Conoflow®

105 Commerce Way
Westminster, SC 29693
Tel: (864) 647-9521
Fax: (864) 647-9568

WARNING

Conoflow's products are designed and manufactured using materials and workmanship required to meet all applicable standards. The use of these products should be confined to services specified and/or recommended in the Conoflow catalogs, instructions, or by Conoflow application engineers.

To avoid personal injury or equipment damage resulting from misuse or misapplication of a product, it is necessary to select the proper materials of construction and pressure-temperature ratings which are consistent with performance requirements.

INSTRUCTION AND MAINTENANCE MANUAL HP500 HIGH PRESSURE REGULATOR HIGH PURITY MODEL

CAUTION: These instructions should be read and understood prior to installation, use, or maintenance.

GENERAL PRODUCT OVERVIEW

The HP500 Series Regulator is a self-contained, HIGH PURITY, diaphragm sensed pressure regulator. This unit is designed for use in high purity gas systems and systems handling corrosive media.

This regulator uses a PCTFE (Kel-F) main valve seat for helium tight shut off and a 316 stainless steel diaphragm for good pressure control sensitivity.

MATERIALS OF CONSTRUCTIONS

The HP500 will operate with any fluid (liquid or gas) compatible with the materials of construction. To identify the materials of construction refer to the Control Engineering Data contained on pages 4 and 5.

Body	Brass/316 SS/316L SS N.A.C.E./Monel/Hastelloy
Bonnet	Brass/Plated Brass/316 SS
Main Valve Seat	Kel-F (Teflon/Vespel Optional)
Diaphragm and Trim	316 SS (Elgiloy Optional
Inner Friction Bushing	Teflon
Filter Screen	316 SS (120 Mesh)

REGULATOR CLEANING

The HP500 Series High Pressure Regulators are cleaned to ITT Conoflow Specification ES8A 01 294.

OXYGEN SERVICE

Specification of materials in regulators used for oxygen service is the USER'S RESPONSIBILITY. Cleaning for oxygen service (per ES8A 01 297) to 3500 PSIG (24.20 MPa) is supplied by ITT Conoflow at no additional cost. For special cleaning requirements, the customer must supply specifications for the desired level of cleaning. Cost will be advised prior to performing the cleaning operation.

CAUTION: Maximum Supply Pressure

Stainless Steel	6000 PSIG (41.40 MPa)
Brass	5000 PSIG (34.50 MPa)

Maximum supply pressure can be derated based on connection and internal material selections. See notes in CED code (pages 4 & 5).

An internal filter screen is provided in the inlet ("IN") port only to stop random contamination resulting from installation. An auxiliary filter is recommended for all but the cleanest fluid. Gaseous fluid must be free of excessive moisture to prevent internal icing or condensation during operation.

OUTLET PRESSURE RANGES

OPTION CODE	RANGE
"A"	0- 25 PSIG (0.173 MPa)
"B"	0- 50 PSIG (.345 MPa)
"C"	0-100 PSIG (.690 MPa)
"E"	0-250 PSIG (1.73 MPa)
"F"	0-500 PSIG (3.45 MPa)

PORTING CONFIGURATIONS

There are two (2) 1/4" NPTF connections on the HP500. The supply connection port is labeled "IN" (stamped on the bottom of the regulator body). The outlet port is labeled "OUT." CARE should be exercised when installing the high pressure line to assure it is connected to the inlet ("IN") port, otherwise the regulator will not function properly.

Teflon thread tape is the preferred thread sealant when the regulator is installed.

OTHER PORTING CONFIGURATIONS AND STYLES ARE AVAILABLE. REFER TO CONTROL ENGINEERING DATA ON PAGES 4 AND 5 FOR ADDITIONAL INFORMATION.

INSTALLATION

The HP500 can be line, panel, or rear mounted. For line mounted applications refer to porting configurations for proper orientation of ports.

Rear Mounting:
This style of mounting can be achieved using to (2) #10-32 mounting screws.

Panel Mounting:
1. Remove handwheel, knob, or "T" bar handle and insert the regulator from the rear of the panel.
2. Projection of regulator through the panel may be controlled by adjustment of panel mounting nuts
3. Replace the handwheel, knob, or "T" handle.
4. Connect inlet, outlet and gauge ports as applicable.

PRINCIPLE OF OPERATION

The HP500 is a self-contained, spring-loaded, high purity pressure regulator. Turning the control knob clockwise will increase the force on the range spring and, in turn, the outlet set pressure will increase. With a relieving option, when the outlet pressure is greater than the set pressure, the diaphragm will rise and unseat the relief valve. As the outlet pressure approaches the set pressure, the diaphragm will move down and close the relief valve. Conversely, turning the control knob counterclockwise will decrease the outlet set pressure. In equilibrium, the force exerted by the range spring is balanced by the outlet pressure.

An unbalance between the outlet pressure and the set pressure causes a corresponding reaction in the diaphragm and main valve. If the outlet pressure rises above the set pressure, the metal diaphragm will lift, allowing the main valve to seat. If the outlet pressure falls below the set pressure, the range spring will push the diaphragm down, unseating the main valve, allowing supply pressure to flow through the main valve to the downstream port increasing the set pressure.

At equilibrium, the valve plug assumed a position which supplies the required flow while maintaining the outlet pressure.

Setting Limit on Maximum Outlet (Control) Pressure

The handwheel on the HP500 Regulator can be adjusted to limit the maximum outlet pressure attainable to any value between 50% and 100% of the rated outlet pressure range. To set this limit, connect the regulator to a pressure source and a gauge to indicate the regulator outlet pressure. Apply an inlet pressure to the regulator equal to the maximum inlet pressure expected in service. Remove the hole plug from the handwheel and loosen the jam nut with a 9/16" socket. Using a screwdriver, turn the adjusting screw clockwise until the indicated outlet pressure is 5% to 10% higher than the pressure at which the limit is desired. Spin the handwheel clockwise until it stops against the top of the bonnet (on stainless steel models the handwheel seats against the packing nut). Then turn the handwheel back about 1/8 of a turn counterclockwise and hold it in this position with one hand. While doing so, tighten the jam nut against the handwheel with 70-120 in.lbs. of torque. Turn the handwheel counterclockwise until it is no longer seated against the top of the bonnet or packing nut. Check by adjusting the handwheel clockwise to insure that it stops when outlet pressure reaches the maximum desired pressure.

SCHEDULED MAINTENANCE

All regulators require scheduled maintenance to remove deposits left by the media and to replace parts worn or damaged as a result of use. Annual maintenance is recommended when the regulator is used under normal conditions. More frequent maintenance may be required due to the condition, cleanliness and/or corrosiveness of the media.

TOOLS REQUIRED

7/16" Socket (seat gland)
1/2" Open or box wrench (wrench knob adjustment option)
9/16" Socket (jam nut within standard hand knob)
9/16" Open end wrench (jam nut on wrench knob or "T" handle)
1-7/8" Socket wrench (bonnet)
Krytox 240 AB grease or equivalent

Other tools and maintenance aids include a vise, tweezers, clean lint free cloth, swabs, and a torque wrench.

CAUTION: MAINTENANCE
It is recommended that maintenance be performed by a person experienced in the operation and repair of high pressure regulators.

Maintenance of this unit is best performed by gripping a protruding end of a pipe fitting installed into the regulator body.

WARNING: Bleed System Pressure Prior to Removing Regulator for Servicing.

MAINTENANCE PROCEDURE

1. Adjust the handwheel to the full counterclockwise position until the handwheel, hole plug, jam nut, and adjusting screw are fully disengaged.

2. Using a 1-7/8" wrench, loosen and remove the bonnet. On stainless steel models use a 3/4" wrench or socket to remove the packing nut to service packing washers.

3. Remove the spring button, range spring, the diaphragm backup plate, and diaphragm.

4. The main valve assembly can be disassembled by using a 7/16" socket to turn the seat gland counterclockwise until it is free from the regulator body. The main valve seat, the main valve plug, and the plug spring can be lifted from the body. The inner and outer friction bushings can be removed from the body by either inverting the body (if the bushings are loose), or by carefully easing them out with a long thin instrument inserted in the center holes.

5. Remove the main valve seat from the seat gland.

(See Figure 2 on page 6 for exploded view)

THE REGULATOR IS RE-ASSEMBLED IN THE REVERSE ORDER OF DISASSEMBLY, OBERSVING THE FOLLOWING PRECAUTIONS:

1. Inspect all component parts and replace those worn or damaged with ITT Conoflow replacement parts.

2. All component parts should be cleaned to the cleanliness level required for safe operation with the media used. All parts in the flow stream must be free of particles which could prevent proper seating of the main valve.

3. Place the outer friction bushing in the 1/4” center hole of the body with the countersunk side up.

4. Place the plug spring on the main valve plug so it mates with the shoulder. Slide the inner friction bushing on the main valve plug with the flat side against the plug spring. Holding the main valve plug by the small diameter end, slide the three components into the body on top of the outer friction bushing.

5. Lubricate the threads of the seat gland lightly with Krytox. Snap the main seat into the seat gland with the countersunk side facing out (Kel-F seats have a countersunk side, Vespel seats do not).

6. Place the seat gland and the main valve seat assembly over the main valve plug and screw the seat gland into the body. Torque the seat gland 70-80 in.lbs.

7. Turn the bonnet over and lubricate the large chamfer in the bonnet and the threads. Place a dab of grease in the well of the spring button. Use Krytox grease.

8. **Standard Non-Relieving Models:** Place the diaphragm on the body so it is centered. Place the range spring backup plate, the range spring, and the spring button on the diaphragm.

Optional Relieving Models: Screw the relief plug on the main valve plug finger tight. Install the diaphragm assembly, O-ring, diaphragm backup plate, range spring, and the spring button by stacking on the body as illustrated.

9. With the components listed above centered on top of the body, place the bonnet over them and screw it on hand tight. When the bonnet tightens, be sure the diaphragm assembly does not shift off center.

10. Secure the body in the vise at the flats and torque the bonnet to 100 ft.lbs. This is critical as the regulator relies on a metal to metal seat to contain the outlet pressure.

11. Install the filter screen in the inlet port of the body and seat it by pushing it lightly with a small, clean socket wrench.

Prior to re-installation, the regulator should be connected to a pressure source with a media compatible with the use of the regulator and pressurized to check for internal and external leakage and operating characteristics.

Regulator Model Breakdown (CED Code)

Control Engineering Data is intended to provide a single source from which one can determine, in detail, the full scope of the product line. In addition to the materials of construction, diaphragm and elastomer selection, it also provides all necessary data regarding adjustment option and range selections. Control Engineering Data also provides a means of communicating by way of a code number which is fully descriptive in product selection. All catalog numbers received must contain fifteen (15) characters.

1 through 5	HP500	Pressure Reducing Regulator, High Purity - Diaphragm Type
		Body / Bonnet / Trim
6	F	Brass / Brass / 316SS
	M	Brass / 316SS / 316SS
	B	Brass / Nickel Plated Brass / 316SS
	H	316SS / Nickel Plated Brass / 316SS
	3	316SS / Nickel Plated Brass / 316SS – 15Ra (See Note 1)
	R	N.A.C.E. 316SS / Nickel Plated Brass / 316SS (See Note 2)
	P	316SS / 316SS / 316SS
	7	316SS / 316SS / 316SS – 15Ra (See Note 1)
	N	N.A.C.E. 316SS / 316SS / 316SS (See Note 2)
	L	316LSS / Nickel Plated Brass / 316SS (See Note 3)
	5	316LSS / Nickel Plated Brass / 316SS – 15Ra (See Notes 1 and 3)
	J	N.A.C.E. 316LSS / Nickel Plated Brass / 316SS (See Notes 2 and 3)
	T	316LSS / 316SS / 316SS (See Note 3)
	8	316LSS / 316SS / 316SS – 15Ra (See Notes 1 and 3)
	W	N.A.C.E. 316LSS / 316SS / 316SS (See Notes 2 and 3)
	E	Monel / Nickel Plated Brass / Monel and Inconel
	K	Hastelloy / Nickel Plated Brass / Hastelloy and Inconel
		Diaphragm / Main Valve Seat(s)
7 through 8	11	316 Stainless Steel / Kel-F (Standard)
	12	316 Stainless Steel / Teflon (Optional) (See Note 5)
	13	316 Stainless Steel / Vespel (Optional)
	14	Elgiloy / Kel-F
	15	Elgiloy / Teflon
	16	Elgiloy / Vespel
9	R	Non-relieving, captured bonnet (Standard)
	W	Non-reliving (No Filter) (Optional) (See Note 7)
	V	Relieving, captured bonnet
10 through 11	*Inlet/Outlet Ports (No Gauge Ports)*	
	NPT Connections:	
	N1	1/4” NPT Connections
	Butt Welded Tubing Connections (See Note 9):	
	B1	316L Stainless Steel 1/4” x 4” Tubing welded per port
	B2	316L Stainless Steel 1/4” x 4” Tubing welded per port, 15Ra Finish
	Field Welded Connections (See Note 10):	
	W1	1/4” Butt weld preparation
	W2	1/4” Socket weld preparation
	High Purity Internal Connections (See Note 11):	
	H1	1/4” Vacuseal - Preparation
	H2	1/4” VCR - Preparation
	H3	1/4” Ultra Seal – Preparation
	Zero Clearance High Purity Butt Weld Connections (See Notes 9 and 12):	
	Z1	1/4” Vacuseal
	Z2	1/4” VCR
	Z3	1/4” Ultra Seal

		Butt Weld 90 Degree Elbow (See Notes 9 and 13):
	91	1/4” Butt weld 90 Degree Elbow
		Inlet/Outlet/2-Gauge Ports (80 Degrees)
		NPT Connections:
	81	1/4” NPT connections
		Butt Welded Tubing Connections:
	82	316L Stainless Steel 1/4” x 4” Tubing welded per port
	83	316L Stainless Steel 1/4” x 4” Tubing welded per port, 15 Ra Finish
		Field Welded Connections (See Note 10):
	84	1/4” Butt weld Preparation
	85	1/4” Socket weld Preparation
		High Purity Internal Connections (See Note 11):
	86	1/4” Vacuseal - Preparation
	87	1/4” VCR - Preparation
	88	1/4” Ultra Seal – Preparation
		Zero Clearance High Purity Butt Weld Connections (See Note 12):
	89	1/4” Vacuseal
	8A	1/4” VCR
	8F	1/4” Ultra Seal
	8H	1/4” Butt weld 90 Degree Elbow
12	R	Rear Mounting (Standard)
	P	Panel Mounting (2-nut) (Optional)
13	A	Regulator is cleaned to ITT Conoflow Specification ES8A 01 294
	B	Oxygen Cleaning: Specification of materials in regulators used for oxygen service is the user’s responsibility. Cleaning for oxygen service to 3500 PSIG (24.20 MPa) is supplied by ITT Conoflow at no additional cost.
	C	Customer Specified Cleaning: Customer to specify the desired level of cleanliness. ITT Conoflow will advise cost prior to performing cleaning operation. Specification of materials is the USER’S RESPONSIBILITY.
14	B	Handwheel
	K	Wrench knob with locking device (Optional)
	T	“T” bar handle (Optional)
15	A	0-25 PSI (0-0.172 MPa)
	B	0-50 PSI (0-0.345 MPa)
	C	0-100 PSI (0-0.690 MPa)
	E	0-250 PSI (0-1.73 MPa)
	F	0-500 PSI (0-3.45 MPa)

NOTES:
1. These options are offered when a 15 Ra microinch finish is required. This finish will apply to the wetted surfaces only. Refer to price sheets for the list price adder.
2. National Association of Corrosion Engineers.
3. 316L Stainless Steel is offered for welded connections. Refer to position 10-11.
4. Maximum supply pressure must not exceed the maximum pressure rating of the supply connection and the supply gauge connection.
5. Utilizing this option will reduce maximum supply pressure rating to 400 PSIG (2.76 MPa)
6. A relieving diaphragm is not available in elgiloy.
7. Option “W” is recommended for hydraulic service.
8. A relieving diaphragm reduces the supply (inlet) rating to 3000 PSIG.
9. The maximum pressure rating of a 1/4” welded connection is 3500 PSIG (24.2 MPa) to assure a minimum of a 4:1 safety factor.
10. Weld preparation to standard tubing tolerance.
11. Customer to supply fittings.
12. Fitting(s) supplied by ITT Conoflow.
13. Fittings are installed down away from control handle.
14. All gauge port connections are 1/4” NPT.

HP500 REGULATOR CONNECTION IDENTIFICATION AND TYPICAL GEOMETRY

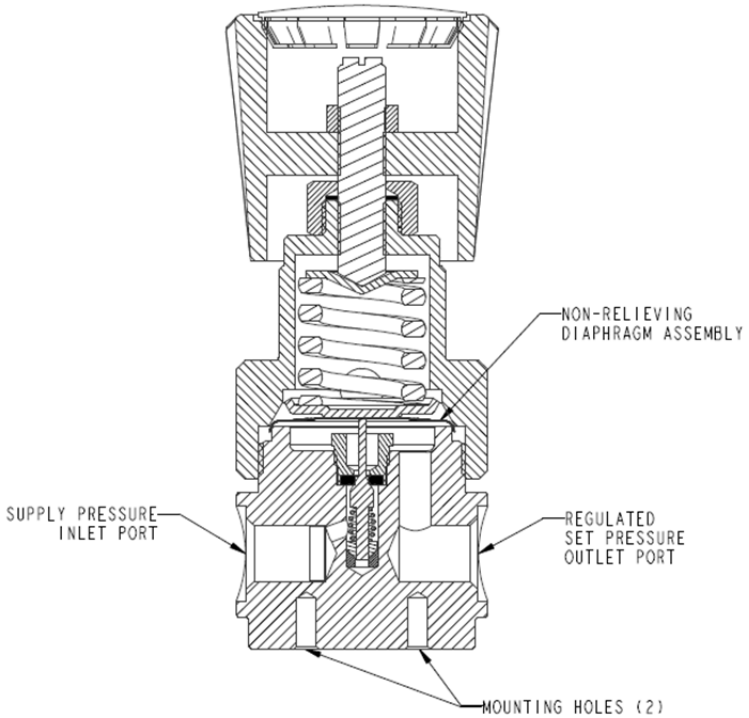

FIGURE 1: HP500 REGULATOR SECTIONED VIEW

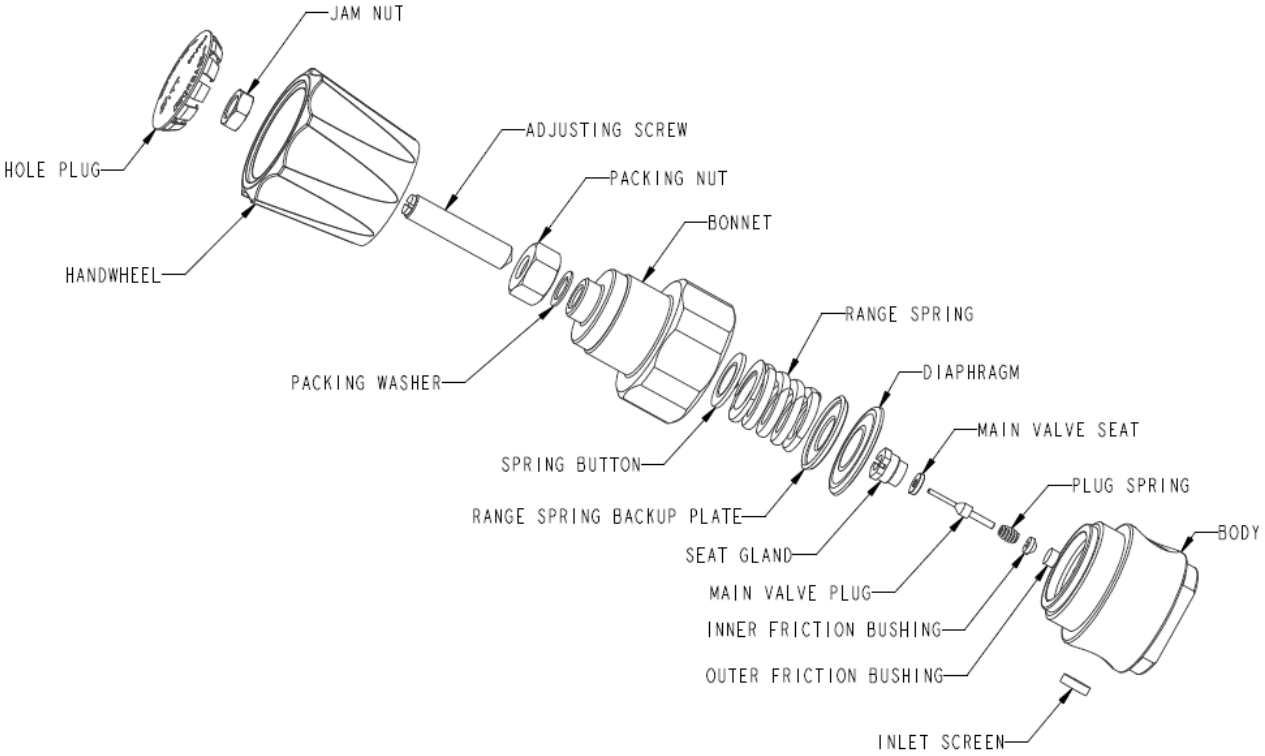

FIGURE 2: HP500 REGULATOR LABELED EXPLODED VIEW

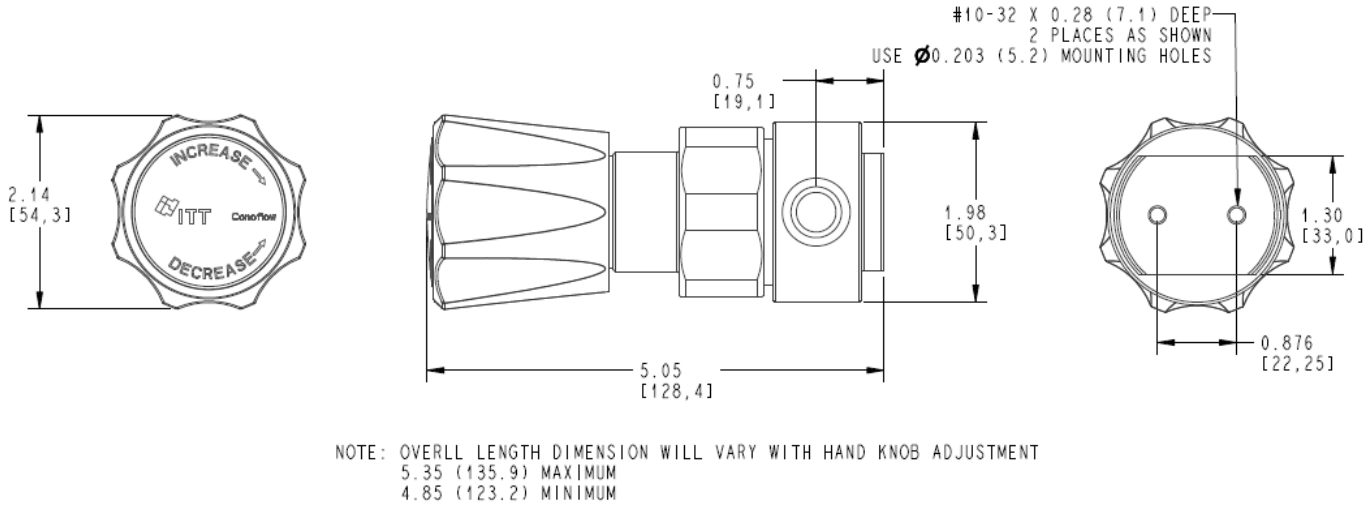

FIGURE 3: HP500 REGULATOR DIMENSIONAL DRAWING (STANDARD HANDWHEEL SHOWN)

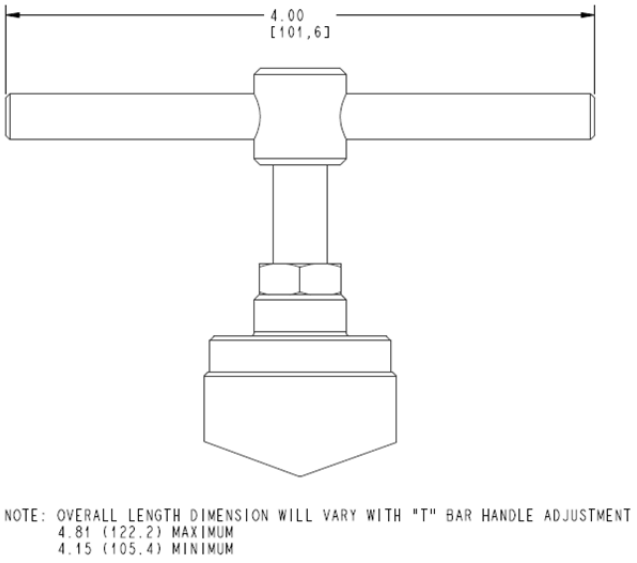

FIGURE 4: HP500 REGULATOR SHOWN WITH “T” BAR ADJUSTMENT OPTION

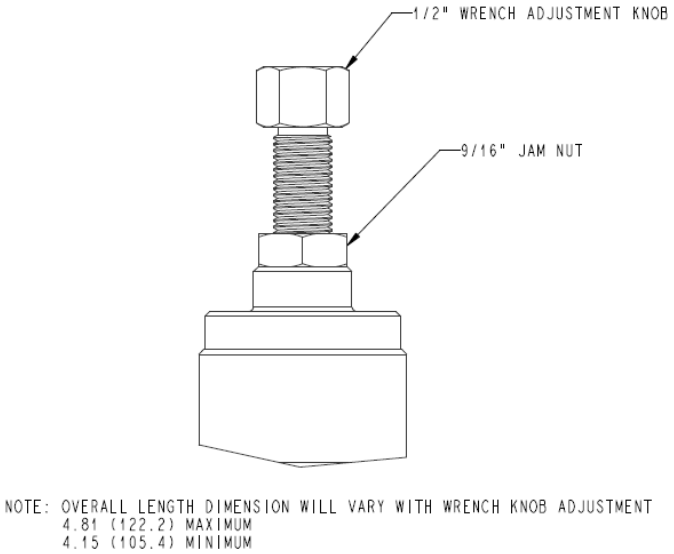

FIGURE 5: HP500 REGULATOR SHOWN WITH WRENCH KNOB ADJUSTMENT OPTION

TROUBLESHOOTING

When performing necessary corrective action in the following operations, refer to the **MAINTENANCE** section for the necessary procedure.

PROBLEM:
The regulated pressure continues to increase after lock-up and without change in the control mechanism position.

POSSIBLE CAUSE:
The main valve seat needs replacement; follow maintenance procedure and regulator assembly.

PROBLEM:
Continuous leakage through the edge of the bonnet.

POSSIBLE CAUSE:
Insufficient torque on bonnet. Re-torque to 100 ft.lbs. If leakage persists, disassemble the regulator per instructions in maintenance section and inspect body for nicks and scratches on the radius where the diaphragm seat against the body. Replace the body if nicked. Replace the diaphragm and re-assemble the regulator.

POSSIBLE CAUSE:
Relief valve is worn or dirty. Disassemble per instructions and replace the diaphragm assembly and relief valve.

PROBLEM:
Regulated pressure drops off sharply when the flow is within the regulator's capabilities.

POSSIBLE CAUSE:
Clogged inlet filter. Remove the old filter with a sharp instrument and press in the new filter using the blunt end of an instrument.