STD	3.00	EACH	0.000%	HEAD 1ST STAGE 6T-855-62B	
61138			6.00	EA	0.000%	O-RING 2-047 VITON 90 DURO	
60056			6.00	EA	0.000%	O-RING 2-233 VITON 90 VITON	
51086	*	STD	1.00	EACH	0.000%	FRONT ENG MNT 855	
42439			1.00	EACH	0.000%	COVER OIL PUMP 855	
42440	*	STD	1.00	EACH	0.000%	COVER WATER PUMP 855	
42441			2.00	EACH	0.000%	COVER CAM 855 1" NPT	
30518			1.00	EACH	0.000%	INSTRUCTNS 855 BUILD	
63634			1.00	EACH	0.000%	SEAL 855 FRONT REVROT CRANK	
63635			1.00	EACH	0.000%	SEAL 855 REAR REVROT CRANK	
63636			1.00	EACH	0.000%	SEAL 855 ACC DRIVE REVROT	
30520	*	STD	1.00	EACH	0.000%	855 OIL PUMP HOSE PARTS	
63753			1.00	EACH	0.000%	CAPLUG RP-10 (5/8-18)	
62728-03	*	STD	1.00	EACH	0.000%	GSKT KIT 855 PUMPER BUILD	
91674			1.00	EACH	0.000%	PLUG 3/8-24STMOR	
62728-02			6.00	EACH	0.000%	PISTON 855 ENGINE	
62728-01			6.00	EACH	0.000%	ROD 855 RECON CONNECTING	
60064			3.00	EA	0.000%	O-RING 2-042 VITON 90 DURO	
41384			1.00	EA	0.000%	COVER STARTER (636/903)	
62728-22	*	STD	1.00	EACH	0.000%	OIL PUMP, 855 REV ROT	
91673			1.00	EACH	0.000%	PLUG, 1-3/16"-12STM O-RING ALL	
63840			1.00	EACH	0.000%	PLUG FREEZE 7/8"	
62728-23	*	STD	1.00	EACH	0.000%	TUBE 855 OIL PUMP INLET	
42441-02	*	STD	1.00	EACH	0.000%	COVER ASSY, CAM 855 1"NPT W/BA	
61396			3.00	EA	0.000%	O-RING, 2-225 VITON 90 DURO	
62917			3.00	EA	0.000%	O-RING, 2-228 VITON 90 DURO	
63689			3.00	EACH	0.000%	O-RING 2-251 VITON 90 DURO	
90489			1.00	EA	0.000%	PLUG 3/8NPT CSK	
64056			1.00	EACH	0.000%	VALVE OIL 1"-18 FUMOTO	
90371			1.00	EA	0.000%	PLUG, 1/8NPT CSK STEEL	
90567			1.00	EA	0.000%	PLUG, 1 1/2 300# SQ HEAD	
42698			3.00	EACH	0.000%	PISTON COMP 3"DIA 6T-855 TUBUL	
42693			3.00	EACH	0.000%	PISTON COMP 2"DIA 6T-855 TUBUL	
51318			6.00	EACH	0.000%	PISTON-ROD ASSY 6T-855 TUBULAR	
64960	000	STD	6.00	EACH	0.000%	BEARING LOCKWASHER	
21892			0.00	EACH	0.000%	ILLUS COMPR LAYOUT 855-62/2000	
21892-01			0.00	EACH	0.000%	ILLUS COMP ASSY 855-62/2000	
21892-02			0.00	EACH	0.000%	ILLUS COMP ASSY 855-62/2000	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE:

BILL	REVISION		OPTN	TYPE	U/M	DESCRIPTION	
51318	000	(CURRENT)	BASE	STANDARD	EACH	PISTON-ROD ASSY 6T-855 TUBULAR	
LAST USED:		06/01/07	YIELD%:		100.000%	MAX LOT SIZE:	0
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
42689			1.00	EACH	0.000%	PISTON CROSSHEAD 6T-855-62B TU	
51079	*	STD	1.00	EACH	0.000%	CONN ROD ASSY WITH SLEEVE	
63617			1.00	EACH	0.000%	PIN WRIST 6T-855-62B	
63632-01	*	STD	2.00	EACH	0.000%	BEARING ROD CUM 855 MODIFIED	
64098			2.00	EACH	0.000%	BEARING NEEDLE 855 PISTON PIN	
64099			4.00	EACH	0.000%	RETAINING RING 2.188" BORE	
80374			1.00	EACH	0.000%	SHCS 5/16-24 X 1" SELF LOCKING	
90489			1.00	EA	0.000%	PLUG 3/8NPT CSK	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION		OPTN	TYPE	U/M	DESCRIPTION	
30520	000	(CURRENT)	BASE	STANDARD	EACH	855 OIL PUMP HOSE PARTS	
LAST USED:		06/01/07	YIELD%:		100.000%	MAX LOT SIZE:	0
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
30520-01	*	STD	1.00	EACH	0.000%	PRESSURE REG. PRE-INSTALL	
30520-02	*	STD	1.00	EACH	0.000%	TEE ASSY MALE RUN PRE INSTALL	
91850			2.00	EA	0.000%	SWIVEL #16 JIC STRAIT CRIMP CS	
61773			2.00	EA	0.000%	SWIVEL #16JIC 90DG CS	
70160			60.00	IN	0.000%	HOSE #213-16 STRATOFLEX	
63652-01	*	STD	1.00	EACH	0.000%	ADAPT MOD.7/8 -18	
60732			1.00	EA	0.000%	ADAPT 1-5/16-12STM X #16JIC	
90372			2.00	EA	0.000%	ADAPT 1/4 NPTM X #4 JIC CS	
90953			1.00	EA	0.000%	SWIVEL #4JIC x #4 STRT CRIMP	
90939			1.00	EA	0.000%	SWIVEL #4JIC X #4 90DG CRIMP	
70243			36.00	IN	0.000%	HOSE #4 T1170-04 CRIMPABLE	
80505			1.00	EACH	0.000%	WASHER 7/8-18 SOFT SEALING	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION	OPTN	TYPE	U/M	DESCRIPTION		
62728-03	000 (CURRENT)	BASE	STANDARD	EACH	GSKT KIT 855 PUMPER BUILD		
LAST USED: 06/01/07		YIELD%: 100.000%		MAX LOT SIZE: 0			
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
62728-04			1.00	EACH	0.000%	GSKT 855 OIL PAN	
62728-05			1.00	EACH	0.000%	GSKT 855 WATER PUMP	
62728-08			1.00	EACH	0.000%	GSKT 855 FUEL PUMP	
62728-09			0.00	EACH	0.000%	GSKT 855 ACCESSORY DRIVE SUPT	
62728-10			3.00	EACH	0.000%	GSKT 855 CAM FOLLOWER HSG	
62728-11			1.00	EACH	0.000%	GSKT 855 REAR SEAL COVER	
62728-12			0.00	EACH	0.000%	GSKT 855 HYDRAILIC PUMP	

SINGLE-LEVEL BILL OF MATERIALS REPORT

GrimmerSchmidt/Hurricane Co

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION		OPTN	TYPE	U/M	DESCRIPTION		
62728-22	000	(CURRENT)	BASE	STANDARD	EACH	OIL PUMP, 855 REV ROT		
LAST USED:		06/01/07		YIELD%: 100.000%		MAX LOT SIZE: 0		
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION		FIND
62728-06			1.00	EACH	0.000%	GSKT 855 LUBE OIL PUMP		
62728-07			1.00	EACH	0.000%	GSKT 855 LUBE OIL PUMP COVER		
62728-14			0.00	EACH	0.000%	INSTRUCTNS 855 OIL PUMP MOD		
62728-15			1.00	EACH	0.000%	COVER ASSY, 855 OIL PUMP REV R		
62728-16	*	STD	1.00	EACH	0.000%	SHAFT 855 OIL PUMP MOD		
62728-18	*	STD	1.00	EACH	0.000%	PLUNGER STOP, 855 OIL PUMP		
62728-19	*	STD	1.00	EACH	0.000%	OIL PUMP BODY, 855 MOD		
80503			1.00	EACH	0.000%	DOWEL PIN 3/16 X 7/8" LG		
80504			2.00	EACH	0.000%	HHCS 7/16-20 Z 5-1/2 LG GR8		
91690			1.00	EACH	0.000%	PLUG, 7/16-20 STMOR		
63802			1.00	EACH	0.000%	PLUG FREEZE 1-1/8"		
90371			1.00	EA	0.000%	PLUG, 1/8NPT CSK STEEL		

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION	OPTN	TYPE	U/M	DESCRIPTION		
21512	000 (CURRENT)	BASE	STANDARD	EACH	COUPLING GROUP, 6T-855-62B/150		
LAST USED: 06/01/07		YIELD%: 100.000%		MAX LOT SIZE: 0			
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
42479			1.00	EACH	0.000%	ADAPT SAE FLYWHEEL #1 TO #1	
42480			1.00	EACH	0.000%	ADAPT SAE FLYWHEEL #1 TO #1	
63645			1.00	EACH	0.000%	CPLG ASSY 6T-855-62B	
63645-01			1.00	EACH	0.000%	FLANGE ADAPTER AC-7	
80285			8.00	EA	0.000%	SHCS, 1/2-13 x 3 1/2	
21509			0.00	EACH	0.000%	ILLUS FLYWHEEL/HSG 6T-855-62B	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION	OPTN	TYPE	U/M	DESCRIPTION		
21413	000 (CURRENT)	BASE	STANDARD	EACH	FUEL GROUP, 6T-855-62B/2000		
LAST USED: 06/01/07		YIELD%: 100.000%		MAX LOT SIZE: 0			
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
91849			4.00	EA	0.000%	SWIVEL #8 JIC CRIMP STRAIT CS	
70158			120.00	IN	0.000%	HOSE #213-8 STRATOFLEX	
60745			2.00	EA	0.000%	L 7/8-14 STM X #8 JIC 90DG CS	
90194			2.00	EA	0.000%	ADAPT 1/2 NPTM X #8 JIC CS	
60563			1.00	EA	0.000%	VALVE BALL 1/2 NPT FEMALE	
90707			1.00	EA	0.000%	NIPL 1/2 NPTM HEX CS	
90911			1.00	EA	0.000%	L 9/16-18 STM X #6 JIC 90DG CS	
91848			2.00	EA	0.000%	SWIVEL #6 JIC CRIMP 90DG CS	
70092			120.00	IN	0.000%	HOSE #213-6	
90047			2.00	EACH	0.000%	ADAPT 3/8 NPT X #6 JIC	
91620			1.00	EACH	0.000%	VALVE, BALL 3/8"NPT 600WOG	
91621			1.00	EACH	0.000%	NIPL 3/8 NPTM HEX CS	
41938-49			1.00	EA	0.000%	NAMEPLATE 'RETURN'	
41938-90			1.00	EACH	0.000%	NAMEPLATE 'SUPPLY'	
91624			1.00	EACH	0.000%	ADAPT 3/8 NPTF X -6 JICM CS	
90377			1.00	EA	0.000%	NIPL 3/8 NPT SCH40 X 3" LG	
51230	*	STD	1.00	EACH	0.000%	BULKHEAD FUEL 3/8 & 1/2 NPT	
90329			2.00	EA	0.000%	PLUG, 1/2 STEEL HEX HEAD	
64008			1.00	EACH	0.000%	PANEL DECAL MTG	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION	OPTN	TYPE	U/M	DESCRIPTION		
21414	000 (CURRENT)	BASE	STANDARD	EACH	AIR CLEANER GROUP 6T-855-62B/2		
LAST USED: 06/01/07		YIELD%: 100.000%		MAX LOT SIZE: 0			
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
63439			1.00	EACH	0.000%	AIR CLEANER 18" HORIZONTAL	
63440			2.00	EACH	0.000%	BAND 18" AIC MOUNTING	
63441			1.00	EACH	0.000%	HOOD 8.00" AIR INLET	
63444			2.00	EACH	0.000%	L 8" 90 DG RUBBER	
62688			1.00	EACH	0.000%	INSERT REDUCING 8 X 6" RUBBER	
62708			10.00	EA	0.000%	CLAMP 7-5/8 - 9-1/8 BAND	
70170-0098	*	STD	1.00	EACH	0.000%	TUBING 8 OD X 14 GA X 9.80" L	
63251			1.00	EA	0.000%	INDICATOR AIR FILTER 30" SER VI	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION		OPTN	TYPE	U/M	DESCRIPTION	
21415	000	(CURRENT)	BASE	STANDARD	EACH	EXH GROUP 6T-855-62B/2000	
LAST USED:		06/01/07	YIELD%:		100.000%	MAX LOT SIZE:	0
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
62726			1.00	EACH	0.000%	MUFFLER COWL 8" C16	
63050			2.00	EACH	0.000%	CLAMP 8" OD EXH MUFFLER	
91599			1.00	EACH	0.000%	L 8" SCH 40 SHORT RAD WELD	
42397			1.00	EACH	0.000%	PLATE, EXHAUST	
42398	*	STD	1.00	EACH	0.000%	REDUCER 6 x 8" SCH 40 MOD BELL	
70170-0088	*	STD	1.00	EACH	0.000%	TUBING 8 OD X 14 GA X 8.80" L	
63048			1.00	EACH	0.000%	RAINCAP 8"OD	
92194			1.00	EA	0.000%	BSHG 3/8 X 1/4 CS	
91028-0015	*	STD	1.00	EACH	0.000%	PIPE 6" SCH 40 1 1/2" LONG	
120-42012001			4.00	EACH	0.000%	WASHER 3/4 SPLIT LOCK PLAIN	

SINGLE-LEVEL BILL OF MATERIALS REPORT

GrimmerSchmidt/Hurricane Co

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION	OPTN	TYPE	U/M	DESCRIPTION		
21827	000 (CURRENT)	BASE	STANDARD	EACH	PIPING GROUP SUCTION, 6T-855-6		
LAST USED: 06/01/07		YIELD%: 100.000%		MAX LOT SIZE: 0			
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
21827-01	*	STD	1.00	EACH	0.000%	BALL VALVE SUB ASSY POST PAINT	
21827-02	*	STD	1.00	EACH	0.000%	PILOT VALVE PRE-INSTALL	
21827-03	*	STD	1.00	EACH	0.000%	REGULATOR VALVE PRE-INSTALL	
63953			1.00	EACH	0.000%	TANK SCRUBBER INLET PRIMARY 50	
63451			2.00	EA	0.000%	FLANGE 4.0 SPLIT HALVES W/KIT	
63450			2.00	EA	0.000%	FLANGE 4.0 BW/O-RG SCH40 PIPE	
91556			3.00	EACH	0.000%	FLANGE 4" SW RF 300# ANSI	
91816-03			1.00	EACH	0.000%	PIPE FORMED 4" SUCT CLR TO SEP	
90310			1.00	EA	0.000%	CPLG 1/4 NPT 3000# HALF TT	
90525			1.00	EA	0.000%	CPLG 1 NPT 3000# HALF TT	
91843-03			1.00	EACH	0.000%	PIPE 4" SCH 40 FORMED 1RST STG	
91843-01			1.00	EACH	0.000%	PIPE 4" SCH 40 FORMED INDUCTIO	
90927			3.00	EA	0.000%	CLAMP 4" NOM PIPE SUPT	
51091-05	*	STD	2.00	EACH	0.000%	BRKT PIPE SUPT 4" PIPE	
51300	*	STD	1.00	EACH	0.000%	MANIFOLD ASSY INLET 1RST STG	
91843-09	*	STD	2.00	EACH	0.000%	NIPL 4" SCH 80 VICT 3.38" LG	
63622			1.00	EACH	0.000%	VALVE S. REL 450PSIG 400DEG	
91430			1.00	EACH	0.000%	L 4" 90 DG SOCKET WELD 3000#	
90256			1.00	EA	0.000%	L 2 NPT 150# STREET	
91297			1.00	EA	0.000%	CPLG ASSY VICTAULIC 4"	
91627			1.00	EACH	0.000%	PLUG, 1/4NPT FS HEX HEAD	
91819			2.00	EACH	0.000%	CONN 1/2"NPT CORD STRAIN RELIE	
62894			1.00	EA	0.000%	SIGHT GLASS 2" OIL LEVEL	
90455			1.00	EA	0.000%	BSHG 1 X 1/2 2000# FS	
61470			1.00	EA	0.000%	THERMOWELL MURPHY SDB 5000PSIG	
90059			1.00	EA	0.000%	BSHG 1 X 1/4 2000# FS	
63685			3.00	EACH	0.000%	GSKT FLG ANSI 4" 300# CG FLEX1	
62040			2.00	EA	0.000%	VALVE, BALL 1/4"NPT 600PSIG	
91675			2.00	EACH	0.000%	NIPL 1/4 NPT XS 1-1/2" LG	
80439			16.00	EACH	0.000%	STUD, 3/4-10 x 4-1/2 ASTM A1	
80438			32.00	EACH	0.000%	NUT 3/4-10 HEAVY HEX ASTM A563	
123-67302			1.00	EACH	0.000%	SWITCH LIQUID LEVEL 2" NPT	
90411			1.00	EA	0.000%	L 1 NPT 300# STREET	
90063			1.00	EA	0.000%	L 1-1/2 NPT 3000# STREET	
70243			54.00	IN	0.000%	HOSE #4 T1170-04 CRIMPABLE	
60735			1.00	EA	0.000%	T 1 NPT MALE RUN CS	
90953			2.00	EA	0.000%	SWIVEL #4JIC x #4 STRT CRIMP	
91636			1.00	EACH	0.000%	THREADOLET 4 X 1-1/2 NPT 3000#	

SINGLE-LEVEL BILL OF MATERIALS REPORT

GrimmerSchmidt/Hurricane Cor

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE:

BILL	REVISION	OPTN	TYPE	U/M	DESCRIPTION		
21825	000 (CURRENT)	BASE	STANDARD	EACH	PIPING GROUP, 1ST 6T-855 LARIA		
LAST USED: 06/01/07		YIELD%: 100.000%		MAX LOT SIZE: 0			
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
63954			1.00	EACH	0.000%	TANK SEPARATOR 3" FLG 1200 PSI	
91364			2.00	EACH	0.000%	FLANGE 3" SW RF 600# ANSI	
91843-02			1.00	EACH	0.000%	PIPE 3" SCH 40 FORMED	
91268			2.00	EA	0.000%	L 3" NOM SCH40 SHORT RAD WELD	
91823			2.00	EACH	0.000%	FLANGE 3.0 SW/O-RG HEAD SP	
92257	*	STD	2.00	EACH	0.000%	NIPL 3" SCH 80 VICT X 3.75" LG	
90797			3.00	EA	0.000%	CPLG ASSY VICTAULIC 3" #77 "O"	
63838			1.00	EACH	0.000%	VALVE BALL 3NPT FP 1KPSI ZERK	
90926			5.00	EA	0.000%	CLAMP 3" PIPE SUPT ALUM HD	
42664			2.00	EACH	0.000%	BRACKET 3" PIPE SCRUBBER 6T-27	
50501-04	*	STD	1.00	EA	0.000%	PIPE 3 SCH 80 VICT X 2.25"LG	
91608	*	STD	1.00	EACH	0.000%	NIPL VICT 3 NOM SCH80 X 3" LG	
51299	*	STD	1.00	EACH	0.000%	MANIFOLD ASSY DISCHRG 1RST STG	
91843-04			1.00	EACH	0.000%	PIPE 3" SCH 40 FORMED 2ND STG	
91635			1.00	EACH	0.000%	THREDOLET 3 X 1-1/2 NPT 3000#	
90411			1.00	EA	0.000%	L 1 NPT 300# STREET	
60922			1.00	EA	0.000%	VALVE BALL 1 FPT (1500#)	
90410			1.00	EA	0.000%	NIPL 1 NPT SCH80 X 3-1/2" LG	
63623			1.00	EACH	0.000%	VALVE S. REL 1000PSIG 400DEG	
91516			1.00	EACH	0.000%	L 2" NPT 300# STREET 90DEG	
91627			2.00	EACH	0.000%	PLUG, 1/4NPT FS HEX HEAD	
61069			1.00	EA	0.000%	THERMOWELL MURPHY A 4000PSIG	
62698			2.00	EACH	0.000%	SIGHT GAUGE, 3/4NPT 1500PSI	
90749			1.00	EA	0.000%	BSHG 1 X 1/4 CS	
51075	*	STD	1.00	EACH	0.000%	MANIFOLD ASSY INLET 2ND STAGE	
62208			2.00	EA	0.000%	FLANGE 3.0 SPLIT HALVES W/KIT	
51290-54			1.00	EACH	0.000%	BRACKET 3" PIPE SUPT	
63686			2.00	EACH	0.000%	GSKT FLG ANSI 3" 600# CG FLEX1	
80440			16.00	EACH	0.000%	STUD, 3/4-10 x 6 ASTM A193 B	
80438			32.00	EACH	0.000%	NUT 3/4-10 HEAVY HEX ASTM A563	
91675			1.00	EACH	0.000%	NIPL 1/4 NPT XS 1-1/2" LG	
123-67302			1.00	EACH	0.000%	SWITCH LIQUID LEVEL 2" NPT	
92198			1.00	EA	0.000%	NIPL 3/8 NPTM X 1/4 NPTM HEX C	
90523			5.50	IN	0.000%	PIPE 3 SCH 40 ASTMA-106B	
91843-11	*	STD	1.00	EACH	0.000%	NIPL 3" NPT HALF SCH 8.75"L	
91003			1.00	EA	0.000%	L 3" 3000# SOCKET WELD 90DG	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION		OPTN	TYPE	U/M	DESCRIPTION	
21826	000 (CURRENT)		BASE	STANDARD	EACH	PIPING GROUP 2ND, 6T-855-62B/2	
LAST USED:		06/01/07	YIELD%:		100.000%	MAX LOT SIZE:	0
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
91843-06	*	STD	1.00	EACH	0.000%	PIPE 2" SCH 80 FORMED	
91177			2.00	EA	0.000%	FLANGE 2.0 SW/O-RG HEAD SP	
61331			1.00	EA	0.000%	FLANGE 2.0 4-BOLT SW/FF PIPE S	
90290-0035	*	STD	1.00	EA	0.000%	PIPE 2 NOM SCH 80 X 3-1/2" LG	
90525			1.00	EA	0.000%	CPLG 1 NPT 3000# HALF TT	
63624			1.00	EACH	0.000%	VALVE S. REL. 2500PSIG 400DEG	
91825			1.00	EACH	0.000%	FLANGE 3.0 4-BOLT SW/OR CODE62	
91637			3.00	EACH	0.000%	FLANGE 3" SW RF 1500# ANSI	
62742			1.00	EACH	0.000%	VALVE, CHECK HB 3"2000PSI2700C	
91816-10			1.00	EACH	0.000%	PIPE FORMED 3" 2ND STG DISCH	
90926			3.00	EA	0.000%	CLAMP 3" PIPE SUPT ALUM HD	
90876			2.00	EA	0.000%	CLAMP 2" PIPE SUPT ALUM HD	
51290-43			1.00	EACH	0.000%	BRACKET PIPE SUPT 1 1/2 & 2"	
42577			1.00	EACH	0.000%	BRKT, 3" SUCTION PIPE	
61334			2.00	EA	0.000%	FLANGE 2.0 SPLIT HALVES W/KIT	
90310			2.00	EA	0.000%	CPLG 1/4 NPT 3000# HALF TT	
91627			1.00	EACH	0.000%	PLUG, 1/4NPT FS HEX HEAD	
61069			1.00	EA	0.000%	THERMOWELL MURPHY A 4000PSIG	
51076	*	STD	1.00	EACH	0.000%	MANIFOLD ASSY OUTLET 2ND STAGE	
63688			3.00	EACH	0.000%	GSKT FLG ANSI 3" 1500# CG FLEX	
91678			1.00	EACH	0.000%	SOCKOLET, 2X1 3000#	
90053			1.00	EA	0.000%	L 1 NPT 3000# STREET	
90411			1.00	EA	0.000%	L 1 NPT 300# STREET	
80441			16.00	EACH	0.000%	NUT 1-1/8-7 HEAVY HEX ASTM A56	
80452			8.00	EACH	0.000%	STUD, 1-1/8"-7 x 11"LG B7 A193	
80516			4.00	EACH	0.000%	HHCS 1-1/8-7 X 5-1/2 GR8	
91843			1.00	EACH	0.000%	PIPE 3" SCH 80 FORMED	

SINGLE-LEVEL BILL OF MATERIALS REPORT

GrimmerSchmidt/Hurricane Co

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION	OPTN	TYPE	U/M	DESCRIPTION		
21420	000 (CURRENT)	BASE	STANDARD	EACH	FINISH GROUP 6T-855-62B/2000		
LAST USED: 06/01/07		YIELD%: 100.000%		MAX LOT SIZE: 0			
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
127-32109			4.00	EACH	0.000%	DECAL WARNING MOVING PARTS	
40293			1.00	EA	0.000%	DECAL MADE IN U.S.A.	
42207			1.00	EA	0.000%	PLATE, COMP. I.D. (ALUMINUM)	
40297			3.00	EA	0.000%	DECAL RELIEF VALVE CAUTION	
40459			1.00	EA	0.000%	DECAL AIR NOT SUITABLE	
40547			1.00	EA	0.000%	DECAL HURRICANE COMPRESSORS	
62700			1.00	EACH	0.000%	DECAL LOAD/UNLOAD	
41128			1.00	EA	0.000%	DECAL MANUFACTURED BY HURRICAN	
61006			1.00	EA	0.000%	DECAL DIESEL FUEL	
63061			4.00	EACH	0.000%	DECAL HURRICANE COMPRESSORS	
63128			2.00	EACH	0.000%	DECAL SCRUBBER/SEPARATOR DRAIN	
127-32121			1.00	EACH	0.000%	DECAL NEVER OPEN HOT	
63144			1.00	EACH	0.000%	DECAL 24VDC NEGATIVE GROUND	
120-16257			4.00	EACH	0.000%	POP RIVET 1/8 X 1/4	
41767			1.00	EA	0.000%	DECAL DISCHARGE VALVE WHITE	
63570			2.00	EACH	0.000%	DECAL HURRICANE COMPRESSORS	
40629			1.00	EA	0.000%	DECAL HURRICANE COMPRESSORS	
63061			2.00	EACH	0.000%	DECAL HURRICANE COMPRESSORS	
63750			1.00	EACH	0.000%	DECAL 325PSIG-2000PSIG-2700SCF	
40573W			1.00	EA	0.000%	DECAL INLET VALVE WHITE	
63749W			2.00	EACH	0.000%	DECAL 6T-855-62B/2000	
64937			1.00	EACH	0.000%	DECAL SS HURRICANE COMPRESSORS	
63835			2.00	EACH	0.000%	DECAL STAGING CLOSED	
63836			1.00	EACH	0.000%	DECAL STAGING OPEN	
122-69636			2.00	EACH	0.000%	PLUG 3/4" NPT PVC	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION		OPTN	TYPE	U/M	DESCRIPTION	
21421	000 (CURRENT)		BASE	STANDARD	EACH	COOLANT CONNECT GROUP, 6T-855-	
LAST USED: 06/01/07			YIELD%: 100.000%		MAX LOT SIZE: 0		
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
51092	*	STD	1.00	EACH	0.000%	MANIFOLD ASSY WC VALVE	
61284			1.00	EA	0.000%	L 1-1/16-12 STM X 3/4 NPTF	
70085			192.00	IN	0.000%	HOSE 1" ID HEATER BLK	
91672			1.00	EACH	0.000%	T 1 NPT CS	
90134			1.00	EA	0.000%	ADAPT BARB L 1/2 NPTM X 3/4 90	
70044			48.00	IN	0.000%	HOSE 3/4" ID COOLANT	
90380			2.00	EA	0.000%	ADAPT BARB 3/4 NPTM X 3/4	
90372			24.00	EA	0.000%	ADAPT 1/4 NPTM X #4 JIC CS	
90551			12.00	EA	0.000%	SWIVEL, #4x1/4HOSE ST PUSH-LOK	
90945			14.00	EA	0.000%	SWIVEL, #4x1/4HOSE 90 PUSH-LOK	
90943			168.00	IN	0.000%	HOSE 1/4" ID GRAY OIL	
51129	*	STD	1.00	EACH	0.000%	MANIFOLD 855 OIL COOLER RETURN	
91591			2.00	EACH	0.000%	L 3/4 NPTM X 3/4 HB	
51097-01	*	STD	1.00	EACH	0.000%	TUBE LOWER INLET OIL PUMP MOD	
91692			1.00	EACH	0.000%	L 1 NPT X 3/4 HB BRASS	
60736			1.00	EA	0.000%	L 1 NPT 90DG CS STREET	
122-13361			1.00	EACH	0.000%	NIPL 1 X 5-1/2 BLK	
90830			1.00	EA	0.000%	ADAPT BARB 1 NPTM X 1 BRASS	
61101			1.00	EA	0.000%	NIPL 3/4 NPTM X 1/2 NPTM HEX C	
90705			1.00	EA	0.000%	T 3/4 NPTF CS	
90832			1.00	EA	0.000%	ADAPT BARB L 3/4 NPTM X 1 90DG	
91534			1.00	EACH	0.000%	ADAPT 3/4 NPTF X 1-1/16 12 STM	
90769			1.00	EA	0.000%	ADAPT BARB 3/4 NPTM X 1 B	
120-11771			4.00	EACH	0.000%	CLAMP HOSE B12H #12	
120-67742			4.00	EACH	0.000%	CLAMP #16 HOSE	
64013			1.00	EACH	0.000%	VALVE COOLANT RELIEF 0-30 PSIG	
91818			1.00	EACH	0.000%	BSHG 3/4" X 3/8" C.S.	
90790			1.00	EA	0.000%	T 3/4 NPT MALE RUN CS	
62066			1.00	EA	0.000%	T 1/4 NPTM X #4JIC MALE RUN	
91646			1.00	EACH	0.000%	CAP -4 JIC CS END	
62067			1.00	EA	0.000%	T 1/4 NPTM X #4JIC MALE BRANCH	

SINGLE-LEVEL BILL OF MATERIALS REPORT

GrimmerSchmidt/Hurricane Co

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION	OPTN	TYPE	U/M	DESCRIPTION		
21424	000 (CURRENT)	BASE	STANDARD	EACH	KIT AUTOUNLOAD 6T-855-62B/2000		
LAST USED: 06/01/07		YIELD%: 100.000%		MAX LOT SIZE: 0			
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND/
21424-01	*	STD	1.00	EACH	0.000%	REGULATOR PRE-INSTALL 6T-855	
21424-02	*	STD	1.00	EACH	0.000%	FINITE FILTER PRE-INSTALL 6T-8	
21424-03	*	STD	1.00	EACH	0.000%	SOLENOID VALVE PRE INSTALL 6T-	
61895			1.00	EA	0.000%	VALVE, SOLE. 3-WAY 24VDC N/C	
90360			2.00	EA	0.000%	L 1/4 NPTM X #4 JIC 90DG CS	
90953			3.00	EA	0.000%	SWIVEL #4JIC x #4 STRT CRIMP	
60733			1.00	EA	0.000%	BSHG 1 X 1/2 CS	
90503			1.00	EA	0.000%	PLUG, 1/4 NPT CSK STEEL	
90939			1.00	EA	0.000%	SWIVEL #4JIC X #4 90DG CRIMP	
70243			168.00	IN	0.000%	HOSE #4 T1170-04 CRIMPABLE	
61200			1.00	EA	0.000%	DIODE 3AMP 40VDC	
60667			1.00	EA	0.000%	GAUGE 0-3000 PSI 2-1/2" UC	
122-13536			1.00	EACH	0.000%	NIPL 1/2 CLOSE BLK	
42596	*	STD	1.00	EACH	0.000%	BRKT COALESCING FILTER	
61097			1.00	EA	0.000%	L 1/4 NPT 90DG CS STREET	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION	OPTN	TYPE	U/M	DESCRIPTION		
21682	000 (CURRENT)	BASE	STANDARD	EACH	PIPING GROUP STAGING, 1ST LARI		
LAST USED: 06/01/07		YIELD%: 100.000%		MAX LOT SIZE: 0			
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
91823			2.00	EACH	0.000%	FLANGE 3.0 SW/O-RG HEAD SP	
62208			2.00	EA	0.000%	FLANGE 3.0 SPLIT HALVES W/KIT	
90926			2.00	EA	0.000%	CLAMP 3" PIPE SUPT ALUM HD	
63838			1.00	EACH	0.000%	VALVE BALL 3NPT FP 1KPSI ZERK	
91843-07			2.00	EACH	0.000%	PIPE 3" ELBOW FORMED	
51081-43			2.00	EACH	0.000%	BRKT PIPE SUPT	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION		OPTN	TYPE	U/M	DESCRIPTION	
21683	000 (CURRENT)		BASE	STANDARD	EACH	PIPING GROUP STAGING 2ND, LARI	
LAST USED:		06/01/07	YIELD%:		100.000%	MAX LOT SIZE: 0	
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FINC
91177			1.00	EA	0.000%	FLANGE 2.0 SW/O-RG HEAD SP	
61334			1.00	EA	0.000%	FLANGE 2.0 SPLIT HALVES W/KIT	
62709			1.00	EACH	0.000%	SOCKOLET, 3X2 3000#	
63837			1.00	EACH	0.000%	VALVE BALL 2NPT FP 2.5KPSI ZER	
91843-05	*	STD	1.00	EACH	0.000%	PIPE 2" SCH 80 FORMED ELBOW	
90876			1.00	EA	0.000%	CLAMP 2" PIPE SUPT ALUM HD	
51290-43			1.00	EACH	0.000%	BRACKET PIPE SUPT 1 1/2 & 2"	
91843-10	*	STD	1.00	EACH	0.000%	NIPL 2" NPT HALF 11.50" LG	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION	OPTN	TYPE	U/M	DESCRIPTION		
21524	000 (CURRENT)	BASE	STANDARD	EACH	CRANK CASE VENT GROUP, 6T-855-		
LAST USED: 06/01/07		YIELD%: 100.000%		MAX LOT SIZE: 0			
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND:
63763			2.00	EACH	0.000%	BREATHER ENVIROGUARD	
90735			2.00	EA	0.000%	ADAPT 1/4 NPTF X 9/16-18 STM	
122-15498			2.00	EACH	0.000%	ADAPT BARB L 1/4 NPTM X 3/8 90	
90835			2.00	EA	0.000%	ADAPT BARB L 1 NPTM X 1 90DG B	
70085			192.00	IN	0.000%	HOSE 1" ID HEATER BLK	
122-66396			2.00	EACH	0.000%	L 1/2 90 STREET YELLOW DICHROM	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION		OPTN	TYPE	U/M	DESCRIPTION	
21830	000	(CURRENT)	BASE	STANDARD	EACH	PIPING GROUP UNLOAD, 6T-855-62	
LAST USED:		06/01/07	YIELD%:		100.000%	MAX LOT SIZE: 0	
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
21830-01	*	STD	1.00	EACH	0.000%	FISHER VALVE PRE INSTALL	
63764			1.00	EACH	0.000%	VALVE FISHER ASCO QUICK EXHAUS	
90349-0030	*	STD	2.00	EACH	0.000%	PIPE 1 SCH 80 X 3" LG	
61338			2.00	EA	0.000%	FLANGE 1.0 4 BOLT SW/FF PIPE S	
91293			2.00	EA	0.000%	FLANGE 1.0 SW/O-RG HEAD SP	
90349-0045	*	STD	1.00	EA	0.000%	PIPE 1 SCH 80 X 4-1/2" LG	
91843-08			1.00	EACH	0.000%	PIPE 1" FORMED UNLOAD	
91030			2.00	EA	0.000%	CLAMP 1-1/2" PIPE SUPT ALUM HD	
91612			1.00	EACH	0.000%	SOCKOLET, 3 x 1 3000#	
90503			1.00	EA	0.000%	PLUG, 1/4 NPT CSK STEEL	
90310			1.00	EA	0.000%	CPLG 1/4 NPT 3000# HALF TT	
91641			1.00	EACH	0.000%	SOCKOLET, 4X1 3000#	
91565			2.00	EACH	0.000%	CPLG ASSY VICTAULIC 1"	
61333			4.00	EA	0.000%	FLANGE 1.0 SPLIT HALVES W/KIT	

SINGLE-LEVEL BILL OF MATERIALS REPORT

GrimmerSchmidt/Hurricane Co

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION		OPTN	TYPE	U/M	DESCRIPTION	
21511	000 (CURRENT)		BASE	STANDARD	EACH	COOLING GROUP, ASME CODED 6T-8	
LAST USED: 06/01/07			YIELD%: 100.000%		MAX LOT SIZE: 0		
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
63714			1.00	EACH	0.000%	COOLER ASME PRE 6T-855-62(2700	
63715			1.00	EACH	0.000%	COOLER ASME 1ST 6T-855-62(2700	
63716			1.00	EACH	0.000%	COOLER ASME 2ND 6T-855-62(2700	
63626			1.00	EACH	0.000%	FAN 48" 855-62B/2000(2700SCFM)	
42437	*	STD	1.00	EACH	0.000%	ANGLE COOLER SUPPORT R/H	
42438	*	STD	1.00	EACH	0.000%	ANGLE COOLER SUPPORT L/H	
51048	*	STD	2.00	EACH	0.000%	GUARD ASSY 48" FAN HALF (903-85 800 CFM)	
51084			1.00	EACH	0.000%	SHROUD FAN 6T-855-62B	
41365-03	*	STD	1.00	EACH	0.000%	VENTURI ASSY 48" 6T-855-62B	
51125	*	STD	1.00	EACH	0.000%	GUARD ASSY COOLER 6T-855-62B	
63774			1.00	EACH	0.000%	SPACER FAN 855	
80183			6.00	EA	0.000%	HHCS 1/2-13 X 3 GR5	
51130	*	STD	1.00	EACH	0.000%	BRKT GROUP, 855 FAN GUARD	
63783			1.00	EACH	0.000%	GUARD ASSY BELT 6T-855-62B	
42513	*	STD	1.00	EACH	0.000%	BRACKET, ENG BELT GUARD 6T-855	
63762			3.00	EACH	0.000%	BELT FAN 6T855	
51221	*	STD	1.00	EACH	0.000%	BRKT, 855 BLOCK TO FAN GUARD S	
80396			16.00	EACH	0.000%	HHCS 3/8"-16 X 1-3/4" FULL THR	
41548-02			1.00	EACH	0.000%	DOOR CLEAN OUT PANEL	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE:

BILL	REVISION		OPTN	TYPE	U/M	DESCRIPTION	
21811	000	(CURRENT)	BASE	STANDARD	EACH	FRAME GROUP, 6T-855-62B/2000	
LAST USED:		06/01/07	YIELD%:		100.000%	MAX LOT SIZE:	0
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
51290			1.00	EACH	0.000%	FRAME ASSY 6T-855-62B	
51290-22			2.00	EACH	0.000%	ANGLE COOLER SUPT	
51290-60	*		2.00	EACH	0.000%	SUPPORT 2ND STG SEPARATOR	
51290-26			1.00	EACH	0.000%	UPRIGHT PLUMBING SUPT	
51290-53			1.00	EACH	0.000%	UPRIGHT PLUMBING SUPT	
51290-37			1.00	EACH	0.000%	CROSSMEMBER UPPER BOLT IN	
51290-38			1.00	EACH	0.000%	UPRIGHT DISCHARGE SUPT	
51290-45			1.00	EACH	0.000%	BRACKET CONTROL BOX	
51290-49			1.00	EACH	0.000%	CROSSMEMBER EXHAUST SUPT	
51290-58			1.00	EACH	0.000%	SUPPORT UNLOADER VALVE	
90830			4.00	EA	0.000%	ADAPT BARB 1 NPTM X 1 BRASS	
120-67742			4.00	EACH	0.000%	CLAMP #16 HOSE	
90342			2.00	EA	0.000%	PLUG, 1 HEX HEAD STEEL	
70085			30.00	IN	0.000%	HOSE 1" ID HEATER BLK	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION		OPTN	TYPE	U/M	DESCRIPTION	
21412	000	(CURRENT)	BASE	STANDARD	EACH	INST/CTRL GRP 6T-855-62B/2000	
LAST USED:		06/01/07	YIELD%:		100.000%	MAX LOT SIZE:	0
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND.
21340-01	*	STD	1.00	EACH	0.000%	PANEL SUB-ASSY, 6T-414-62B	
21279-02	*	STD	1.00	EACH	0.000%	BATTERY GROUP 4T-276-41B	
21298-05	*	STD	1.00	EACH	0.000%	NAMEPLATE GRP 6T-903-82B/1500	
21298-03	*	STD	1.00	EACH	0.000%	HOSE KIT INSIDE PANEL 6T-903-8	
21298-04	*	STD	1.00	EACH	0.000%	HOSE KIT OUTSIDE PANEL 6T-903-	
51082	*	STD	0.00	EACH	0.000%	BRACKET ASSY INST PANEL	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION	OPTN	TYPE	U/M	DESCRIPTION		
21340-01	000 (CURRENT)	BASE	STANDARD	EACH	PANEL SUB-ASSY, 6T-414-62B		
LAST USED: 06/01/07		YIELD%:		100.000%	MAX LOT SIZE:	0	
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
62489			1.00	EA	0.000%	SWITCH, ESD PUSH-BUTTON 40MM	
61451			2.00	EA	0.000%	BLOCK, END BRKT TERMINAL	
61450			14.00	EA	0.000%	TERMINAL BLOCK FEED THROUGH	
60328			2.00	EA	0.000%	RELAY MAN RESET TTR 12/24VDC	
61312-03			8.00	EA	0.000%	BLOCK CONTACT	
61958			1.00	EA	0.000%	ENCLOSURE 24x24 W/WINDOW RED	
61883			1.00	EA	0.000%	GA TEMP SWITCH 32-160 16FT	
61344			2.00	EA	0.000%	GAUGE TEMP SWITCH 300-440 16FT	
61581			1.00	EA	0.000%	LAMP 24 VDC 4W .17A INCANDESC	
61312-01			1.00	EA	0.000%	SWITCH, 3POS RIGHT MOMENTARY	
61938			1.00	EA	0.000%	GAUGE 0-100PSI OIL PRESS SWITC	
60582			12.00	IN	0.000%	RAIL DIN 35MM	
62078			1.00	EA	0.000%	LIGHT UNIT 22-1/2 MM 24VDC	
62070			1.00	EA	0.000%	PUSHBOTTON, GREEN MOMENTARY	
63088			1.00	EA	0.000%	CONN ROX 9 WIRE	
61455			4.00	EA	0.000%	BLOCK, GROUND TERMINAL	
62750			1.00	EA	0.000%	LENS 22-1/2 MM GREEN	
62072			1.00	EA	0.000%	SWITCH, 2-POSITION MAINTAINED	
62430			1.00	EACH	0.000%	MONITOR POWERVIEW 101	
62430-01			1.00	EACH	0.000%	GAUGE TACH PV100	
62430-02			1.00	EACH	0.000%	GAUGE COOLANT PV100	
62430-03			1.00	EACH	0.000%	GAUGE OIL PSIG PV100	
63259			1.00	EACH	0.000%	BREAKER PANEL 20 AMP CIRCUIT	
62430-10			1.00	EACH	0.000%	WIRE PV100 CAN EXTENSION 20'	
62430-06			1.00	EACH	0.000%	WIRE PV100 CAN/POWER	
62430-07			3.00	EACH	0.000%	WIRE PV100 JUMPER	
62430-08			1.00	EACH	0.000%	TERMINATOR PV100 RESISTOR END	
63336			1.00	EACH	0.000%	GAUGE 0-600 PSIG 4 FLANGE PANE	
63337			1.00	EACH	0.000%	GAUGE 0-1500PSIG 4 FLANGE PANE	
63458			1.00	EACH	0.000%	GAUGE 0-3000PSIG 4 FLANGE PANE	
42360	*	STD	1.00	EACH	0.000%	PANEL LASER CUT 6T-903-82B / 6T855-62B	
21358	*	STD	0.00	EA	0.000%	SCHEM, WIRING 6T-414-62B/1850	
62215			2.00	EA	0.000%	BREAKER PANEL 15AMP CIRCUIT	
61200			1.00	EA	0.000%	DIODE 3AMP 40VDC	
21588			0.00	EA	0.000%	SCHEM, WIRING 6T-855-62B	
62127			1.00	EA	0.000%	SWITCH PRESS 295-3400 PSI	
91819			2.00	EACH	0.000%	CONN 1/2"NPT CORD STRAIN RELIE	
61312-04			1.00	EA	0.000%	SWITCH, 3 POS CENTER MOMENTARY	
90949			2.00	EA	0.000%	PLUG, GAUGE BLIND 52mm HOLE	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION	OPTN	TYPE	U/M	DESCRIPTION		
21279-02	000 (CURRENT)	BASE	STANDARD	EACH	BATTERY GROUP 4T-276-41B		
LAST USED: 06/01/07		YIELD%: 100.000%		MAX LOT SIZE: 0			
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND.
50638	*	STD	1.00	EA	0.000%	BOX, BATTERY 24VDC SERIES	
123-32013			2.00	EACH	0.000%	BATTERY 12V 1125 CCA	
62584			2.00	EA	0.000%	GROMMET RUBBER BATTERY CABLE	
42329			1.00	EACH	0.000%	CABLE ASSY BATT	
102-67803			70.00	IN	0.000%	CABLE ASSY STARTER 2/O RED	
102-12503			60.00	IN	0.000%	CABLE ASSY STARTER 2/O BLK SX	
123-17369			2.00	EACH	0.000%	SOLDER LUG 2/O GA x 3/8 STUD	
123-12505			2.00	EACH	0.000%	SOLDER LUG 2/OGA x 1/2" STUD	
80101			2.00	EA	0.000%	NUT 1/2-13 HEX	
80099			2.00	EA	0.000%	NUT 3/8-16 HEX GRADE 8	
80026			4.00	EA	0.000%	HHCS 5/16-18 X 1-1/4 ZINC	
80172			8.00	EA	0.000%	WASHER, FLAT 5/16 SAE GR8 ZINC	
80115			7.00	EA	0.000%	WASHER, 5/16 SPLIT LOCK	
80113			4.00	EA	0.000%	NUT 5/16-18 HEX ZINC	
80132			3.00	EA	0.000%	HHCS 5/16-18 X 3/4 GR 8 ZINC	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION		OPTN	TYPE	U/M	DESCRIPTION	
21298-05	000	(CURRENT)	BASE	STANDARD	EACH	NAMEPLATE GRP 6T-903-82B/1500	
LAST USED:		06/01/07	YIELD%:		100.000%	MAX LOT SIZE:	0
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
41938-01			2.00	EA	0.000%	NAMEPLATE 'SUCTION'	
41938-02			1.00	EA	0.000%	NAMEPLATE '1ST STAGE'	
41938-03			1.00	EA	0.000%	NAMEPLATE 'DISCHARGE'	
41938-33			1.00	EA	0.000%	NAMEPLATE 'OFF/RUN/BY-PASS'	
41938-26			1.00	EA	0.000%	NAMEPLATE 'START'	
41938-56			1.00	EACH	0.000%	NAMEPLATE 'AIR TEMP FAULT'	
41938-36			1.00	EA	0.000%	NAMEPLATE 'EMERGENCY STOP'	
41938-18			1.00	EA	0.000%	NAMEPLATE 'COOLANT'	
41938-15			1.00	EA	0.000%	NAMEPLATE 'PUMPER OIL'	
41938-16			1.00	EA	0.000%	NAMEPLATE 'ENGINE OIL'	
41938-69			1.00	EACH	0.000%	NAMEPLATE 'PUMPER FAULT'	
41938-68			1.00	EACH	0.000%	NAMEPLATE 'ECM SWITCHED'	
41938-65			1.00	EACH	0.000%	NAMEPLATE 'MAIN'	
41938-55			1.00	EACH	0.000%	NAMEPLATE 'UNLOAD/AUTOLOAD'	
41938-21			1.00	EA	0.000%	NAMEPLATE 'LOAD'	
41938-64			1.00	EACH	0.000%	NAMEPLATE 'DOWN/RPM/UP'	
41938-67			1.00	EACH	0.000%	NAMEPLATE 'ECM UNSWITCHED'	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION	OPTN	TYPE	U/M	DESCRIPTION		
21298-03	000 (CURRENT)	BASE	STANDARD	EACH	HOSE KIT INSIDE PANEL 6T-903-8		
LAST USED: 06/01/07		YIELD%: 100.000%		MAX LOT SIZE: 0			
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND.
61184			3.00	EA	0.000%	L 1/4 NPTF X #4 JIC 90DG CS	
90938			1.00	EA	0.000%	L 1/8 NPTF X #4 JIC 90DG CS	
90936			4.00	EA	0.000%	UNION, #4JIC BULKHEAD CS	
90953			4.00	EA	0.000%	SWIVEL #4JIC x #4 STRT CRIMP	
70243			120.00	IN	0.000%	HOSE #4 T1170-04 CRIMPABLE	
63585			120.00	IN	0.000%	TUBE 1/2 HEAT SHRINK	
90939			4.00	EA	0.000%	SWIVEL #4JIC X #4 90DG CRIMP	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION	OPTN	TYPE	U/M	DESCRIPTION		
21298-04	000 (CURRENT)	BASE	STANDARD	EACH	HOSE KIT OUTSIDE PANEL 6T-903-		
LAST USED: 06/11/07		YIELD%: 100.000%		MAX LOT SIZE: 0			
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
90939			8.00	EA	0.000%	SWIVEL #4JIC X #4 90DG CRIMP	
90953			8.00	EA	0.000%	SWIVEL #4JIC x #4 STRT CRIMP	
90360			2.00	EA	0.000%	L 1/4 NPTM X #4 JIC 90DG CS	
70243			816.00	IN	0.000%	HOSE #4 T1170-04 CRIMPABLE	
90395			1.00	EA	0.000%	ADAPT 1/8 NPTM X #4 JIC CS	

SINGLE-LEVEL BILL OF MATERIALS REPORT

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION	OPTN	TYPE	U/M	DESCRIPTION		
10169-02	000 (CURRENT)	BASE	STANDARD	EACH	OPTION 6T-855-62B FLANGES SUCT		
LAST USED: 06/12/07		YIELD%: 100.000%		MAX LOT SIZE: 0			
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
91728			1.00	EACH	0.000%	FLANGE 4" NPT RF 300# ANSI	
91729			1.00	EACH	0.000%	FLANGE 3" NPT RF 1500# ANSI	
80439			8.00	EACH	0.000%	STUD, 3/4-10 x 4-1/2 ASTM A1	
80438			16.00	EACH	0.000%	NUT 3/4-10 HEAVY HEX ASTM A563	
63685			1.00	EACH	0.000%	GSKT FLG ANSI 4" 300# CG FLEXI	
80459			8.00	EACH	0.000%	STUD, 1-1/8"-7 x 7"LG B7 A193	
80441			16.00	EACH	0.000%	NUT 1-1/8-7 HEAVY HEX ASTM A56	
63688			1.00	EACH	0.000%	GSKT FLG ANSI 3" 1500# CG FLEX	
91765			1.00	EACH	0.000%	PLUG, 4" NPT PVC DWV	
91538			1.00	EACH	0.000%	PLUG, 3" NPT PVC DWV	

SINGLE-LEVEL BILL OF MATERIALS REPORT

GrimmerSchmidt/Hurricane Co

WITH PHANTOM BLOW THROUGH - EFFECTIVE DATE

BILL	REVISION	OPTN	TYPE	U/M	DESCRIPTION		
10186-01	000 (CURRENT)	BASE	STANDARD	EACH	SPARE PARTS 6T-855-62B/2000(27		
LAST USED:		YIELD%:		100.000%	MAX LOT SIZE: 0		
COMPONENT	REV	TYP	QTY/BILL	U/M	SCRAP %	DESCRIPTION	FIND
63657			1.00	EACH	0.000%	O-RING 2-117 VITON 90 DURO	
63722			1.00	EACH	0.000%	FILTER OIL CUMMINS 855	
61869			1.00	EA	0.000%	O-RING 2-161 VITON 90 DURO	
63689			3.00	EACH	0.000%	O-RING 2-251 VITON 90 DURO	
41138			3.00	EA	0.000%	VALVE COMPR	
62739			15.00	EACH	0.000%	RING 3.000 COMPR CI PS TF WIDE	
41079			3.00	EA	0.000%	RING 3.00DIA 3PC OIL	
62420			18.00	EACH	0.000%	RING 2.000 COMPR CI PS TF WIDE	
62284			3.00	EA	0.000%	RING 2.00DIA OIL (3PC)	
62439			3.00	EACH	0.000%	VALVE, COMPR 1ST STAGE	
60051			3.00	EA	0.000%	O-RING 2-035 VITON 90 DURO	
61392			6.00	EA	0.000%	O-RING 2-043 VITON 90 DURO	
63580			3.00	EACH	0.000%	O-RING 2-156 VITON 90 DURO	
61945			3.00	EA	0.000%	O-RING 2-046 VITON 90 DURO	
61138			6.00	EA	0.000%	O-RING 2-047 VITON 90 DURO	
60056			6.00	EA	0.000%	O-RING 2-233 VITON 90 VITON	
61396			6.00	EA	0.000%	O-RING, 2-225 VITON 90 DURO	
60328			2.00	EA	0.000%	RELAY MAN RESET TTR 12/24VDC	
61883			1.00	EA	0.000%	GA TEMP SWITCH 32-160 16FT	
61344			2.00	EA	0.000%	GAUGE TEMP SWITCH 300-440 16FT	
61938			1.00	EA	0.000%	GAUGE 0-100PSI OIL PRESS SWITC	
63439-01			1.00	EACH	0.000%	ELEMENT A/C 18" PRIMARY	
63439-02			1.00	EACH	0.000%	ELEMENT A/C 18" SAFETY	
61354			2.00	EA	0.000%	O-RING, 2-245 VITON 90 DURO	
63622			1.00	EACH	0.000%	VALVE S. REL 450PSIG 400DEG	
91297			3.00	EA	0.000%	CPLG ASSY VICTAULIC 4"	
63685			3.00	EACH	0.000%	GSKT FLG ANSI 4" 300# CG FLEXI	
62208-01			7.00	EACH	0.000%	O-RING 3" SPLIT FLANGE	
90798			9.00	EA	0.000%	GSKT VICTAULIC 3" #77 'O'	
63623			1.00	EACH	0.000%	VALVE S. REL 1000PSIG 400DEG	
63686			6.00	EACH	0.000%	GSKT FLG ANSI 3" 600# CG FLEXI	
62742			1.00	EACH	0.000%	VALVE, CHECK HB 3"2000PSI2700C	
62917			4.00	EA	0.000%	O-RING, 2-228 VITON 90 DURO	
63624			1.00	EACH	0.000%	VALVE S. REL 2500PSIG 400DEG	
63688			3.00	EACH	0.000%	GSKT FLG ANSI 3" 1500# CG FLEX	
30252			2.00	EA	0.000%	O-RING, 2-219 VITON 90 DURO	
91565-01			2.00	EACH	0.000%	GSKT VICTAULIC 1" #77 'O'	
61895			1.00	EA	0.000%	VALVE, SOLE. 3-WAY 24VDC N/C	
62127			1.00	EA	0.000%	SWITCH PRESS 295-3400 PSI	
62512			1.00	EA	0.000%	REGULATOR AIR 3000#IN/125#OUT	
63202-01			1.00	EACH	0.000%	ELEMENT ADSORPTION 1/4" NPT	
63687			2.00	EACH	0.000%	GSKT FLG ANSI 2" 1500# CG FLEX	
63762			2.00	EACH	0.000%	BELT FAN 6T855	
63834-01			1.00	EACH	0.000%	KIT VALVE BODY REBUILD	
63834-02			1.00	EACH	0.000%	KIT DIAPHRAM REBUILD	
62917			3.00	EA	0.000%	O-RING, 2-228 VITON 90 DURO	



HURRICANE COMPRESSORS WARRANTY POLICY

The Warranty. Hurricane Compressors products are warranted to be free from defects in workmanship and material, under normal use and service, for the period or hours of operation stated below, whichever shall occur first, from the date in service to the first purchaser (beginning at machine startup if startup occurs within six (6) months after shipment from the Hurricane factory and registration card is returned within ten (10) days after startup or thirty (30) days after date of invoice if registration card not returned).

WARRANTY DURATION

PRODUCT	HOURS	MONTHS
Diesel Rotary, Gas Gathering Compressors	2,000	12
Multi-Stage & Booster Reciprocating Compressors	2,000	12
Crankshaft, Crankcase Casting, Connecting Rods, Crossheads and Compressor Head Castings		36
Rotary Air Ends	2,000	24
Parts and Exchange Valves	Unlimited	3

Hurricane's Responsibilities. With respect to a product failure, which occurs as the result of a defect in workmanship or material during the warranty period, which is not otherwise excluded by this warranty, Hurricane shall have the following responsibilities:

Rotary, Gas Gathering Compressors: Hurricane will pay for parts and labor during the warranty period.

Multi-Stage Reciprocating and Booster Reciprocating Compressors: Hurricane will pay for replacement or repair of parts and labor within the first 90 days from date placed in service and parts only for the remainder of the warranty period.

Rotary Air Ends: Failures will be replaced with new or exchange air ends. When an air end (either new or exchange) fails under warranty, it must be returned to the factory in its failed state. If the air end is disassembled, the warranty is void. The parts covered by this plan include all components of the air end, with the exception of the drive coupling, air intake housing assembly and discharge housing assembly, which are not included.

Parts and Exchange Valves: Hurricane will pay for the replacement or repair of parts or valves only.

Repairs: Repairs or replacement parts are warranted for 90 days from the date that the repaired or replaced products are shipped or installed. This warranty does not cover labor costs and other contingent expenses for the diagnosis of defects or for removal and reinstallation of the equipment.

Customer Responsibilities: The customer is responsible for the operation and maintenance of the product as required by good industry practice and as specified in the manual supplied by Hurricane.

In order to make a claim for warranty service, the customer must notify Hurricane or its authorized dealer of the defect within the warranty period; return the product or part thereof to Hurricane for inspection; pay all shipping charges as required.

The customer is responsible for communication expenses, meals, lodging, travel, access to the compressor, downtime expenses, all business costs and losses and similar costs incurred resulting from any warrantable failure.

The warranty period shall be established by the date placed in service by the first user as reported by the warranty registration card mailed to Hurricane by the owner or distributor. If a registration card is not on file, the invoice date will establish the start of the warranty period.

Limitations: Except as otherwise stated, this warranty is limited to the repair or replacement of parts at distributor net cost if, upon inspection, such parts are found to be defective in material or workmanship. When requested, allegedly defective parts shall be shipped prepaid to the factory for Hurricane inspection. Before parts are returned to the factory for warranty, Hurricane's warranty claim form must be filled out and sent to Hurricane, within 30 days from date of failure, for consideration and instructions regarding further disposition. Claims filed after this 30-day time period will not be considered. After Hurricane reviews the claim, a determination will be made as to whether the parts should be sent back for evaluation. Warranted parts will be repaired or replaced to the initial user during normal working hours at a Hurricane Compressors Distributor authorized to sell the type of equipment involved or other establishment authorized by Hurricane Compressors

This warranty does not apply to (1) any compressor unit that shall have been subject to use outside the recommended rpm operating range, chemical or abrasive action, negligence, accident or other misuse, (2) any compressor or part that shall have been repaired or altered by anyone who is not an authorized Hurricane distributor if, in the judgement of Hurricane, its performance and reliability are adversely affected, (3) any part of a compressor unit improperly applied or installed, (4) failures in any way resulting from use of parts not manufactured or approved by Hurricane or (5) normal maintenance services including, but not limited to, tune-up and repair or replacement of oil, filters and belts.

Hurricane shall not be liable for loss of time to the user while the compressor or other equipment is out of commission or for special, incidental or consequential damage arising for any alleged breach of warranty.

Engines, electrical equipment, gauges, valves, clutches, radiators, coolers, CNG dispensers, gas dryers and other items not manufactured by Hurricane which are warranted by their respective manufacturers, are not warranted by Hurricane.

Labor charges are paid based on Repair Time Standards and Rates established by Hurricane.

All implied warranties, if any, applicable to consumer products terminate concurrently with the expiration of the express warranties applied to such product.

There are no other warranties, expressed or implied, including warranties for merchantability or fitness for a particular purpose by Hurricane except the warranty against defects in material and workmanship specified herein. No person is authorized to bind Hurricane for any other warranty.



WARRANTY CLAIM PROCEDURE FOR DISTRIBUTOR

Any problem encountered by a customer should be reviewed and, if it cannot be determined if the problem is covered by warranty, contact the factory.

The procedure for handling warranty repairs on items not warranted by Hurricane is on the back of this form. **Do not process a Hurricane warranty claim form on these items.**

The flow of events is:

1. Customer Experiences Failure – customer's first concern is to repair the equipment and return it to service as soon as possible.
2. Repair Parts – if parts needed for repair are not in your inventory, order the parts from Hurricane Compressors parts department in the same manner as any other parts order.
3. Parts shipped and Billed – parts order will be shipped and billed to your account. After repairing the unit, complete the three-part Warranty Claim Form and return the white and yellow copies to Hurricane Compressors **within 30 days of the actual work.**
4. Return Material Authorization (RMA) Number – if it is necessary to return the failed parts to Hurricane Compressors, an RMA number will be issued to you. This number is to be marked on the outside of the package or on the packing slip. The parts must be returned prepaid – **no CODs will be accepted.**
5. Processing the Claim – upon receipt of the Warranty Claim Form, a warranty claim number will be assigned. The warranty department will evaluate the claim and, if it is valid, a credit memo will be issued. If partial warranty is allowed or the warranty claim is denied, you will be advised in writing.



NOTE:

For items warranted by their respective manufacturers, the procedure is as follows:

Engines and engine related items

1. Contact the nearest industrial engine manufacturer dealer/distributor as listed in the Engine Operation and Maintenance Manual or Service Distributor Directory supplied with the compressor. **Do not process a Hurricane Compressors warranty claim form.**
2. If a dealer/distributor cannot be located, contract the Hurricane Compressors factory.

Batteries

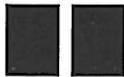
Attached to each battery or in the technical literature package on each compressor is a warranty tag with the name and phone number of the East Penn Manufacturing Company (1-800-237-6162 or in Florida call collect 813-581-1393), manufacturer of the Deka battery. Section A is to be filed out by the customer on receipt of the air compressor.

If you have a warranty problem, call the appropriate phone number for your location with the following information: The problem, name of the battery, where you purchased it and your location. They will inform you of the nearest distributor.

Limitations

If a replacement part is purchased from someone other than the Hurricane Compressors factory, the warranty reimbursement should be handled through the source for the part.

Warranty reimbursements on replacement parts from Hurricane Compressors will be at your cost.



**GrimmerSchmidt
Compressors**

(317) 736-8416 FAX (317) 736-3831
TOLL FREE (800) 428-9703

1015 N. HURRICANE ROAD
FRANKLIN, IN 46131



(317) 736-3800 FAX (317) 736-3801
TOLL FREE (800) 754-7408

FOR OFFICE USE ONLY

WARRANTY CLAIM

Date _____

Your Customer Name _____

Street Address _____

City, State, Zip _____

Claim # _____

Received _____

NOTE: All claims must be filed within 30
days of actual work. Parts must
be tagged and held for 60 days
from date of claim.

Type of Equipment (Compressor-Air or Gas, Part, etc.)

Model No.

Serial # (Found on Data Plate)

Date Sold to Your Customer

Date of Failure

Amount of Hours Used

Give accurate detailed description of problem and how it was handled below, or attach separate paper.

PARTS LIST

Qty.	Part No.	Part Name	Net Cost	Qty.	Part No.	Part Name	Net Cost

LABOR

DESCRIPTION	DATE	HOURS	RATE	NET COST

☐ Parts are being held for instructions.

☐ Parts are being returned prepaid per instructions from

RMA# _____

☐ Other Disposition: _____

Your account # _____

Distributor _____

Street _____

City and State _____

Zip _____

Name (Please Print) _____

Title _____

Telephone # _____

Fax # _____

White return to address above - Attention: Warranty
Yellow - Customer Copy