

Installation, Operation
and
Maintenance Manual
for
1357 Series
Servo Dome
Pressure Reducing Regulator

Manufactured by

APCO Controls
a division of U.S. Para Plate Corporation
FCSM 66573

12/14/99

WARNING

- 1 DO NOT EXCEED THE MAXIMUM INLET OR OUTLET PRESSURE WHICH IS MARKED ON THE VALVE NAMEPLATE.**

WARNING

- 2 THE 1357 SERIES ADJUSTABLE REGULATOR OPERATES UNDER HIGH PRESSURE. TO AVOID PERSONAL INJURY, BE SURE BOTH THE INLET AND OUTLET PORTS AND DOME ARE COMPLETELY DEPRESSURIZED PRIOR TO ATTEMPTING IN-LINE VALVE REPAIR OR REMOVAL.**

WARNING

- 3 TO AVOID PERSONAL INJURY NEVER PRESSURIZE THE DOME CHAMBER ABOVE THE MAXIMUM ALLOWABLE OUTLET PRESSURE MARKED ON THE VALVE NAMEPLATE.**

WARNING

- 4 NEVER ALLOW A DIFFERENTIAL IN EXCESS OF 1000 PSID ACROSS THE DOME DIAPHRAGM.**

Maintenance Instructions
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1.0 General

The instructions contained in this manual refer to Figures 1 through 5. Regulator maintenance consists of disassembly, inspection, cleaning, lubrication, assembly, testing and troubleshooting.

2.0 Installation and Operation Instructions

2.1 Connect the inlet port (marked "IN" or "INLET" on the body - item 19) to a source of line pressure.

WARNING: DO NOT EXCEED THE MAXIMUM INLET OR OUTLET PRESSURE WHICH IS MARKED ON THE NAMEPLATE (item 1)

2.2 Connect the outlet port (marked "OUT" or "OUTLET" on the body) to the outlet line.

2.3 Connect a source of variable pneumatic pressure to the dome loading port on top of the dome (item 35). The dome loading pressure can be tapped off the inlet pressure line to an APCO regulator. Mounting brackets designed to mount an APCO adjustable pressure regulator atop the servo-dome regulator are available; this provides a compact local control package. An APCO adjustable pressure regulator can also be connected to the dome loading port from a remote point to provide remote control.

2.4 To set the outlet pressure, increase pressure applied to the dome until the desired outlet pressure is obtained. Hold the dome pressure to maintain the desired outlet pressure.

2.5 Downstream sensing, for close control of outlet pressure at a point downstream of the regulator, can be provided on APCO servo-dome regulators. Connect a line from the downstream sensing port to the downstream point at which pressure is to be sensed. The servo-dome regulator will now provide outlet pressure as required to maintain the preset pressure at this point.

Note: Regulators not shipped for remote sensing applications have a plug and packing (items 32 and 33) in the remote sensing port and are ported internally for internal sensing. Do not connect a downstream sensing line to a regulator that has the internal sensing port open. You may convert to a remote sensing application by ordering a sensing plug (item 37), APCO part number 134854.

2.6 The regulator will now automatically provide the set outlet pressure as long as sufficient pressure supply is provided at the inlet port. No further adjustment of the unit is required unless it is desired to change the outlet pressure setting.

2.7 To bleed pressure from the unit, first close off inlet pressure, then dome pressure. If a non self relieving regulator or metering valve is used to load the dome, crack open fitting to dome loading port and bleed off dome pressure.

3.0 How the Regulator Operates

3.1 The Servo-Dome Pressure Regulator is a self-contained pressure regulating device that is designed to reduce and regulate the pressure of a gas or liquid. The 1357 Series consists of a diaphragm-actuated (item 6), spring-loaded (item 22) pressure regulating piston (item 12), together with the required seals and associated parts housed in a body (item 19) and dome (item 35).

3.2 In servo-dome pressure regulators, a fixed volume of gas serves as the pressure

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adjustment. The pressure of this gas determines the outlet pressure. Any inert gas may be used to pressurize the servo-dome chamber and establish the outlet pressure. Dome pressure will be slightly greater than downstream pressure.

- 3.3 The pressure in the servo-dome chamber acts on the top side of the diaphragm. The outlet pressure of the system being regulated acts on the bottom of the diaphragm. When these two pressures are balanced the piston seats, closing the flow path through the regulator. This condition is referred to as “lockup”.
- 3.4 The instant that pressure in the system being regulated drops below the pressure established in the servo-dome, the pressure in the servo-dome moves the diaphragm down and unseats the piston. Pressure from the inlet side is immediately admitted to the outlet side. When the outlet pressure again balances the established pressure in the servo-dome chamber, the piston goes to lockup position.
- 3.5 The interaction of the inlet, outlet and servo-dome pressure can be considered instantaneous. The speed of operation is determined by the rate of gas or liquid flow through the orifices. These orifices have been calculated to provide maximum speed of operation for the pressures and flows of each unit.

Warning: The 1357 Series Adjustable Pressure Regulator operates under high pressure. To avoid personal injury, be sure both the inlet and outlet ports and dome are completely depressurized prior to attempting in-line valve repair or removal.

4.0 Disassembly

- 4.1 The piston (item 12), hard seat (item 13), soft seat or metal seat (item 14 or 39), seat backer (item 27), seat retainer (item 18), spring (item 22), packings and backup rings (items 20, 21, 24, 25, 36 and 38), bushing (item 10) and sleeve (item 26), may be removed without removal of the unit from the line.
- 4.2 The diaphragm (item 6), diaphragm backer (item 9) and associated parts are removed by removing the dome bolts (item 7) and lifting off the dome (item 35). There are two threaded holes on top of the dome to accommodate a hoist ring.
- 4.3 For units equipped with G-con flanges the unit must be removed from the line in order to remove flange adapters (item 16) and packings (item 17).

5.0 Inspection

- 5.1 Check seats, packings, backup rings and sleeves (items 26 and 28) for contamination, damage or deterioration. Check all moving parts for excessive wear or distortion. Pay particular attention to the sealing surfaces of the piston (item 12), seats, body and the bore of the cylinder (item 23).
- 5.2 Replace any part that is damaged or deteriorated. Replace all packings, backup rings, soft seat, diaphragm (item 6) and sleeves during every overhaul. Reference APCO soft goods part number configuration shown on Figure 1 for all softgoods needed.

6.0 Cleaning

- 6.1 Metal parts of the regulator should be thoroughly washed in cleaning solvent and dried with clean, compressed air. For specially cleaned units refer to the

applicable cleaning procedures or contact APCO Controls.

7.0 Lubrication

7.1 Lubricate threads, packings, and functional surfaces with DuPont Krytox 240AC.

8.0 Reassembly

8.1 In general, reassembly is the reverse of disassembly. Refer to Figures 1 through 5 for specific reassembly information, torque values, positioning of non-symmetrical parts, etc.

WARNING: NEVER ALLOW A DIFFERENTIAL IN EXCESS OF 1000 PSID ACROSS THE DOME DIAPHRAGM.

9.0 Testing

9.1 External Leakage Test (Media: GN2)

9.1.1 Load inlet to the maximum inlet pressure marked on the nameplate (item 1). With downstream shutoff valve in closed position slowly load dome to maximum outlet pressure marked on the nameplate.

9.1.2 Submerge the unit in water or apply soapy water solution to valve joints and check for external leakage as evidenced by escaping air bubbles.

Test: No external leakage allowed over a 2-minute period.

9.2 Internal Leakage Test (Media: GN2)

9.2.1 Load inlet port to the maximum inlet pressure marked on the nameplate. Attach a ¼" tube to outlet port and submerge 1/8" to ¼" underwater.

Test: Soft seat; leakage not to exceed 5 sccm (67 bubbles/minute) per nominal valve size over a 3-minute period.

Metal Seat; leakage not to exceed 1 scfm over a 3-minute period.

9.3 Functional Test (Media: GN2)

9.3.1 Load inlet to the maximum inlet pressure marked on the nameplate. With downstream shutoff valve in closed position apply pressure to dome port until outlet reaches 10% of maximum outlet pressure. Open downstream shutoff valve and allow moderate flow. Close downstream shutoff valve.

Test: Outlet to lockup at +/- 2% of set outlet pressure.

9.3.2 Repeat at 50% and 100% of rated outlet pressure marked on the nameplate.

10.0 Troubleshooting

10.1 **Observation:** Outlet pressure too low.

Problem:

- a) Insufficient dome (item 35) pressure.
- b) Stem (item 11) binding in bushing (item 10).
- c) Piston (item 12) binding in cylinder (item 23).

Solution:

- a) Adjust dome pressure.
- b) Replace stem or bushing as required.
- c) Replace piston or cylinder as required.

10.2 **Observation:** Outlet pressure too high.

Problem:

- a) Excessive dome pressure.
- b) Piston not sealing on soft or metal seat (item 14 or 39)

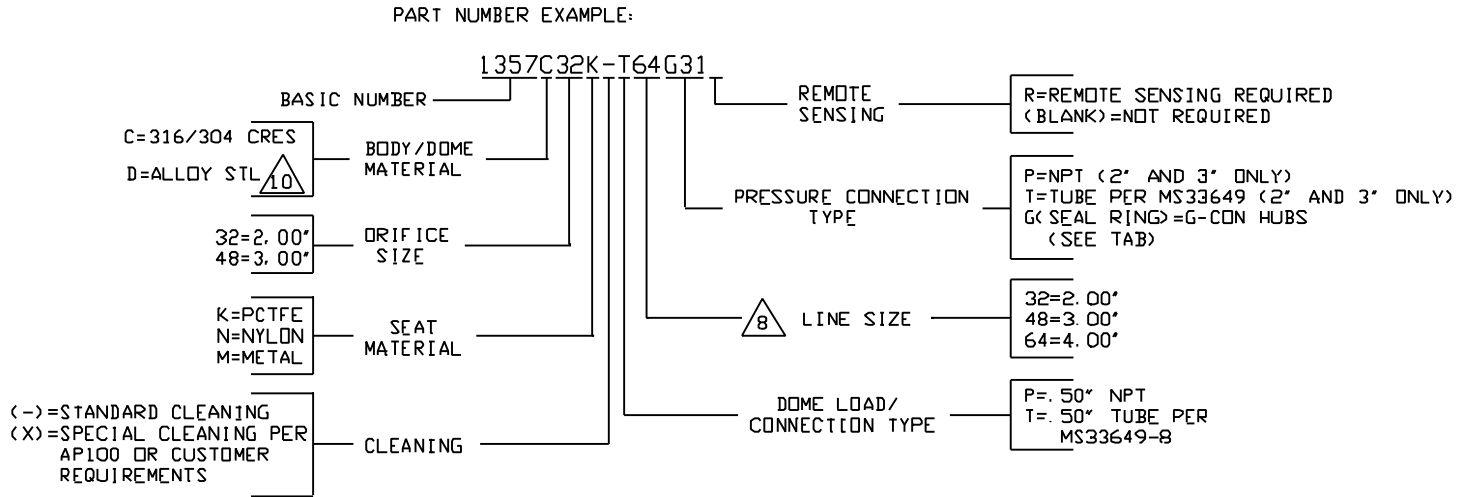
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- Solution:**
- c) Metal seat packing (item 38) defective.
 - c) Hard seat packing (item 36) defective.
 - d) Spring (item 22) defective.
 - a) Bleed pressure from dome.
 - b) Replace soft seat or metal seat and metal seat packing and/or piston.
 - c) Replace hard seat packing.
 - d) Replace spring.
- 10.3 Observation:** Regulation not within 2 percent.
- Problem:**
- a) Stem binding in bushing, or piston binding in cylinder.
 - b) Leakage past seat.
 - c) Spring defective.
- Solution:**
- a) Replaced damaged parts.
 - b) Replace seat.
 - c) Replace spring.
- 10.4 Observation:** External leakage between body (item 19) and dome .
- Problem:**
- a) Inadequate or unevenly torqued dome bolts (item 7).
 - b) Damaged diaphragm (item 6).
 - c) Damaged dome/body diaphragm sealing surfaces.
- Solution:**
- a) Check bolt torque. Torque as specified in cross pattern to evenly load diaphragm.
 - b) Replace diaphragm.
 - c) If possible polish sealing surfaces or contact factory.

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Figure 1

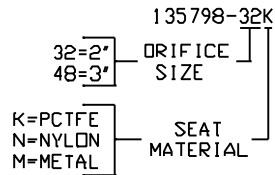


NOTES:

- FLUID MEDIA: FLOW: GASES AND LIQUIDS.
CONTROL -- GASES.
- PRESSURE RATINGS:

	INLET	OUTLET
OPERATING PRESSURE	6000 PSI MAX	0-6000 PSI
PROOF PRESSURE	9000 PSI	1.5 X OPER PRESS
BURST PRESSURE	24000 PSI	4X OPER PRESS
- TEMPERATURE RATING: -45°F TO +165°F
- Cv = (SEE TAB)
ORIFICE = (SEE TAB)
- LEAKAGE: INTERNAL-(SOFT SEAT): 10 SCCM MAX
(METAL SEAT): 1.0 SCFM MAX
EXTERNAL-BUBBLE TIGHT
- TEST PER TP135700.
- FOR SOFT GOODS REPAIR KIT REFERENCE PART NUMBER CONFIGURATION:

Cv	ORIFICE SIZE
81	2.00"
116	3.00"



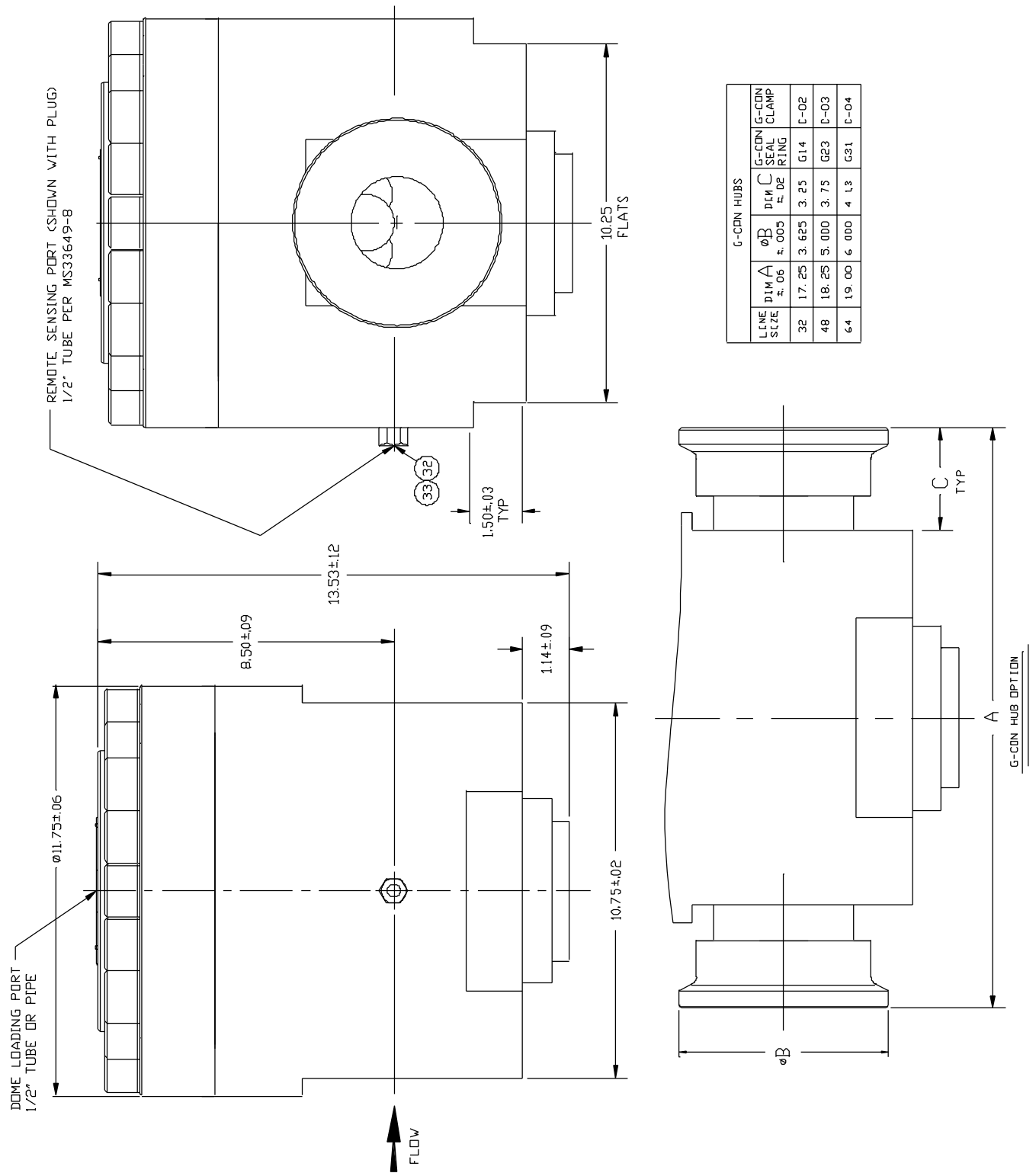
$\triangle 8$ LINE SIZES 64 (4.00") AVAILABLE IN G-CON HUBS ONLY.

- SEE SHEETS 2 FOR ASSEMBLY DRAWINGS.
SEE SHEET 3 FOR BILL OF MATERIALS.

$\triangle 10$ ELECTROLESS NICKLE PLATE.

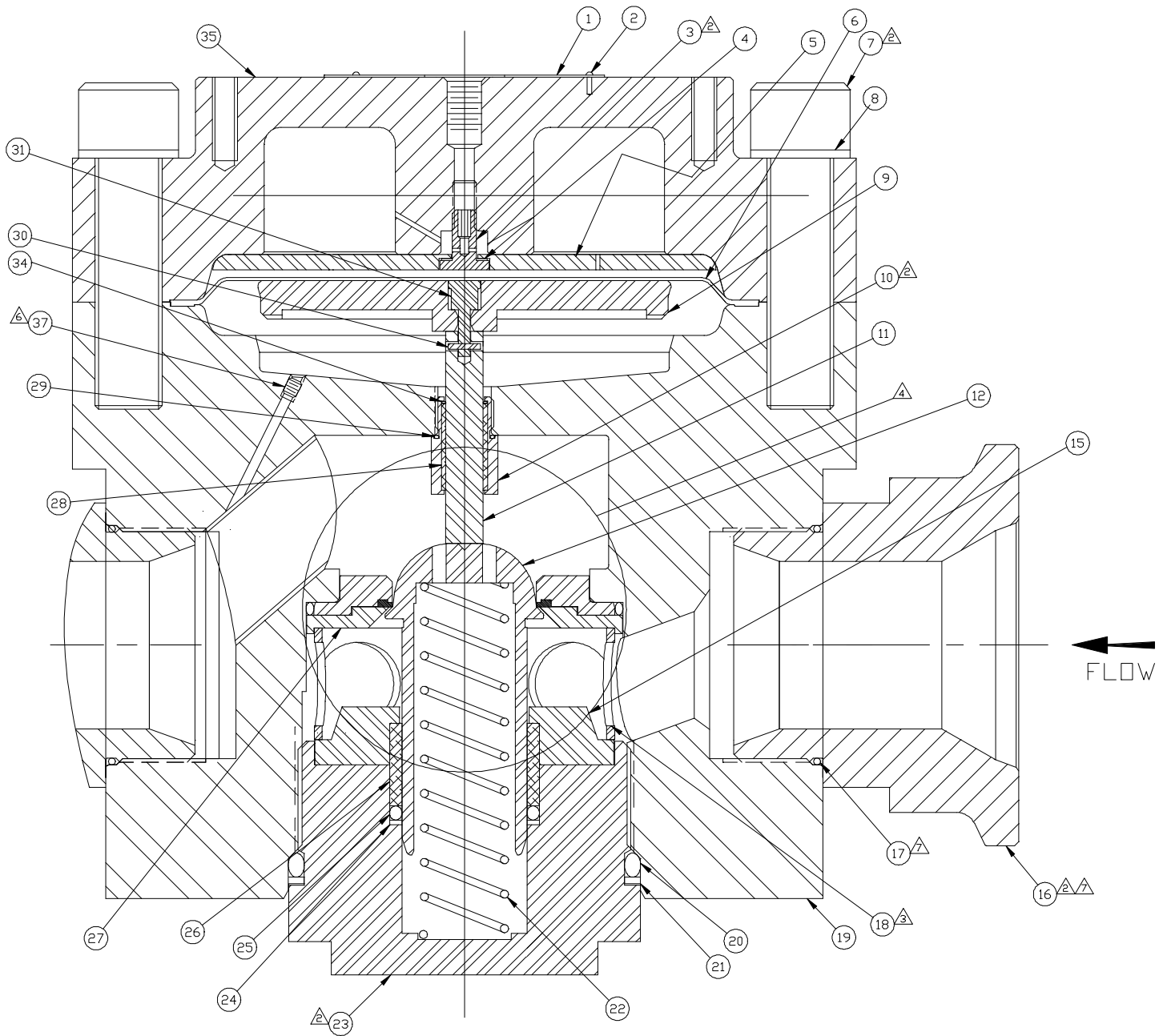
- APPROX WEIGHT: 350 LBS.

Figure 2



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Figure 3



NOTES:

1. LUBRICATE ALL PACKINGS, THREADS AND SLIDING SURFACES WITH 'KRYTOX 240AC FLUORINATED GREASE' (DUPONT).

ITEM NO	TORQUE
3	15±2 FT-LBS
7	46±20 FT-LBS
10	20±5 FT-LBS
16	400±20 FT-LBS
23	500±20 FT-LBS

3. ALIGN OPENING WITH INLET PORT.

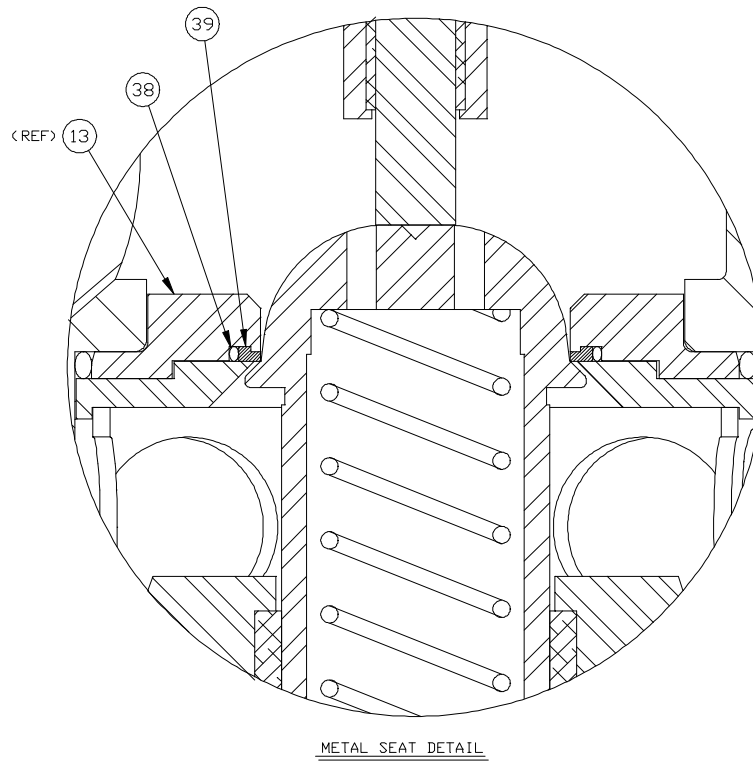
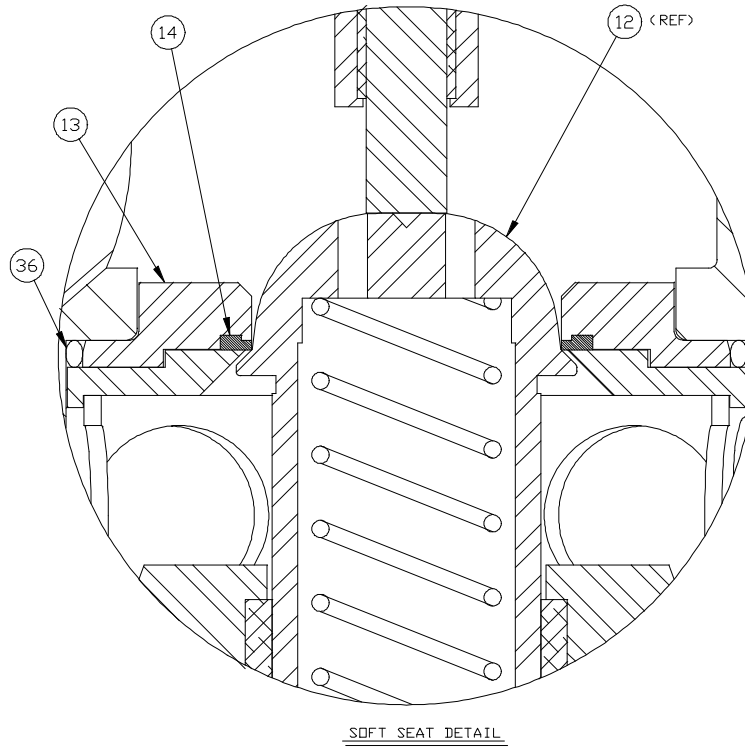
4. SEE FIGURE 4 FOR SEAT DETAIL.

5. SEE FIGURE 2 FOR ITEMS 32 AND 33.

6. FOR REMOTE SENSING UNITS ONLY.

7. FOR UNITS WITH G-CON FLANGES ONLY.

Figure 4



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Figure 5

36	1	0202-2246	PACKING	BUNA-N
34	1	0202-2015	PACKING	BUNA-N
31	1	112279	PIN	316 CRES
30	1	MS171463	PIN, SPRING	CRES
29	1	0202-2019	PACKING	BUNA-N
28	1	112322-3	SLEEVE	TEFLDN
21	1	0227-2427	RING, BACK-UP	TEFLDN
20	1	0202-2427	PACKING	BUNA-N
18	1	112315	RETAINER, SEAT	304 CRES
11	1	112354	STEM	17-4 PH CRES
10	1	125208-1	BUSHING	316 CRES
9	1	135609	BACKER, DIAPHRAGM	304 CRES
8	20	134945	WASHER	416 CRES
7	20	AS176-16F36	SDC HD CAP SCREW 1-12 X 40 X 4.0	STL (ZINC PLT)
6	1	135717	DIAPHRAGM	VITDN
5	1	112282-1	PLATE, UPPER	17-4 PH CRES
4	1	135528	WASHER, LOCK	CRES
3	1	112174	SCREW	316 CRES
2	3	MS21318-8	DRIVE SCREW (#0 X 3/16)	STL (CAD PLT)
1	1	135610-2	NAMEPLATE	AL ALLOY
ITEM	QTY	PART NO	NOMENCLATURE	MATERIAL

PARTS COMMON TO ALL UNITS

17	2	0202-2237	PACKING	BUNA-N			
64	G31	XX	16	2	135720C64GXX	ADAPTER, G-CDN HUB	304 CRES
48	G23	XX	16	2	135714C48GXX	ADAPTER, G-CDN HUB	304 CRES
32	G14	XX	16	2	135722C32GXX	ADAPTER, G-CDN HUB	304 CRES
LINE	SEAL	SCHED	ITEM	QTY	PART NO	NOMENCLATURE	MATERIAL
SIZE	RING						

G-CDN CONNECTIONS

(BLANK)	33	1	0202-3008	PACKING	BUNA-N
	32	1	AN814-8K	PLUG	316 CRES
R	37	1	134854	SET SCREW	300 SERIES CRES
ITEM	QTY	PART NO	NOMENCLATURE	MATERIAL	

SENSING TYPE

19	1	135706<SEE PART NUMBER EXAMPLE>	BODY	<SEE PART NUMBER EXAMPLE>
ITEM	QTY	PART NO	NOMENCLATURE	MATERIAL

1 BODY REQUIREMENTS

27	1	112340	BACKER, SEAT	316 CRES
26	1	112372	BUSHING	NYLATRDN GS
25	1	0202-2335	PACKING	BUNA-N
24	1	0227-2335	RING, BACK-UP	TEFLDN
23	1	135711	CYLINDER	17-4 PH CRES
22	1	125211	SPRING	17-7 PH
15	1	112371	RETAINER, BUSHING	316 CRES
13	1	125305	SEAT, HARD	17-4 PH CRES
12	1	125214-2	PISTON	A286 CRES
27	1	112337	BACKER, SEAT	316 CRES
26	1	112374	BUSHING	NYLATRDN GS
25	1	0202-2328	PACKING	BUNA-N
24	1	0227-2328	RING, BACK-UP	TEFLDN
23	1	135710	CYLINDER	17-4 PH CRES
22	1	112358	SPRING	17-7 PH
15	1	112375	RETAINER, BUSHING	304 CRES
13	1	125306	SEAT, HARD	17-4 PH CRES
12	1	112321-2	PISTON	A286 CRES
ITEM	QTY	PART NO	NOMENCLATURE	MATERIAL

ORIFICE SIZE

M	39	1	112369-1	SEAT, METAL	A286 CRES	
	38	1	0202-2043	PACKING	BUNA-N	
N	14	1	112339	SEAT, SOFT	NYLON	
K	14	1	112339-1	SEAT, SOFT	PCTFE	
M	39	1	112290-1	SEAT, METAL	A286 CRES	
	38	1	0202-2037	PACKING	BUNA-N	
N	14	1	112239	SEAT, SOFT	NYLON	
K	14	1	112239-1	SEAT, SOFT	PCTFE	
ORIFICE	MATL	ITEM	QTY	PART NO	NOMENCLATURE	MATERIAL
SIZE	CODE					

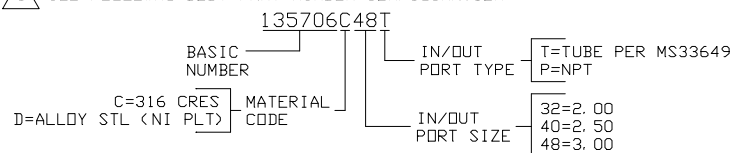
SEAT MATERIAL

T	C	35	1	1357-2715CT8	DDOME	304 CRES
	B	35	1	1357-2715BT8	DDOME	ALLOY STL
P	C	35	1	1357-2715CP8	DDOME	304 CRES
	B	35	1	1357-2715BP8	DDOME	ALLOY STL
LOAD	MATL	ITEM	QTY	PART NO	NOMENCLATURE	MATERIAL
TYPE	CODE					

DOME MATERIAL/DOME LOAD CONNECTION TYPE

NOTES:

1 SEE FOLLOWING BODY PART NUMBER CONFIGURATION:



ALL UNITS USING G-CDN ADAPTERS WILL USE BODIES WITH 3" TUBE PORTS.