



Bettis Canada Ltd.
4112 91A Street
Edmonton, Alberta, Canada T6E 5V2
Tel: (403) 450-3600
Fax: (403) 450-1400

Edmonton

SERVICE MANUAL No. I-0185

TYPE "UM" GATE VALVE OPERATOR UNIVERSAL MOUNT / QUICK DISCONNECT

CUSTOMER: _____

P.O.#: _____

W.O.#: _____

TAG: _____

DATE: _____

APPLIES TO OPERATOR MODEL: _____

TABLE OF CONTENTS

	DESCRIPTION	DWG. NO	PAGE
I	INTRODUCTION		3
II	INSTALLATION		3
III	OPERATION		3
IV	REMOVAL OF ACTUATOR FROM BONNET ASSEMBLY		4
V	REMOVAL OF BONNET FROM VALVE		4
VI	DISASSEMBLY OF BONNET		5
VII	REASSEMBLY OF BONNET		5
VIII	REINSTALLATION OF BONNET ONTO VALVE		6
IX	DISASSEMBLY OF CYLINDER TYPE ACTUATOR		7
X	REASSEMBLY OF CYLINDER TYPE ACTUATOR		8
XI	DISASSEMBLY OF DIAPHRAGM TYPE ACTUATOR		10
XII	REASSEMBLY OF DIAPHRAGM TYPE ACTUATOR		11
XIII	REINSTALLATION OF ACTUATOR TO BONNET		13
XIV	TROUBLE SHOOTING		14
XV	REGULAR MAINTENANCE		15
XVI	SERVICE		15
	PNEUMATIC CYLINDER ASSEMBLY	A-0443	16
	PNEUMATIC CYLINDER PARTS LIST	A-0443-10	17
	HYDRAULIC ACTUATOR ASSEMBLY w/ PARTS LIST	AB0444-10	18
	DIAPHRAGM ACTUATOR ASSEMBLY	A-0500	19
	DIAPHRAGM ACTUATOR PART LIST	A-0500-10	20
	FINAL ASSEMBLY INSTRUCTIONS	AB0440	21
	FINAL ASSEMBLY INSTRUCTIONS	AB0501	22
	UM BONNET ASSEMBLY (standard packing)	I-0186	23
	UM BONNET ASSEMBLY (optional packing)	I-0186-10	24
	UM BONNET ASSEMBLY TOOLS	I-0187	25
	SPRING COMPRESSION WARNING LABEL	SP-9684-20	26
XVII	NOTES		27

I INTRODUCTION

Bettis UM (Universal Mount) Gate Valve Operators consist of an actuator and bonnet that mount together on a reverse-acting gate valve. The Bettis UM Gate Valve Operator product line includes three different styles of actuators. Two of the actuators are LP (low pressure) pneumatic actuators; specifically one is a piston style and the other is a diaphragm style. The third is a HP (high pressure) hydraulic piston style actuator. Bonnets are manufactured to fit certain classes and brands of reverse acting gate valves. Each of the three different UM actuators styles can be interchanged without removing the bonnet from the valve.

The bonnet and actuator are manufactured with a universal mount quick disconnect feature. This feature allows any of the above three styles of actuators to be interchanged onto the same UM bonnet, without any modification to the bonnet or actuator, providing the actuators being interchanged are designed for similar net thrust output and the same valve stem diameter.

II INSTALLATION

If the Bettis UM Valve Operator assembly was shipped mounted on the valve, it has been factory assembled and tested. The valve and operator assembly may be installed directly into the process line.

If the Bettis UM Valve Operator assembly was shipped without the valve, the valve must be disassembled for installation. See valve manufacturer's instructions. Valve gate travel is typically controlled within the actuator. The gate valve fully closed position, or lower position, is set by adjusting the actuator's lower stop. Typically, the gate valve fully open position, or upper position, is not adjusted. However, if the gate valve has a stem backseat, this upper position may be determined by the valve stem contacting the bonnet.

NOTE: Upper and lower end of stroke positions should never be limited by the gate contacting valve body. Refer to sections VIII and XIII for bonnet and actuator installation procedures.

Supply power to the actuator from a clean source of hydraulic fluid, air or gas.

III OPERATION

(FAILSAFE CLOSED REVERSE ACTING- ie. GATE "DOWN" TO OPEN)

Typically the operator will be controlled via a three-way, normally closed valve, which directs the power supply to the actuator to maintain the valve in the open position. When the supply is removed, or vented, the combined forces of the spring and hydrostatic stem forces acting on the valve stem lift the gate upwards to close the valve.

NOTE: If the jackscrew manual override is provided, be sure to retract after use to allow normal operation.

IV REMOVAL OF ACTUATOR FROM VALVE AND BONNET ASSEMBLY

Refer to typical assembly drawing A-0443 on page 16.

1. Mark or identify port and tubing locations to facilitate reassembly.
2. Depressurize the actuator and remove tubing and fittings as required.

NOTE: In the depressurized condition, the actuator will be in the upper position, and the gate valve will be closed.

3. Remove the four capscrews (129) that fasten the actuator end plate (2), via the adapter plate (128) and lockplate (175), to the bonnet.
4. Rotate the actuator assembly 45° counterclockwise (ie. viewing from above). This will disengage the actuator drive rod (1) from the valve stem (120) and coil pin (123).
5. Lift the actuator assembly vertically upward until it clears the valve stem (120).

V REMOVAL OF BONNET FROM VALVE

Refer to typical assembly drawing A-0443 on page 16.

1. Vent the process line to zero pressure.
2. Vent the valve body cavity to zero pressure according to the valve manufacturer's recommendations. This may include bleeding the stem cavity area.

NOTE: Failure to vent the process line and valve body cavity to zero pressure could result in personnel injury.

3. Remove all of the bonnet nuts (97).
4. Carefully, remove the roll pin (123) from the valve stem (120). Take care not to damage valve stem sealing area.
5. Loosen the packing follower (127). The special tool shown in drawing I-0187 on page 25 is designed for this purpose.
6. Vertically lift the bonnet assembly over the valve stem (120). Install eyebolts through the adapter plate (128) and lock plate (175) for lifting purposes, if necessary.

NOTE: The gate and valve stem assembly may lift out of the valve with the bonnet, due to packing friction.

7. Remove the valve stem and gate from the valve according to the valve manufacturer's recommendations.

VI DISASSEMBLY OF BONNET

Refer to typical bonnet assembly drawing I-0186 on page 23.

1. With the roll pin (123) removed and the packing follower (127) loose, pull the valve stem (120) down through the interior bore of the bonnet (126), until the valve stem is completely out of bonnet. Take care not to damage valve stem sealing area.
2. Remove the packing follower (127) from bonnet (126). The special tool shown in drawing I-0187 on page 25 is designed for this purpose.
3. Pull the top stack of stem packing rings (121) out the top of the bonnet bore. Take care not to damage bonnet sealing area.
4. Remove the lantern ring (139) from the inner bore of bonnet (126).
5. Pull the bottom stack of stem packing rings (121) out the top of the bonnet bore. Take care not to damage bonnet sealing area.
6. If required, remove the bleeder plug (165), bleeder ball (164) and plug (109) from the bonnet.

VII REASSEMBLY OF BONNET

Refer to typical bonnet assembly drawing I-0186 on page 23.

NOTE: Reassembly of the bonnet must be done in a clean area, free from dirt or other containments, using clean tools. To keep the replacement seals clean, do not open the shipping package until parts are needed for assembly.

1. Clean all parts of bonnet assembly, as required.
2. Inspect each part individually for scratches, nicks, burrs, etc. prior to reassembly. Take extra time and care when inspecting critical sealing areas, such as the bonnet bore, bonnet/valve gasket and the valve stem sealing areas.
3. Install lower packing rings into the bonnet (126) bore in the following order:
 - a) 1 white TFE bottom (male) adapter ring (121b), flat side down.
 - b) 1 black nitrile vee-ring (121c), groove side down.
 - c) 3 black nitrile fabric covered vee-rings (121d), groove side down.
 - d) 1 white TFE top (female) adapter ring (121a), flat side up.

NOTE: Do not lubricate the bonnet bore and packing rings before assembly. Energize each vee-ring packing individually after it is installed into the bonnet bore. The packing rings can be energized by firmly pushing down on the top of the packing stack. The special tool shown in drawing I-0187 on page 25 is designed for this purpose. Take care not to damage inner bonnet bore or top of adaptor ring when energizing the stack.

4. Insert lantern ring (139) into bonnet bore.
5. Install the upper packing rings into bonnet (126) bore in the following order:
 - a) one white TFE bottom (male) adapter ring (121b), flat side down.
 - b) one white TFE vee-ring (121f), groove side down.
 - c) one white TFE 1/4 MoS₂ vee-rings (121e), groove side down.
 - d) one white TFE top (female) adapter ring (121a), flat side up.

6. Lubricate the packing follower o-ring (134) with Dow Corning #111 grease, or equivalent. Insert the o-ring (134) into its groove in the packing follower (127).
7. Thread the packing follower(127), until hand tight, into the top of the bonnet (126), while checking that the stem packing is aligned correctly. Torque the packing follower to 50 lb_r-ft. The special tool shown in drawing I-0187 on page 25 is designed for this purpose.
8. Verify that the tee nut (312) has been installed onto the valve stem (120) following valve manufacturer instructions.
9. Push the valve stem (120) up through from the bottom the bonnet bore until the stem (120) contacts the bonnet (126).
10. Insert and hammer the roll pin (123) into the valve stem (120) until an equal length of the pin is exposed on each side of the valve stem. Take care not to damage valve stem sealing area.
11. Insert the bleeder ball (164) into the smaller tapped hole in the side of the bonnet body, then thread the bleeder plug (165) into hole. Tighten the bleeder plug (165) to 30 lb_r-ft of torque.
12. Thread in the plug (109) or packing injection fitting, if supplied, and torque to 100 lb_r-ft.
13. The bonnet assembly may now be assembled onto the valve and tested, as required.

NOTE: Replacement packing material is shipped stacked together in the order in which the packing goes into the bonnet. Optional packing materials are available; refer to drawing I-0186-10 on page 24.

VIII REINSTALLATION OF BONNET ONTO VALVE

Refer to typical assembly drawing A-0443 on page 16.

1. Assemble the valve stem to the valve gate, according to the valve manufacturer's recommendations. The tee nut (312) must engage the gate while clearing the bonnet studs (98). Lubricate the valve gate and seats with Dow Corning #111 grease, or equivalent. Lower the bonnet, stem and gate assembly vertically down into the valve body.

NOTE: Do not force the gate assembly between the valve seats; it should drop freely using gravity only.

2. Lubricate the bonnet gasket (224) with Dow Corning #111 grease, or equivalent. Install into its groove in the valve body.
3. Install, but do not tighten the nuts (97).
4. Stroke valve stem to verify that the minimum gate travel 'Tg' is available. Refer to drawing AB0440 on page 21 or drawing AB0501 on page 22.
5. Tighten the bonnet nuts (97) to the valve manufacture's recommended torque.
6. Thread the lockplate (175) (thinner of the two) down fully onto the bonnet. Install the adapter plate (128) so that its top surface is approximately 0.12 inches above the top of the bonnet. Refer to drawing AB0440 on page 21 or AB0501 on page 22.
7. The valve may be shell tested following the valve manufacture's instructions, as required.

IX DISASSEMBLY OF CYLINDER TYPE ACTUATOR

Refer to drawing A-0443 on page 16 and AB0444-10 on page 18.

1. Loosen the stay rod nuts (57) evenly and gradually, in a criss-cross pattern, until the spring (180) is no longer under compression. Remove all of the stay rod nuts (57).
2. Remove the end cap (3) by lifting it vertically up and over the indicator rod (18) using the indicator cover eyebolt (105). Take care not to damage the indicator rod (18) sealing area.
3. Remove gasket (32) if LP cylinder, or o-ring (41) if HP cylinder.
4. If necessary the end cap o-ring (43) if LP cylinder, or the end cap polypak (43) if HP cylinder, wiper (45) and the rod guide (31) may be removed from end cap, if required.
5. With the end cap (3) removed from the actuator, loosen the setscrew (108). Remove the indicator cover (110), indicator sleeve (111), indicator cover o-ring (112), and limit switch, if required.
6. Lift the piston (4) and drive rod (1) up and out of the cylinder (5), by using the indicator rod (18). Take care not to scratch or score the inner bore of the cylinder (5).

NOTE: On larger actuators install eyebolts, into the tapped holes provided on top of the piston for lifting the piston assembly out of cylinder.

7. Loosen the set screw (27) and remove the indicator rod (18) from the drive rod (1). Remove the piston (4) from the drive rod (1). Take care not to damage the drive rod or the indicator rod sealing areas.

NOTE: Removal of the indicator rod from the drive rod may require clamping of the drive rod.

8. If necessary, hammer-out the anti-rotation pin (92) from the drive rod. Take care not to damage the drive rod sealing area.
9. Remove the piston o-ring (42) if LP cylinder or piston polypak (42) if HP cylinder. If HP actuator also remove the piston wear ring(s) (50).
10. Remove the centre piston o-ring (35) from the piston (4).
11. Remove all of the stay rods (6) from the cylinder plate (2). Mark the cylinder end of the stay rod to facilitate reassembly.

NOTE: For access to actuator gaskets and seals, not all the stay rods need to be removed.

12. Lift the cylinder (5) up over the spring (180) and any remaining stay rods (6). Take care not damage the cylinder sealing areas.
13. Remove the gasket (32) if LP cylinder, or the o-ring (41) if HP cylinder from the cylinder plate (2).
14. If required, remove the spring (180) from the cylinder plate (2).
15. If required, remove the lower stop (93) from the anti-rotation tube (133).

X REASSEMBLY OF CYLINDER TYPE ACTUATOR

Refer to drawings A-0443 on page 16 and AB0444-10 on page 18.

NOTE: Reassembly of the actuator must be done in a clean area, free from dirt or other containments, using clean tools. To keep replacement seals clean, do not open shipping package until seals are needed for assembly.

1. Clean all parts of actuator assembly and inspect for wear or damage, as required.
2. Inspect the inner bore of cylinder (5) for scratches or dents.

NOTE: The cylinder should be replaced if the bore is scratched or dented.

3. If necessary, insert and hammer the anti-rotation spring pin (92) into the drive rod (1) until an equal length of the pin is exposed on each side of the drive rod. Take care not to damage the drive rod sealing area.
4. Lubricate the piston centre o-ring (35) with Dow Corning #111 grease, or equivalent. Insert the piston centre o-ring into its groove in the centre of the piston (4).
5. Lower the piston (4) over the threaded end of the drive rod (1), so that the centre o-ring (35) in the piston is against the drive rod.
6. Thread the indicator rod (18) onto the drive rod (1), until hand tight. With the drive rod clamped, torque the indicator rod to 150 lb_r-ft. Take care not to damage the indicator rod or piston sealing areas.
7. Grease the spring (180) with Unirex EP 2 grease, or equivalent. Install the spring (180) over the anti-rotation tube (133), located on cylinder plate (2). Position the spring (180) into the groove in the cylinder plate (2).
8. Lubricate the inner bore of cylinder with a generous amount of Dow Corning #111 grease, or equivalent.
9. A) If cylinder is LP pneumatic:
 - a) Lubricate the two cylinder gaskets (32) with Dow Corning #111 grease, or equivalent. Install one gasket (32) into the groove in the cylinder plate (2) and the other into the groove in the end cap (3).
 - b) Lubricate the piston o-ring (42) with Dow Corning #111 grease, or equivalent. Install the piston o-ring (42) into its groove on piston (4).
 - c) Lower the drive rod (1), piston (4), indicator rod (18) assembly down into the anti-rotation tube (133), located on the cylinder plate (2). The anti-rotation pin (92) should slide easily into its mating slots in the anti-rotation tube (133). Rotate the assembly as required.

NOTE: On larger actuators install eyebolts, into the tapped holes provided on top of the piston (4), for lowering assembly into the anti-rotation tube.

- d) Lower the cylinder (5) over the piston (4), until the bottom of the cylinder is positioned in the groove on the cylinder plate (2). Take care not to damage the piston o-ring (42), cylinder plate gasket (32) or cylinder sealing area.

- B) If cylinder is HP hydraulic
- Lubricate the two cylinder o-rings (41), using Dow Corning #111 grease, or equivalent. Install one cylinder o-ring (41) around the step on the cylinder plate (2) and the other around the step on the end cap (3).
 - Lubricate the piston polypak (42) and piston wear ring (50) with Dow Corning #111 grease or equivalent. Install both into their appropriate grooves on the piston (4).
 - Lower the cylinder (5) onto its locating step on cylinder plate (2). Take care not to damage cylinder o-ring (41) or cylinder sealing area.
 - Lower the drive rod (1), piston (4), indicator rod (18) assembly down into the cylinder (5). The anti-rotation pin (92) should slide easily into its mating slots in the anti-rotation tube (133). Rotate the assembly as required.

NOTE: On larger actuators install eyebolts, into the tapped holes provided on top of the piston (4), for lowering assembly into the cylinder.

10. Thread the stay rods (6) into cylinder plate (2) until hand tight.

NOTE: If one end of the stay rod (6) has a shorter thread, that end threads into the cylinder plate (2).

11. Lubricate the end cap o-ring (43), wiper (45), and rod guide (31), using Dow Corning #111 grease, or equivalent. If necessary, first insert the rod guide (31) into large lower groove, next insert the end cap o-ring (43) into the centre groove if LP cylinder or end cap polypak (43) into the centre groove if HP cylinder. Finally insert the wiper (45) into the top groove in the end cap (3).

NOTE: To install the rod guide, make a single 1/16" wide cut through the wall thickness, down the entire length of the rod guide.

12. Lower the end cap (3) down over the indicator rod (18). With the end cap (3) resting on the piston (4), there should be a gap of about one inch between top of the cylinder (5) and the bottom of end cap (3). Ensure that the cylinder (5) is seated properly on the cylinder plate (2). Take care not to damage the indicator rod (18) sealing area.

13. Install all of the stay rod nuts (57). Tighten the stay rod nuts (57), evenly and gradually in a criss-cross pattern until the cylinder seats into end cap (3) grooves. Take care not to damage the cylinder gasket (32) if LP cylinder and cylinder o-ring (41) if HP cylinder. Torque the stay rod nuts (57) as follows:

STAY ROD NUT TORQUE (LB-FT)		
BOLT SIZE (INCHES)	AIR CYLINDER	HYDRAULIC CYLINDER
1/2	40	45
5/8	80	100
3/4	120	150
7/8	160	200
1	240	300
1-1/8	384	480
1-1/4	540	675

14. Lubricate the indicator sleeve o-ring (112) with Dow Corning #111 grease, or equivalent. Install the o-ring (112) followed by indicator sleeve (111), into the indicator cover (110). Screw the indicator cover assembly onto the end cap (3) and tighten. Thread the indicator cover setscrew (108) into the indicator cover and tighten.
15. Install the Indicator cover plug (100) and eyebolt (105).
16. If necessary, thread the lower stop (93) into the anti-rotation tube (133).

XI DISASSEMBLY OF DIAPHRAGM TYPE ACTUATOR

Refer to typical assembly drawing A-0500 on page 19.

WARNING: Steps 1, 2, 3 & 4 below must be followed to safely remove spring compression.

1. Remove four short capscrews (14), equally spaced around top diaphragm case (2).
2. Install four long capscrews (15) in above holes.
3. Loosen the remaining short capscrews (15) evenly and gradually, in a criss-cross pattern until the spring is no longer under compression. Remove all of the short capscrews (14), lockwashers (16), and nuts (17).
4. Gradually loosen and remove the four long capscrews (15) last to ensure that all the spring compression is safely removed. Refer to spring compression warning label drawing on page 26.
5. Remove the top diaphragm case (2) up and over the indicator rod (18) using the indicator cover eyebolt (105). Take care not to damage the indicator rod (18) sealing area.
6. With the top diaphragm case (2) removed from actuator, loosen the setscrew (107). Take care not to damage the indicator rod (18) sealing areas. Remove the indicator cover (110), indicator sleeve (111), indicator sleeve o-ring (112) and limit switch, if required.
7. Remove the top diaphragm case hub o-ring (43), hub o-ring back-up (44), wiper (45), and upper rod guide (31).
8. Lift the diaphragm (7), retainer (9), diaphragm plate (4) and indicator rod (18), drive rod (1) assembly up and out of the bottom diaphragm case (3). A tapped hole is provided in the top of the indicator rod for lifting purposes.
9. Unscrew the indicator rod (18) from the diaphragm retainer (9). Take care not to damage the indicator rod (18) sealing areas.
10. Remove the diaphragm retainer (9) from the diaphragm plate (4) by removing the four capscrews (12), washers (13) and o-rings (11).
11. Remove the indicator rod o-ring (10) from the bore of the diaphragm retainer (9).
12. Lift the diaphragm (7) off of the diaphragm plate (4).
13. Remove the drive rod nut (8) from the drive rod (1). Lift the diaphragm plate (4) off of the drive rod (1). Removal of drive rod nut (8) may require clamping of the drive rod (9).

NOTE: There is no seal between the diaphragm plate and the drive rod. If the intention is only to replace seals, the diaphragm plate does not have to be removed from drive rod.

14. If necessary, carefully hammer-out the anti-rotation pin (92), from the drive rod (1).
15. If required, remove the spring (180) from the bottom diaphragm case (3).
16. If required, remove the lower stop (93) into the anti-rotation tube (3.3).

XII REASSEMBLY OF DIAPHRAGM TYPE ACTUATOR

Refer to typical assembly drawing A-0500 on page 19.

NOTE: Reassembly of actuator must be done in a clean area, free from dirt or other containments, using clean tools.

1. Clean all parts of actuator assembly and inspect for wear or damage, as required.
2. Inspect the top diaphragm case (2) flange faces for damage.

NOTE: The top diaphragm case may need to be replaced if the grooved sealing area is severely damaged.

3. If necessary, insert and hammer the anti-rotation pin (92) into the drive rod (1), until an equal length of the pin is exposed on each side of the drive rod.
4. Grease the spring (180) with Unirex EP2, or equivalent. Install the spring (180) over the anti-rotation tube (3.3) located on the end plate (3.2). Position the spring (180) into the groove in the end plate (3.2).
5. Lower the diaphragm plate (4) over the threaded end of the drive rod (1). Loosely thread on the drive rod nut (8), so that the diaphragm plate (4) can still be rotated freely.
6. Lower the drive rod (1), diaphragm plate (4) assembly over the spring (180). The anti-rotation pin (92) should slide easily into its mating slots in the anti-rotation tube (3.3). Rotate the assembly as required.
7. Align the diaphragm plate (4) to the correct orientation before torquing the drive rod nut (8). The correct diaphragm plate (4) orientation aligns the two bolt circle hole patterns in the diaphragm (7), with the bolt circle holes in diaphragm case (3) and the bolt circle holes in diaphragm plate (4). Rotate the diaphragm plate (4) and the diaphragm (7) in order to obtain the correct orientation.
8. Torque the drive rod nut (8) to 120 lb_r-ft.
9. With the diaphragm (7), positioned fabric side down over the diaphragm plate (4), verifying that the diaphragm (7) bolt circle holes align with the bolt circle holes in the diaphragm plate (4) and the bolt circle holes in the diaphragm case (3).

NOTE: Do not lubricate the diaphragm, it must be installed dry.

10. Lubricate the indicator rod o-ring (10) with Dow Corning #111 grease, or equivalent. Insert the indicator rod o-ring (10) into its groove in the diaphragm retainer (9).
11. Lubricate the four retainer o-rings (11) with Dow Corning #111 grease, or equivalent. Position the diaphragm retainer (9) on top of diaphragm (7) and bolt the retainer into place using the four retainer capscrews (12) with Loctite applied and flat washers (13) over the retainer o-rings (11). Torque the retainer capscrews (12) in a criss-cross pattern to 25 lb_r-ft.

NOTE: To ensure a consistent torque setting on the retainer capscrews (12), repeat the above torquing procedure on the capscrews twice.

12. Thread the indicator rod (18) into the diaphragm retainer (9). Tighten the indicator rod (18). Take care not to damage the indicator rod (18) sealing area.

13. Lubricate the top diaphragm case hub o-ring (43), hub o-ring back-up (44), wiper (45), and upper rod guide (31) using Dow Corning #111 grease, or equivalent. Insert the rod guide (31) into large groove, followed by the hub o-ring back-up (44) and hub o-ring (43) into the top diaphragm case hub (2.1). Finally insert the wiper (45) into the top groove of the top diaphragm case.

NOTE: To install the rod guide, make a single 1/16" wide cut through the wall thickness, down the entire length of the rod guide.

14. Lower the top diaphragm case (2) down over the indicator rod (18). With the top diaphragm case (2) resting on the diaphragm retainer (9) there should be a gap of about one inch between the top and bottom diaphragm case (2)(3) flanges.

NOTE: Ensure that the top and bottom diaphragm case flange faces are clean and free of all debris. Do not lubricate the diaphragm.

15. Install the four long capscrews (15), equally spaced in the top and bottom diaphragm case (2)(3), with the lockwashers (16) and nuts (17). In a criss-cross pattern, evenly tighten the capscrews to compress the spring (180), until a gap of 1/16" exists between the top and bottom diaphragm cases (2)(3) and diaphragm (7).

16. Install the short capscrews (14) in top and bottom the diaphragm case (2)(3), with the lockwashers (16) and nuts (17). Tighten the capscrews in a criss-cross pattern. Take care not to damage the diaphragm.

NOTE: The four long capscrews (15) may be removed at this time and replaced with four short capscrews (14), or the long capscrews may be left in as installed.

17. Torque all of the capscrews(14)(15), in a criss-cross pattern, to a maximum of 25 lb.-ft.

NOTE: To ensure a consistent torque setting on the capscrews (12), repeat the above torquing procedure on the capscrews twice.

18. Lubricate the indicator sleeve o-ring (112) with Dow Corning #111 grease, or equivalent. Install the sleeve o-ring (112) followed by indicator sleeve (111), into the indicator cover (110). Screw the indicator cover assembly onto the top diaphragm case hub (2.3) and tighten. Thread the indicator cover setscrew (107)(108) into the indicator cover and tighten.
19. Install Indicator cover plug (100) and eyebolt (105).
20. If necessary, install the lower stop (93) into the anti-rotation tube (3.3).

XIII REINSTALLATION OF ACTUATOR TO BONNET

Refer to typical assembly drawing A-0443 on page 16.

NOTE: Before mounting the actuator onto the bonnet, the actuator upper and lower positions and valve specified stroke 'Ta' must be verified.

1. Set the actuator lower position, by turning the lower stop (93) until the specified stroke 'Ta' is obtained. Set the actuator upper position, with the valve fully closed by turning the adapter plate (128) to obtain specified upstroke standout 'U'. Refer to drawing AB0440 on page 21 or AB0501 on page 22.

NOTE: If fine adjustment is required with the actuator engaged on valve stem, the special tool shown in drawing I-0187 on page 25 is designed for this purpose.

2. Lower the actuator assembly over the valve stem (120) until the connector pin (123) bottoms out in its mating slot in the drive rod. Turn the actuator assembly approximately 45° clockwise (viewing from above) in order to fully engage the drive rod with the valve stem (120).
3. Turn the adapter plate (128), as required to align the bolt pattern, keeping it close to the cylinder plate (2), but without bottoming out against the cylinder plate.
4. Turn the lockplate (175) until a 1/16" gap between it and the adapter plate (128).
5. Tighten the four adapter bolts (129); torque as indicated in following table:

ADAPTER BOLT TORQUE	
BOLT SIZE (INCHES)	TORQUE (LB-FT)
3/4	150
1-1/8	500

6. Verify that the upper and lower actuator and valve gate positions are correct by conducting drift and seat tests, as required.

XIV TROUBLE SHOOTING

A. No movement, slow, jerky or partial stroke

1. Check for sufficient supply pressure, and supply control accessories.
2. Check for a change in operating conditions (ie. higher line pressure, different line fluid, valve packing tightened excessively).
3. Check the speed control valves (if used). Sometimes fully opening while switching will remove blockage.
4. Check for continuous leakage - see below.

B. Continuous leakage

General

1. If leakage is across line valve, check actuator stroke length, particularly if actuator has been recently installed or serviced.
2. If leakage is from the valve bonnet flange connection, check bonnet stud torque values.
3. If leakage is from the main 3-way supply valve exhaust port, check the 3-way valve for damage or wear.
4. If leakage is from the bonnet stem packing, the packing may need to be energized by injection of sealant through plug (109) connection.
5. Check for loose fittings, as applicable.

Cylinder style actuator leakage

6. If leakage is from around actuator cylinder to atmosphere, check for insufficient torque on the stay rod nuts and/or a defective cylinder gasket (32) if LP cylinder or cylinder o-ring (41) if HP cylinder.
7. If leakage is from vent port on cylinder plate (2), check for a defective piston seal (42) or piston centre o-ring (35).
8. If leakage is from indicator rod (18), check for a defective end seal (43).

Diaphragm style actuator leakage

9. If from between top (2) and bottom (3) diaphragm cases to atmosphere, check for insufficient torque on the diaphragm case capscrews (14) (15) and/or a defective diaphragm (7).
10. If from vent port in bottom diaphragm case (3), check for sufficient torque on the top (2) and bottom (3) diaphragm case capscrews (14)(15), a defective diaphragm (7) or retainer o-rings (11).
11. If from indicator rod (18), check for a defective top case seal (43).

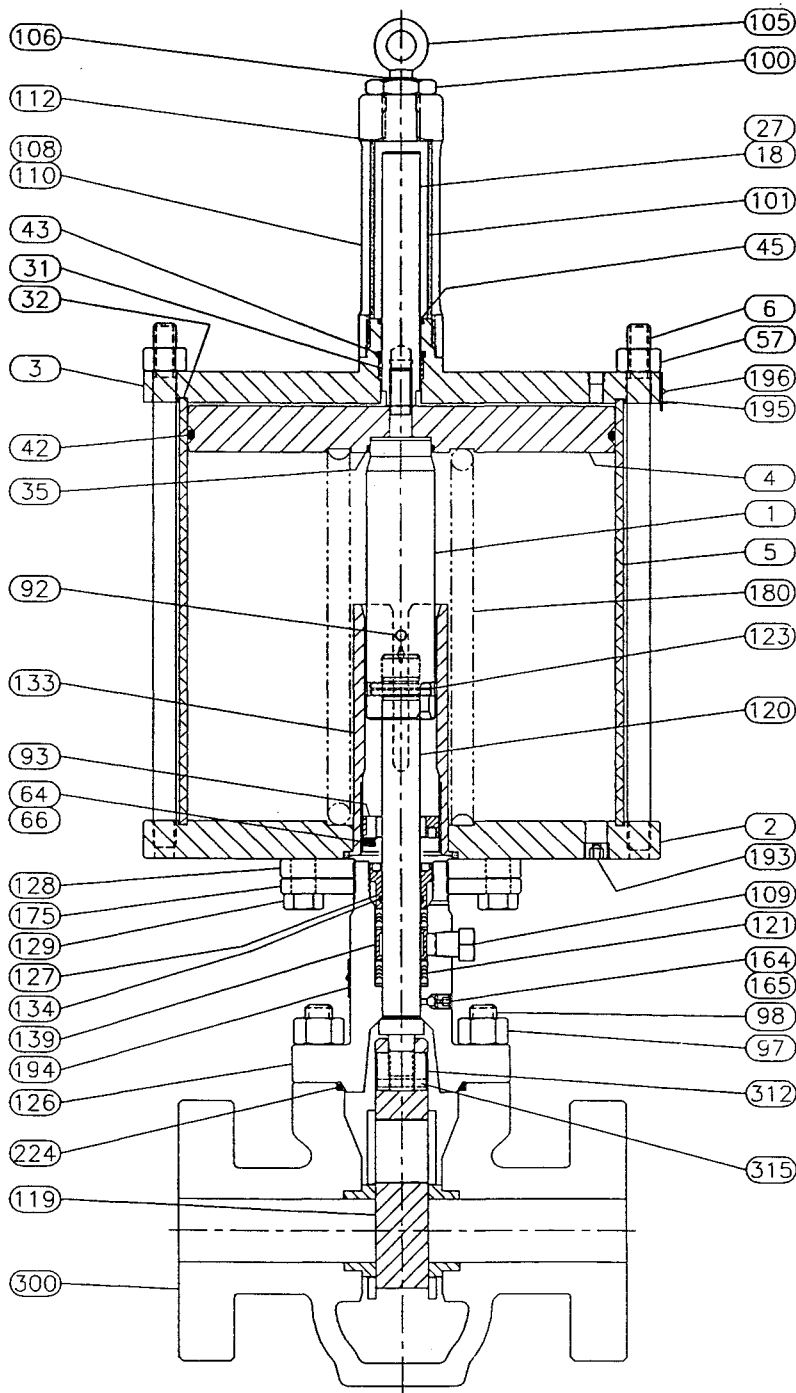
XV REGULAR MAINTENANCE

1. Cycle actuator open and close once a month.
2. Replace seals and diaphragm every 5 years or when leakage occurs.
3. Clean debris from vent or breather holes as needed.
4. Check and lubricate jackscrew (if supplied) with grease occasionally - every three months if outdoors.
5. Check stay rod torque (if cylinder model) or diaphragm case capscrew torque (if diaphragm model) once a year.
6. Check hydraulic fluid reservoir (if supplied) for level and accumulated moisture once a year. Drain and change fluid if necessary.

XVI SERVICE

CAUTION

1. The actuator spring is under considerable preload. If servicing, be sure to back off the cylinder stay rod nuts (57) or diaphragm case capscrews (14)(15) evenly, until all the spring compression is removed.
2. When servicing the actuator, it can be removed from the bonnet with the gate valve and flowline under pressure. However, for maximum safety, it is recommended that flowline pressure in the gate valve be removed before servicing.
3. When servicing the actuator with the gate valve and flowline under pressure, be sure that the gate valve is in the closed position (stem up) and that there is no leakage around the gate valve stem packing before removal.
4. When servicing the actuator and there is leakage around the gate valve stem, it is recommended that all pressure be removed from the gate valve and flowline before removal.



UNLESS SPECIFIED OTHERWISE ALL DIMENSIONS INCHES (mm)		BETTIS BETTIS CANADA LTD.	
PART TO: PARTS LIST A-0443-10		Actuators & Controls	
WAS GLB140-710 REMOVE PARTS LIST RS-1996-07-09 e 7368-4-G DEL ITEM 95; +MAT'L SPEC DEL OPT. PLAIN CHEVRON PACKING +ITEM 191 THRU 315; EDIT NOTE +ITEM 64, 66; UPDT ITEM 1 RD-1995-11-29 e 7368-1-G REV BY-DATE+REF		ASSEMBLY GVO-LP-FS-UM FOR REVERSE ACTING VALVE	
A-0443--DWG_VIEW_00 JUL-09-96		DATE AUG-30-94	
SCALE 1:6		BY RD	CHK <i>MA</i>
W.D. 7368-4-G		DWG. NO. A-0443	REV 2-

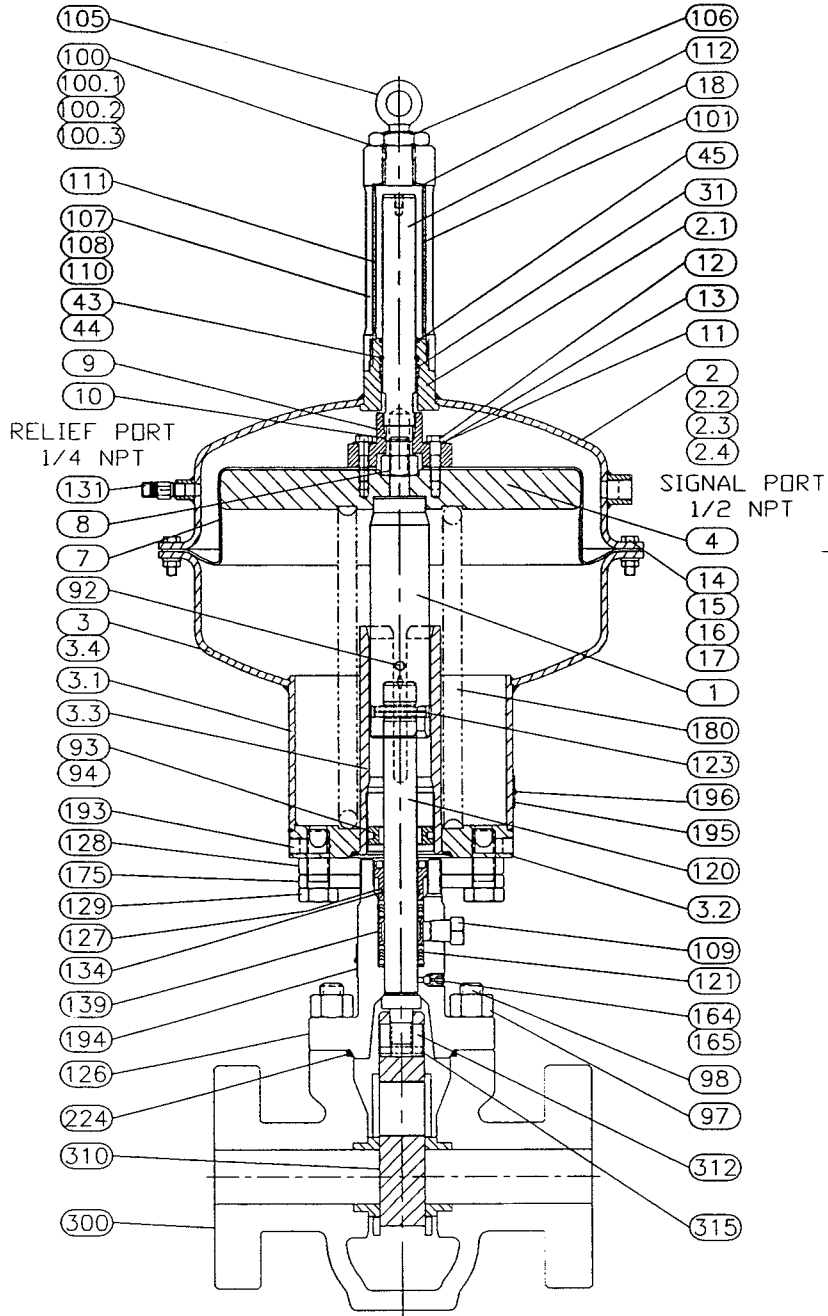
ITEM	DESCRIPTION	MATERIAL	QTY	NOTE	ITEM	DESCRIPTION	MATERIAL	QTY	NOTE
1	DRIVE ROD	AISI C1045 CH PL	1		121	STEM PACKING SET	TFE/NITRILE	1	(Y)
2	CYLINDER PLATE	A516-70/AISI C1018	1		123	COIL PIN, STEM	SS 302../304	1	
3	END CAP	A516-70/AISI C1018	1		126	BONNET	ASTM A487 Gr 4C	1	
4	PISTON	ASTM A516-70	1		127	PACKING FOLLOWER	AISI C1045	1	
5	CYLINDER	BLACK AMALGON	1		128	ADAPTER PLATE	AISI C1020	1	
6	STAY ROD	AISI 4140	8		129	ADAPTER BOLT	SAE GR 5	4	
18	INDICATOR ROD	AISI C1045 CH PL	1		133	ANTI-ROTATION TUBE	AISI C1018	1	
27	SETScrew, INDICATOR ROD	SS 304	1	(H)	134	O-RING, PACKING FOLLOWER	NITRILE	1	
31	ROD GUIDE, UPPER	DELRI	1	(Y)	139	LANTERN RING	SS 316	1	
32	GASKET, CYLINDER	PLANT FIBRE	2	(Y)	164	BLEEDER PLUG	SS 304../316	1	
35	O-RING, PISTON CENTER	NITRILE	1	(Y)	165	BLEEDER BALL	SS 302	1	
42	O-RING, PISTON	NITRILE	1	(Y)	175	BONNET LOCKPLATE	AISI C1020	1	
43	O-RING, END CAP	NITRILE	1	(Y)	180	SPRING	AISI 5160 ALLOY STEEL	1	
45	WIPER	URETHANE	1	(Y)	191	DECAL, PISTON TOP	VINYL	1	(H)
57	NUT, STAY ROD	ASTM A194 2H	8		193	VENT/BREATHER	SS 304	1	
64	CAPSCREW, LOCK STOP	HXSC SS 316	1		194	BONNET NAMEPLATE	SS 304	1	
66	WASHER, LOCK STOP	WSHE SS 410	1		195	ACTUATOR NAMEPLATE	SS 304	1	
92	ANTI-ROTATION PIN	SS 302../304	1		196	DRIVE SCREW	SS 301../304	4	
93	LOWER STOP	AISI C1018	1		224	BONNET GASKET	(Per Valve Mfr Spec)	1	(N)
97	NUT, BONNET	(Per Valve Mfr Spec)	8	(N)	300	VALVE BODY	(Per Valve Mfr Spec)	1	(N)
98	STUD, BONNET	(Per Valve Mfr Spec)	8	(N)	312	TEE NUT	(Per Valve Mfr Spec)	1	(N)
100	INDICATOR COVER PLUG	AISI C12L14	1		315	SPRING PIN, TEE NUT	SS 301../304	1	
101	INDICATOR SLEEVE	ACRYLIC	1						
105	EYEBOLT	ASTM A489 PL	1						
106	WASHER, FLAT	SAE	1						
108	SETScrew, INDICATOR COVER	SS 304	1	(H)					
109	PLUG	ASTM A105	1						
110	INDICATOR COVER	AISI C12L14	1						
112	O-RING, SLEEVE	NITRILE	1	(Y)					
119	VALVE GATE	(Per Valve Mfr Spec)	1	(N)					
120	VALVE STEM	UNS 17400 Type 630	1						

NOTE:

- (H) NOT SHOWN
- (N) SUPPLIED WITH VALVE, SHOWN FOR REFERENCE ONLY
- (Y) RECOMMENDED SPARE PARTS/REPAIR KIT ACTUATOR AND SPECIFY BY MODEL AND SERIAL NUMBER
- REFER TO DWG A80440 FOR ASSEMBLY INSTRUCTIONS
- SHOWN ROTATED 90° ON VALVE BODY, BLEEDER SIDE IS BODY IDENTIFICATION AND FITTING SIDE

<p>UNLESS SPECIFIED OTHERWISE ALL DIMENSIONS INCHES (mm)</p> <p>PART ID: ASSEMBLY A-0443</p> <p>WAS GLB140-710 REMOVE ASSEMBLY LAYOUT RS-1996-07-09 @ 7368-4-G DEL ITEM 95; +MAT'L SPEC DEL OPT. PLAIN CHEVRON PACKING +ITEM 191 THRU 315; EDIT NOTE +ITEM 64, 66 UPDT ITEM 1 Δ RD-1995-11-29 @ 7368-1-G REV BY-DATE+REF</p>		<p>BETTIS BETTIS CANADA LTD. Actuators & Controls PARTS LIST GVO-LP-FS-UM FOR REVERSE ACTING VALVE</p> <p>A-0443---DWG_VIEW_10 JUL-09-96 SCALE 1:6 BY RD CHK DATE AUG-30-94 W.D. 7368-4-G DWG. NO. A-0443-10 REV 2-</p>	
---	--	--	--

DWG. NO. A-0443-10



NOTE:

- ACTUATOR AND BONNET SHOWN ROTATED 90° FROM TRUE POSITION ON VALVE BODY

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

PART TO:
PARTS LIST A-0500-10

PUT PARTS LIST ON DWG AP-0500-10
GENERAL UPDT
⊕ RB-1997-12-09 @ 10577-1-R
GENERAL UPDT
⊕ RB-1997-10-27 @ PREPROD
GENERAL UPDT
⊕ RB-1997-08-26 @ PREPROD
REV BY-DATE+REF

BETTIS BETTIS CANADA LTD.

Actuators & Controls

ASSEMBLY
PNEUMATIC DIAPHRAGM ACTUATOR
GVO-DL²-FS-UM
FOR REVERSE ACTING VALVE

A-0500--DWG_VIEW_00
DEC-09-97

SCALE 1:7	BY RB	CHK <i>RB</i>	DATE JAN-21-97
V.D. 10577-1-R	DWG. NO.	A-0500	REV 3-

ITEM	DESCRIPTION	MATERIAL	QTY	NOTE
1	DRIVE ROD	SUPERIOR 100 CH PL	1	
2	TOP DIAPHRAGM CASE	CS	1	(W)
2.1	HUB	A350-LF2	1	
2.2	HALF COUPLING 1/4 NPT	A105N	1	
2.3	HALF COUPLING 1/2 NPT	A105N	1	
2.4	FORMED HEAD	ASTM A516-70	1	(W)
3	BOTTOM DIAPHRAGM CASE	CS	1	
3.1	SPRING BARREL	A333-6	1	
3.2	END PLATE	ASTM A516-70	1	
3.3	ANTI-ROTATION TUBE	ASTM A516-70	1	
3.4	FORMED HEAD	ASTM A516-70	1	
4	DIAPHRAGM PLATE	ASTM A516-70	1	(Y)
7	DIAPHRAGM	NITRILE/POLYESTER	1	(Y)
8	NUT, DRIVE ROD	GR 2H	1	
9	DIAPHRAGM RETAINER	AL 6061-T6	1	
10	O-RING, INDICATOR ROD	NITRILE	1	(Y)
11	O-RING, RETAINER	NITRILE	4	(Y)
12	CAPSCREW, RETAINER	SS 304	4	
13	WASHER, RETAINER	SS 304	4	
14	CAPSCREW, CASE, SHORT	SS 304	26	(V)
15	CAPSCREW, CASE, LONG	SS 304	4	
16	LOCKWASHER, CASE	SS 304	30	(V)
17	NUT, CASE	SS 304	30	(V)
18	INDICATOR ROD	AISI C1045 CH PL	1	
31	ROD GUIDE, UPPER	DELFIN	1	(Y)
43	O-RING, HUB	NITRILE	1	(Y)
44	BACKUP RING, HUB	NITRILE	1	(Y)
45	WIPER, HUB	URETHANE	1	(Y)
92	ANTI-ROTATION PIN	SS 302/./304	1	
93	LOWER STOP	AISI 4140 HTSR	1	
94	LOCK-PLUG, LOWER STOP	NYLON	2	
97	NUT, BONNET	(Per Valve Mfr Spec)	8	(N)
98	STUD, BONNET	(Per Valve Mfr Spec)	8	(N)

NOTE:

- (N) SUPPLIED WITH VALVE, SHOWN FOR REFERENCE ONLY

- (W) WELDED CONSTRUCTION

- (V) QUANTITY OF THESE PARTS VARIES DEPENDING

ON MODEL, LISTED ABOVE ARE QUANTITIES FOR

16 X 4 X 1.25 GVO-DLP-FS-UM

- (Y) RECOMMENDED SPARE PARTS/REPAIR KIT

ACTUATOR AND PACKING, SPECIFY BY MODEL AND

SERIAL NUMBER

- REFER TO DWG AB0501 FOR ASSEMBLY INSTRUCTIONS

UNLESS SPECIFIED OTHERWISE ALL DIMENSIONS INCHES (mm)		PART TO: PARTS LIST A-0500-10	
BETIS Actuators & Controls			
PARTS LIST PNEUMATIC DIAPHRAGM ACTUATOR GVO-DLP-FS-UM FOR REVERSE ACTING VALVE			
A-0500--DWG-VIEW_10 DEC-10-97	SCALE N/A	BY RB	DATE 12-10-10
REV. BY-DATE+REF 10577-1-R		DWG. NO. A-0500-10	REV. -- DEC-10-97

BETIS BETTIS CANADA LTD.

MANUFACTURER	SIZE	RATING	A	B	C	Ta	Tg	U
BARTON	2-1/16	2000	2.35	4.85		2.64	2.58	6.82
	2-1/16	3000	2.35	4.85		2.64	2.58	6.82
	2-1/16	5000	2.35	4.85		2.64	2.58	6.82
	2-9/16	2000	2.31	5.58		3.08	3.02	6.82
	2-9/16	3000	2.31	5.58		3.08	3.02	6.82
	2-9/16	5000	2.31	5.58		3.08	3.02	6.82
	3-1/8	2000	2.72	7.19		3.92	3.86	6.82
	3-1/8	3000	2.72	7.19		3.92	3.86	6.82
	3-1/8	5000	2.72	7.19		3.92	3.86	6.82
CROWN	2-1/16	2000		4.81		2.56	2.50	6.82
(STREAM-FLD)	2-1/16	3000		4.81		2.56	2.50	6.82
	2-1/16	5000		4.81		2.56	2.50	6.82
	2-9/16	2000	5.64			3.06	3.00	6.82
	2-9/16	3000	5.64			3.06	3.00	6.82
	2-9/16	5000	5.64			3.06	3.00	6.82
	3-1/8	2000	7.12			3.94	3.88	6.82
	3-1/8	3000	7.12			3.94	3.88	6.82
	3-1/8	5000	7.12			3.94	3.88	6.82
FOSTER	2-1/16	2000						
	2-1/16	3000						
	2-1/16	5000						
	2-9/16	2000						
	2-9/16	3000						
	2-9/16	5000						
	3-1/8	2000						
	3-1/8	3000						
	3-1/8	5000						
McEVDOY	2-1/16	2000	N/A	6.22		2.62	2.56	6.82
	2-1/16	3000	N/A	6.22		2.62	2.56	6.82
	2-1/16	5000	N/A	6.22		2.62	2.56	6.82
	2-9/16	2000	N/A	7.16		3.25	3.19	6.82
	2-9/16	3000	N/A	7.16		3.25	3.19	6.82
	2-9/16	5000	N/A	7.16		3.25	3.19	6.82
	3-1/8	2000	N/A	8.15		3.69	3.63	6.82
	3-1/8	3000	N/A	8.15		3.69	3.63	6.82
	3-1/8	5000	N/A	8.15		3.69	3.63	6.82
WKM	2-1/16	2000	2.25	4.84		2.65	2.59	6.82
	2-1/16	3000	2.25	4.84		2.65	2.59	6.82
	2-1/16	5000	2.25	4.84		2.65	2.59	6.82
	2-9/16	2000	2.26	5.62		3.15	3.09	6.82
	2-9/16	3000	2.26	5.62		3.15	3.09	6.82
	2-9/16	5000	2.26	5.62		3.15	3.09	6.82
	3-1/8	2000	2.72	7.12		3.78	3.72	6.82
	3-1/8	3000	2.72	7.12		3.78	3.72	6.82
	3-1/8	5000	2.72	7.12		3.78	3.72	6.82

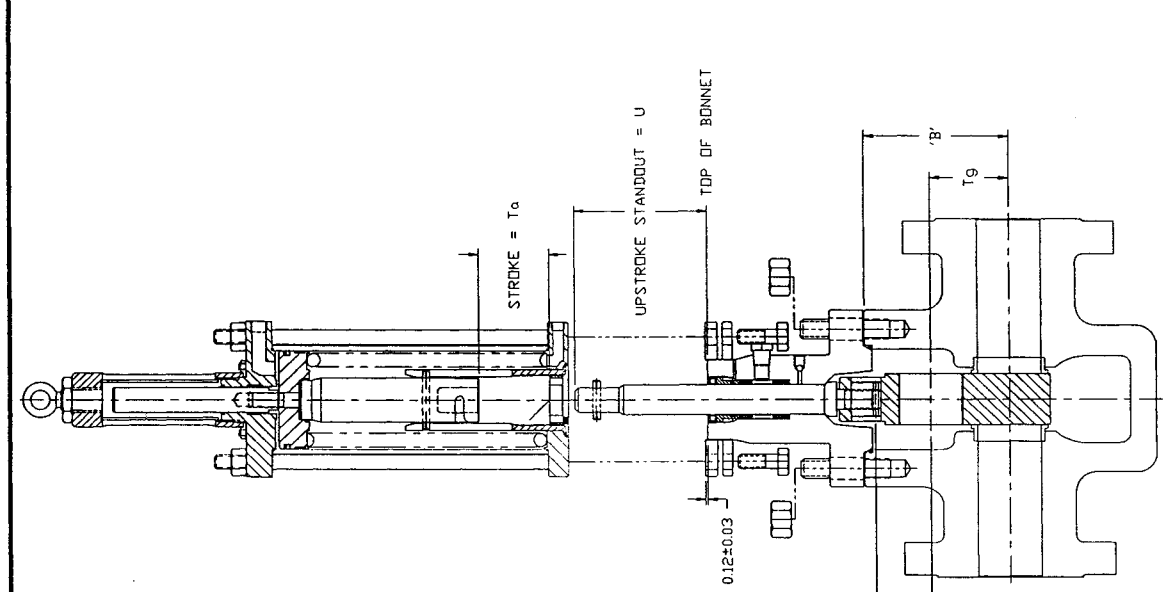
BETTIS
BETTIS CANADA LTD.
ASSEMBLY LOCATION

UNLESS SPECIFIED OTHERWISE ALL MEASURES INCHES (mm), LB (kg)

DEL PART NUMBERS
RD-1996-06-26 @ 08967-1-S
UPDT CYL PLATE, EDIT PROCEDURE
CROWN VALVE 08967-1-S
REV-BI-DATE-REF

FINAL ASSEMBLY INSTRUCTION
TYPE UM ACTUATOR TO REVERSE ACTING
SPEC 6A GATE VALVES

AB0440--DWG
JAN-26-96
SCALE 1:6
BY RD
CHK
DATE APR-16-95
DWG NO. AB0440

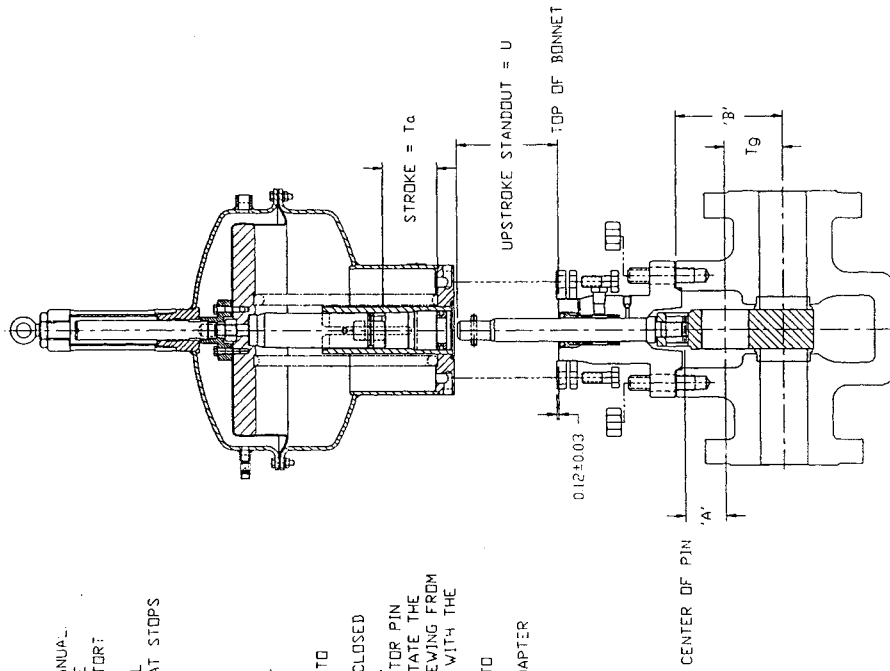


- INSTALLATION PROCEDURE:** (REFER TO DWG GHB053-322)
- A: VALVE BONNET**
- INSTALL VALVE STEM TO GATE, ACCORDING TO ANY PARTICULAR REQUIREMENT OF VALVE MANUFACTURER'S MANUAL. ENGAGE VALVE STEM TO TEE NUT, AND PIN THROUGH TEE NUT AND STEM, SUPPORTING THE NUT SO AS NOT TO DISTORT PACKING OR MAR STEM.
 - INSTALL BONNET BUT DO NOT TIGHTEN NUTS UNTIL TRIAL CONFIRMS SPECIFIED 'Tg' IS AVAILABLE BEFORE BACKSEAT STOPS AGAINST BONNET SEAT.
 - STROKE VALVE STEM TO VERIFY GATE TRAVEL.
 - FASTEN BONNET.
 - INSTALL LOCKPLATE, THINNER OF THE TWO, FULLY ONTO THE BONNET. INSTALL ADAPTER PLATE UNTIL ITS TOP SURFACE IS APPROXIMATELY 0.12" ABOVE TOP OF BONNET.
- B: ACTUATOR TO VALVE**
- SET ACTUATOR DOWNSTROKE STOP, ADJUST LOWER STOP TO MATCH SPECIFIED GATE TRAVEL 'Tg'. LOCK IN PLACE WITH EXTERNAL TOOTH LOCKWASHER AND CAPSCREW.
 - SET ACTUATOR UPSTROKE STOP, WITH THE VALVE IN CLOSED POSITION PER 'Tg', UPSTROKE STANDOUT = SPECIFIED 'U'.
 - LOWER ACTUATOR OVER THE VALVE STEM UNTIL CONNECTOR PIN (123) BOTTOMS OUT IN THE SLOT OF THE DRIVE ROD. TURN AND TWIST ACTUATOR 90° CLOCKWISE (LOOKING FROM THE TOP) ABOUT THE COMMON AXIS TO ENGAGE DRIVE ROD WITH THE VALVE STEM.
 - BACKOFF/RAISE ADAPTER PLATE AS NEAR AS POSSIBLE TO CYLINDER PLATE AND ALIGN MOUNTING HOLES WITH CYLINDER PLATE. BACKOFF LOCKPLATE WITHIN ONE TURN BELOW ADAPTER PLATE AND FASTEN TO CYLINDER PLATE WITH CAPSCREWS.
 - VERIFY STROKE BY DRIFT AND SEAT TESTS.

DWG. NO. AB0440

INSTALLATION PROCEDURE (REFER TO DWG GH8053-322)

- A: VALVE BONNET**
1. INSTALL VALVE STEM TO GATE, ACCORDING TO ANY PARTICULAR REQUIREMENT OF VALVE MANUFACTURER'S MANUAL. ENGAGE VALVE STEM TO TEE NUT, AND PIN THROUGH TEE NUT AND STEM, SUPPORTING THE NUT SO AS NOT TO DISTORT PACKING OR MAR STEM.
 2. INSTALL BONNET BUT DO NOT TIGHTEN NUTS UNTIL TRIAL CONFIRMS SPECIFIED 'T₉' IS AVAILABLE BEFORE BACKSEAT STOPS AGAINST BONNET SEAT.
 3. STROKE VALVE STEM TO VERIFY GATE TRAVEL.
 4. FASTEN BONNET.
 5. INSTALL LOCKPLATE, THINNER OF THE TWO, FULLY ONTO THE BONNET. INSTALL ADAPTER PLATE UNTIL ITS TOP SURFACE IS APPROXIMATELY 0.2" ABOVE TOP OF BONNET.
- B: ACTUATOR TO VALVE**
6. SET ACTUATOR DOWNSTROKE STOP; ADJUST LOWER STOP TO MATCH SPECIFIED GATE TRAVEL 'T₉'.
 7. CHECK ACTUATOR UPSTROKE STOP, WITH THE VALVE IN CLOSED POSITION PER 'T_g'; UPSTROKE STANDOUT = SPECIFIED 'U'.
 8. LOWER ACTUATOR OVER THE VALVE STEM UNTIL CONNECTOR PIN (123) BOTTOMS OUT IN THE SLOT OF THE DRIVE ROD. ROTATE THE ACTUATOR ASSEMBLY APPROXIMATELY 45° CLOCKWISE (VIEWING FROM ABOVE) ABOUT THE COMMON AXIS TO ENGAGE DRIVE ROD WITH THE VALVE STEM.
 9. BACKOFF/RAISE ADAPTER PLATE AS NEAR AS POSSIBLE TO END PLATE AND ALIGN MOUNTING HOLES WITH END PLATE. BACKOFF LOCKPLATE WITH ONE TURN BELOW ADAPTER PLATE AND FASTEN TO END PLATE WITH CAPSCREWS.
 10. VERIFY STROKE BY DRIFT AND SEAT TESTS.



MANUFACTURER	SIZE	RATING	A	B	C	T _g	T ₉	U
BARTON	2-1/16	2000	2.35	4.85		2.64	2.58	6.82
	2-1/16	3000	2.35	4.85		2.64	2.58	6.82
	2-1/16	5000	2.35	4.85		2.64	2.58	6.82
	2-9/16	2000	2.31	5.58		3.08	3.02	6.82
	2-9/16	3000	2.31	5.58		3.08	3.02	6.82
	2-9/16	5000	2.31	5.58		3.08	3.02	6.82
CROWN (STREAM-FLD)	3-1/8	2000	2.72	7.19		3.92	3.86	6.82
	3-1/8	3000	2.72	7.19		3.92	3.86	6.82
	3-1/8	5000	2.72	7.19		3.92	3.86	6.82
	2-1/16	2000	4.81			2.56	2.50	6.82
	2-1/16	3000	4.81			2.56	2.50	6.82
	2-1/16	5000	4.81			2.56	2.50	6.82
FOSTER	2-9/16	2000	5.64			3.06	3.00	6.82
	2-9/16	3000	5.64			3.06	3.00	6.82
	2-9/16	5000	5.64			3.06	3.00	6.82
	3-1/8	2000	7.12			3.94	3.88	6.82
	3-1/8	3000	7.12			3.94	3.88	6.82
	3-1/8	5000	7.12			3.94	3.88	6.82
MCEVOY	2-1/16	2000	2.72	7.12		3.78	3.72	6.82
	2-1/16	3000	N/A	6.28		2.62	2.56	6.82
	2-1/16	5000	N/A	6.22		2.62	2.56	6.82
	2-9/16	2000	N/A	6.22		2.62	2.56	6.82
	2-9/16	3000	N/A	7.16		3.25	3.19	6.82
	2-9/16	5000	N/A	7.16		3.25	3.19	6.82
WKM	3-1/8	2000	N/A	8.15		3.69	3.63	6.82
	3-1/8	3000	N/A	8.15		3.69	3.63	6.82
	3-1/8	5000	N/A	8.15		3.69	3.63	6.82
	2-1/16	2000	2.25	4.84		2.65	2.59	6.82
	2-1/16	3000	2.25	4.84		2.65	2.59	6.82
	2-1/16	5000	2.25	4.84		2.65	2.59	6.82
	2-9/16	2000	2.26	5.62		3.15	3.09	6.82
	2-9/16	3000	2.26	5.62		3.15	3.09	6.82
	2-9/16	5000	2.26	5.62		3.15	3.09	6.82
	3-1/8	2000	2.72	7.12		3.78	3.72	6.82
	3-1/8	3000	2.72	7.12		3.78	3.72	6.82
	3-1/8	5000	2.72	7.12		3.78	3.72	6.82

BETTIS BETTIS CANADA LTD.
Actuators & Control

FINAL ASSEMBLY INSTRUCTIONS
TYPE UM PNEUMATIC DIAPHRAGM ACTUATOR TO
REVERSE ACTING SPEC 6A GATE VALVES

A-0501--DWG-VIEW.00
GET-29-97

SCALE 1:8

BY RB
DATE JAN-20-97

REV 10/3/77

UNLESS SPECIFIED OTHERWISE ALL MEASURES INCHES (mm), LB (kg)

GENERAL UPDT. 457, MASS 997
(NEW 1097) 10/20/96 HSE/PLM

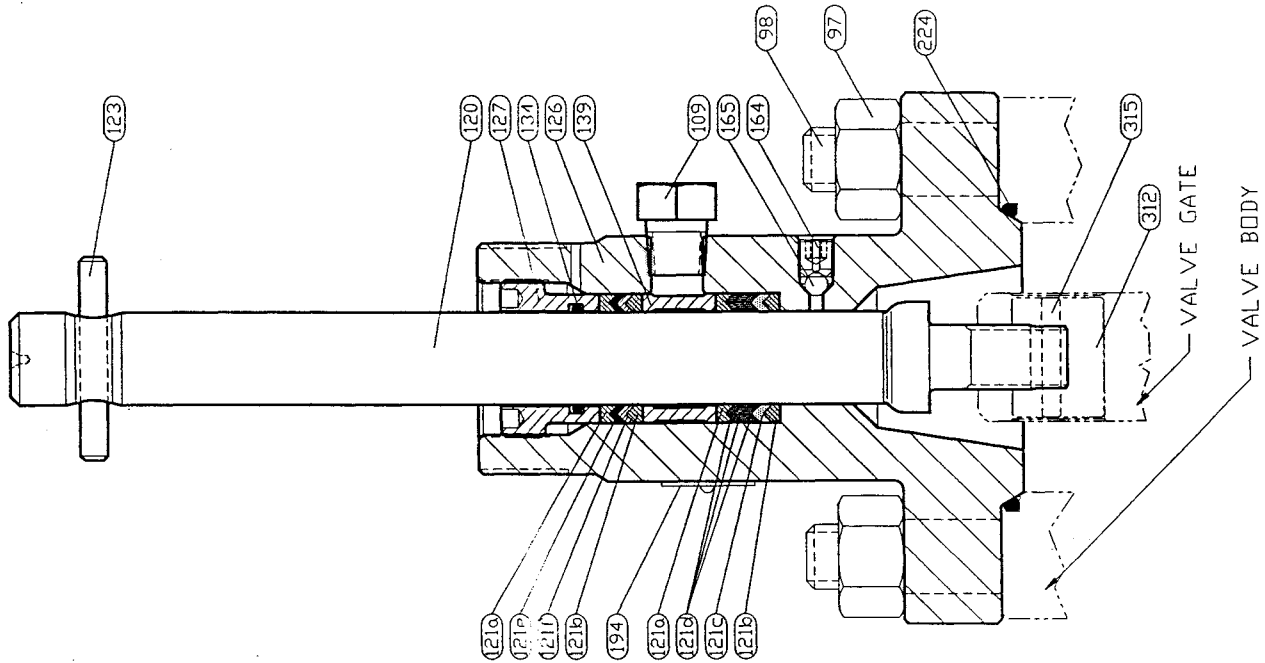
REV BY MAIL/RT

AB0501

ITEM	DESCRIPTION	MATERIAL	QTY	NOTE
97	NUT	(Per Valve Mfr Spec)	8	(N)
98	STUD	(Per Valve Mfr Spec)	8	(N)
109	PLUG	ASTM A105	1	(2)
120	VALVE STEM	17-4 PH//K-MONEL	1	
121a	TOP ADAPTER RING (FEMALE)	TFE	2	(1,Y)
121b	BOTTOM ADAPTER RING (MALE)	TFE	2	(1,Y)
121c	VEE-RING	NITRILE	1	(1,Y)
121d	VEE-RING	NITRILE-FABRIC	3	(1,Y)
121e	VEE-RING	TFE - 25% MoS2	1	(1,Y)
121f	VEE-RING	TFE	1	(1,Y)
123	ROLL PIN, VALVE STEM	SS 302//304	1	(Y)
126	BONNET	ASTM A217//410 SS	1	
127	PACKING FOLLOWER	AISI C1045	1	
134	O-RING, PACKING FOLLOWER	NITRILE	1	(Y)
139	LANTERN RING	SS 316	1	
164	BLEEDER PLUG	SS 304//316	1	
165	BLEEDER BALL	SS 304	1	
194	BONNET NAMEPLATE	SS 304	1	
224	GASKET	(Per Valve Mfr Spec)	1	(N)
312	TEE NUT	(Per Valve Mfr Spec)	1	(N)
315	SPRING PIN, TEE NUT	SS 304	1	(Y)

NOTE:

- (1) STANDARD PACKING MATERIALS, OTHER MATERIALS MAY BE AVAILABLE
- (2) OPTIONAL SEALANT INJECTION FITTING AVAILABLE
- (Y) RECOMMEND SPARE/PARTS/REPAIR KIT
- (N) SUPPLIED WITH VALVE



BETTIS BETTIS CANADA LTD.

Actuators & Controls

ASSEMBLY

UM STYLE BONNET
STANDARD PACKING SET

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES (mm)

REV. BY-DATE+REF

TOLERANCES
XXX ±0.5 (±10)
XX ±0.2 (±5)
X ±0.1 (±2)



A-0186---DWG_VIT.V.00
DCT-31-97

SCALE BY RB

DATE

DCT-31-97

W.T. 10577-1-R DWG. NO. I-0186

REV --

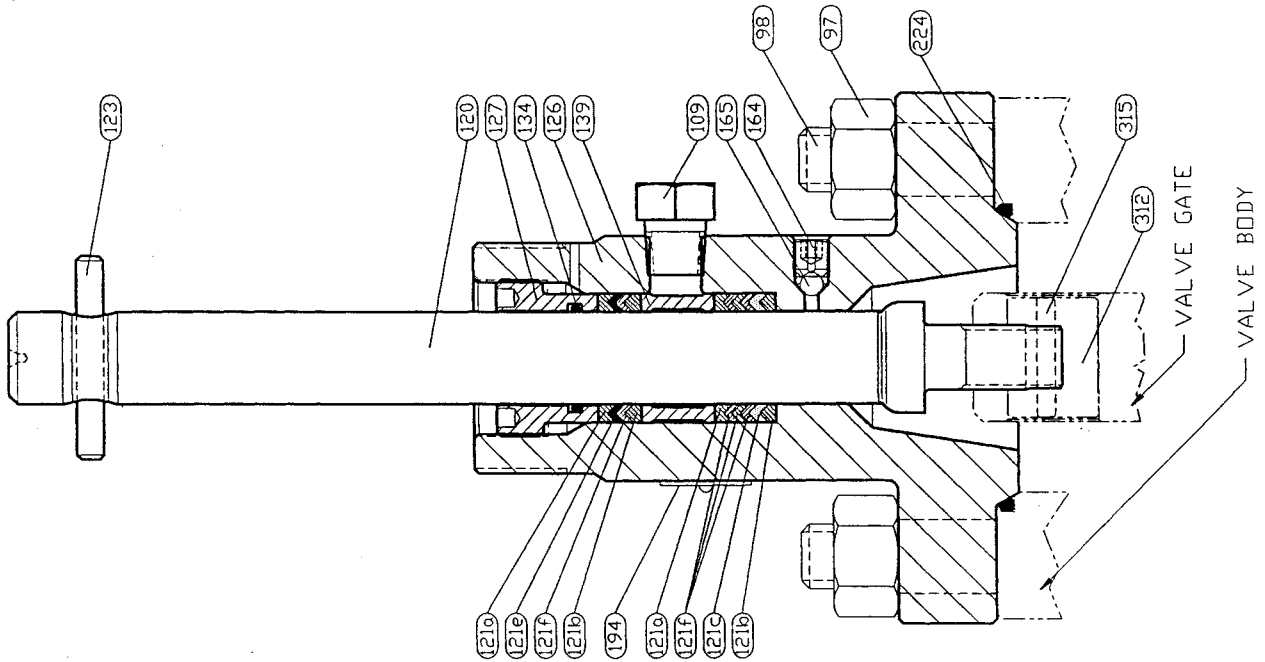
DWG. NO.

I-0186

ITEM	DESCRIPTION	MATERIAL	QTY	NOTE
97	NUT	(Per Valve Mfr Spec)	8	(N)
98	STUD	(Per Valve Mfr Spec)	8	(N)
109	PLUG	ASTM A105	1	(2)
120	VALVE STEM	17-4 PH//K-MONEL	1	
121a	TOP ADAPTER RING (FEMALE)	TFE	2	(1,Y)
121b	BOTTOM ADAPTER RING (MALE)	TFE	2	(1,Y)
121c	VEE-RING	NITRILE	1	(1,Y)
121e	VEE-RING	TFE - 25% MoS2	1	(1,Y)
121f	VEE-RING	TFE	4	(1,Y)
123	ROLL PIN, VALVE STEM	SS 302//./304	1	(Y)
126	BONNET	ASTM A217//./410 SS	1	
127	PACKING FOLLOWER	AISI C1045	1	
134	O-RING, PACKING FOLLOWER	NITRILE	1	(Y)
139	LANTERN RING	SS 316	1	
164	BLEEDER PLUG	SS 304//./316	1	
165	BLEEDER BALL	SS 304	1	
194	BONNET NAMEPLATE	SS 304	1	
224	GASKET	(Per Valve Mfr Spec)	1	(N)
312	TEE NUT	(Per Valve Mfr Spec)	1	(N)
315	SPRING PIN, TEE NUT	SS 304	1	(Y)

NOTE:

- (1) OPTIONAL PACKING MATERIALS, OTHER MATERIALS MAY BE AVAILABLE
- (2) OPTIONAL SEALANT INJECTION FITTING AVAILABLE
- (Y) RECOMMEND SPARE/PARTS/REPAIR KIT
- (N) SUPPLIED WITH VALVE



BETTIS BETTIS CANADA LTD.

Actuators & Controls

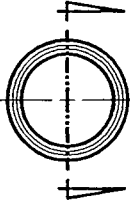
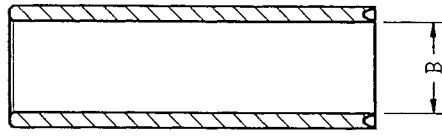
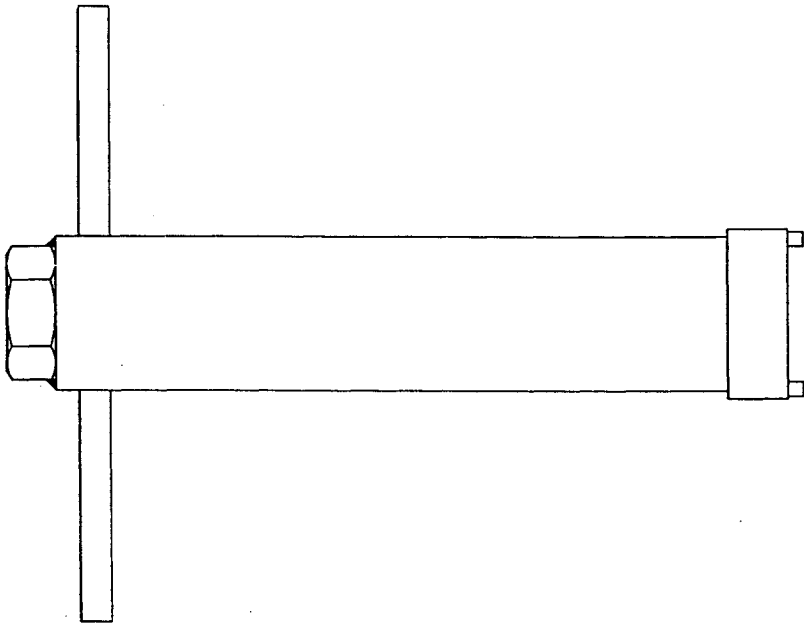
ASSEMBLY
UM STYLE BONNET
OPTIONAL PACKING SET

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES (mm)

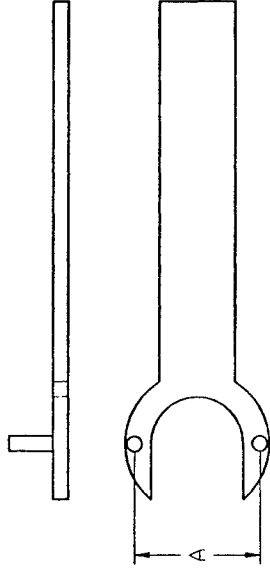
REV. BY-DATE+REF	BY	RB	CHK	DATE
TOLERANCES				
XXX ±0.5 (±10)				
XX ±0.2 (±5)				
X 10.1 (1.2)				
A-0186--DWG_VIEW_10				
DCT-31-97				
SCALE				
W.D. 10577	DWG. NO. I-0186-10			
	REV --			

DWG. NO. I-0186-10

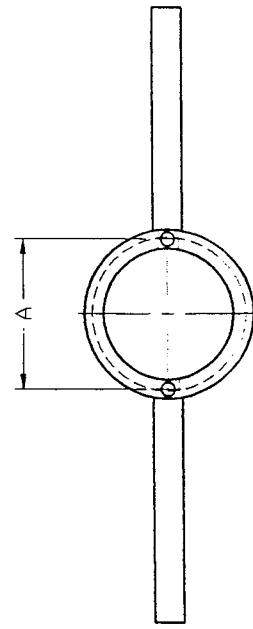
BONNET ASSEMBLY TOOLS	SIZES AVAILABLE DIMENSIONS INCH [mm]	
	A	B
PACKING FOLLOWER SPANNER TOOL	1.63 [41]	
	1.88 [48]	
	2.43 [62]	
PACKING RING ENERGIZING TOOL	1.50 [38]	
	1.75 [45]	
LOWER STOP SPANNER TOOL	2.06 [52]	
	4.00 [102]	



TYPICAL PACKING RING
ENERGIZING TOOL



TYPICAL LOWER STOP
SPANNER TOOL



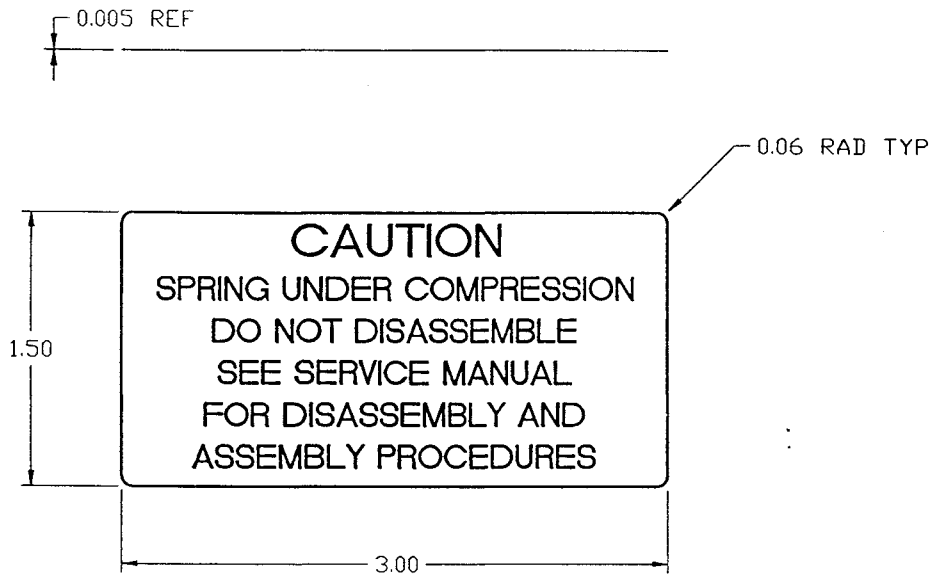
TYPICAL PACKING FOLLOWER
SPANNER TOOL

NOTE:
1) TOOLS MAY NOT BE EXACTLY AS ILLUSTRATED
UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

BETTS BETTIS CANADA LTD.
Actuators & Controls
TYPICAL ASSEMBLY TOOLS
UM STYLE BONNET

A-0187--DWG	REV	BY	CHK	DATE	DI C	REV
11/11/97	10577	10577	10577	10577	10577	10577
SCALE	1:1	1:1	1:1	1:1	1:1	1:1
W.B. 10577	1:1	1:1	1:1	1:1	1:1	1:1

DWG NO. 11-0187



NOTE:

1. WHITE CHARACTERS ON RED BACKGROUND, PEEL-OFF BACK, STICK-ON
2. LETTERING IS 0.18 [4.6mm] AND 0.13 [3.3mm] HEIGHT
3. MANUFACTURER'S STANDARD MATERIAL THICKNESS ACCEPTED EQUAL
4. PACKAGE ON EASY RELEASE ROLLS OF 100 MAXIMUM, IDENTIFY MANUFACTURER AND DATE ON EACH ROLL

REV BY-DATE+REF PART TO: DIAPHRAGM ACTUATOR & SCHM B) MFR'S STD EQUAL OR BETTER UV AND WEATHER RESISTANT A) PRESSURE SENSITIVE ADHESIVE VINYL /NONE MATERIAL/FINISH	UNLESS SPECIFIED OTHERWISE ALL DIMENSIONS INCHES [mm]	BETTS BETTIS CANADA LTD. Actuators & Controls		STICKER CAUTION SPRING UNDER COMPRESSION SEE SERVICE MANUAL...	WEIGHT 0.00038 LB																	
	<table border="1"> <thead> <tr> <th colspan="3">TOLERANCES</th> </tr> <tr> <th>DECIMALS</th> <th>RMS</th> <th>FRACTIONS</th> </tr> </thead> <tbody> <tr> <td>.X ±0.05</td> <td>500</td> <td>XX-X/X ±1/16</td> </tr> <tr> <td>.XX ±0.02</td> <td>250</td> <td>X-X/X ±1/32</td> </tr> <tr> <td>.XXX ±0.005</td> <td>125</td> <td>X/X ±1/64</td> </tr> <tr> <td>T.I.R. ±0.010</td> <td>THD ±1 TURN</td> <td>∠ ±1°</td> </tr> </tbody> </table>	TOLERANCES			DECIMALS	RMS	FRACTIONS	.X ±0.05	500	XX-X/X ±1/16	.XX ±0.02	250	X-X/X ±1/32	.XXX ±0.005	125	X/X ±1/64	T.I.R. ±0.010	THD ±1 TURN	∠ ±1°	SP968420_VIEW_00 MAR-20-98	SCALE 1:1 BY RB	DATE MAR-20-98
TOLERANCES																						
DECIMALS	RMS	FRACTIONS																				
.X ±0.05	500	XX-X/X ±1/16																				
.XX ±0.02	250	X-X/X ±1/32																				
.XXX ±0.005	125	X/X ±1/64																				
T.I.R. ±0.010	THD ±1 TURN	∠ ±1°																				
BREAK SHARP EDGES CHAMFER FIRST THREAD REMOVE ALL BURRS		W.D. 10577-1-R	DWG. NO. SP-9684-20	REV --																		

