Installation, Operation and Maintenance Manual
VA-DC-000-1879 Rev. 1
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Bettis M18 Manual Hydraulic Override System

For HD, T, and G-Series Pneumatic and Hydraulic Actuators

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Section 1: Introduction

1.1 General M18 Service Information

1.1.1 M18 is a compact modular hydraulic override system designed for use with Bettis Double-Acting and Spring-Return Actuators. The system incorporates a piston type hand pump and a fluid reservoir.

NOTE:
The M18 fluid reservoir is required because of the hydraulic cylinder differential, which is due to the inboard piston rod displacement.

1.1.2 MAINTENANCE:

1.1.2.1 Bettis does not recommend periodic field maintenance for the M18 Manual Hydraulic Override System (pump and reservoir).

1.1.2.2 The only time the M18 Manual Hydraulic Override System should be disassembled is when either the pump or the reservoir fails to perform its manual hydraulic override function.

1.1.2.3 When possible the M18 package should be returned to the factory for maintenance.

1.1.3 Numbers in parentheses ( ), indicate the bubble number (reference number) used on the Bettis Assembly Drawing VA-ED-005-1120.

NOTE:
Do not use Teflon tape on M18 system threads.

1.1.4 Use a non-hardening thread sealant on all system threads.

⚠ CAUTION

Apply thread sealant per the manufacturer's instructions.

1.2 Definitions

⚠ WARNING

If not observed, user incurs a high risk of severe damage to actuator and/or fatal injury to personnel.

⚠ CAUTION

If not observed, user may incur damage to actuator and/or injury to personnel.

NOTE:

Advisory and information comments provided to assist maintenance personnel to carry out maintenance procedures.

1.3 General Safety Information

Products supplied by Bettis, in its "as shipped" condition, are intrinsically safe if the instructions contained within this Service Instruction are strictly adhered to and executed by a well-trained, equipped, prepared and competent technician.

⚠ WARNING

For the protection of personnel working on Bettis actuators, this procedure should be reviewed and implemented for safe operation. Close attention should be noted to the WARNINGS, CAUTIONS and NOTES contained in this procedure.

NOTE:

This procedure should not supersede or replace any customer's plant safety or work procedures. If a conflict arises between this procedure and the customer's procedures the differences should be resolved in writing between an authorized customer representative and an authorized Bettis representative.

1.4 Fluid Requirements

M18 Manual Hydraulic Override System Fluid Requirements: Hydraulic fluids, other than those listed in steps 1.4.1 and 1.4.2, should not be used without prior written approval of Bettis Product Engineering.

1.4.1 Standard and high temperature service (-20 °F to +350 °F) use Shell Tellus VX32 Automatic Transmission Fluid.

1.4.2 Low temperature service (-40 °F to +150 °F) Use Exxon Univis J13 or HVI 13 Hydraulic Fluid.

1.5 Bettis Reference Materials

1.5.1 Bettis M18 System Assembly drawing part number VA-ED-005-1120 (attached to the end of the document).

1.5.2 M18 with auto reset module and remote mounting module use the same assembly drawing VA-ED-005-1120.

Section 2: General Information

2.1 Actuator Power Operation

⚠ CAUTION

Power operation of the actuator with the M18 control knob in any other position than "AUTO" will cause fluid to overflow in the reservoir.

2.1.1 Place the M18 control knob (25 - 200) in the Auto position (middle position).

NOTE:
The control knob (25 - 200) is in front and at the bottom of the M18 pump.

⚠ WARNING

Do not exceed the maximum operating pressure rating of the actuator.

2.1.2 Apply an operating media, of the correct pressure, through a control valve to the actuator's power cylinder.

2.2 Actuator M18 Manual Hydraulic Operation

2.2.1 Shut off and exhaust the operating media from both sides of the actuator's power cylinder.

2.2.2 M18 Manual Hydraulic Operation as follows:

2.2.2.1 Double-Acting Actuators – Select actuator rotation desired by placing the control knob (25 - 200) in the Manual CW or Manual CCW position.

2.2.2.2 Spring-Return Actuators – Place the control knob (25 - 200) in the Manual position.

2.2.3 Operate the M18 pump handle until required valve position is reached.

NOTE:
When the actuator is fully stroked against the travel stops, an increased resistance in pumping effort will be noticed. Continued operation of the pump simply circulates fluid through a relief valve.

Section 3: M18 System Fluid Filling Instructions

3.1 Double-Acting Actuator M18 System Fluid Filling

Use either Filling Method Number 1 (steps 3.1.2) or Filling Method Number 2 (steps 3.1.3). Method number 1 is the best, most efficient and the recommended method.

3.1.1 Actuator position as follows:

3.1.1.1 Pneumatic and Hydraulic T-Series Actuators:
Apply pneumatic or hydraulic pressure to the inlet port located in the outer end cap of the actuators power cylinder, placing the actuator in the counterclockwise (CCW) position and proceed to step 3.1.2.

3.1.1.2 Hydraulic G-Series Actuators:
Apply pneumatic or hydraulic pressure to the inlet port located in the inner end cap of the actuators power module (cylinder), placing the actuator in the counterclockwise (CCW) position and proceed to step 3.1.2.

3.1.1.3 Pneumatic G and HD-Series Actuators:
Apply pneumatic pressure to the inlet port located in the inner end cap of the actuators power module (cylinder), placing the actuator in the clockwise (CW) position and proceed to step 3.1.2.

3.1.2 Filling Method Number 1

Filling of the M18 Manual Hydraulic Override System is best accomplished using a pump motor.

NOTE:

If a pump motor is not available go to step 3.1.3 (method number 2) for the manual field service filling procedure.

3.1.2.1 Shut off and exhaust the operating media from the actuator's power cylinder.

3.1.2.2 Remove the bleed plugs from the following locations:

3.1.2.2.1 G-Series Actuators remove plug from the top of the outer and inner end caps of the hydraulic override cylinder.

3.1.2.2.2 T-Series Actuators remove pipe plugs from the top area located on the outer and inner end caps of the hydraulic override cylinder.

3.1.2.2.3 HD-Series Actuators remove pipe plug from the top area on the outer end caps of the hydraulic override cylinder and the cylinder adapter.

3.1.2.3 Connect the pump motor hose to fitting hole located on the reservoir top end cap (10 - 10), keep pipe plug on the other hole.

⚠ CAUTION

The M18 pump handle lever (20 - 10 - 90) should be in the up position and the pump handle (30 - 70) should be removed from the pump handle lever (20 - 10 - 90).

3.1.2.4 Place the M18 pump control knob in the “Auto” position.

NOTE:

To accelate the filling process, set the pressure pump to 35 to 40 psig when force filling the M18 Hydraulic System or place the control knob in ”CW” or “CCW” position when filling the correspondence side of the hydraulic cylinder.

3.1.2.5 Start pumping the hydraulic fluid into the system with the pump motor.

3.1.2.6 When hydraulic fluid appears at the vacant bleed plug port hole located in the inboard area of the hydraulic override cylinder install pipe plug into the vacant port hole.

NOTE:

Use pipe dope on the bleed pipe plug.

3.1.2.7 When hydraulic fluid appears at the vacant bleed plug port hole located in the outboard area of the hydraulic override cylinder stop the pump motor and install pipe plug into the vacant port hole.

NOTE:

Use pipe dope on the bleed pipe plug.

3.1.2.8 Disconnect the pump motor from the M18 reservoir.

3.1.2.9 Run 1-2 cycles for hydraulic override module and fill or drain hydraulic fluid in the reservoir to 1 - 1/2 inches from the bottom of the reservoir.

NOTE:

Add fluid to the reservoir through the open port left vacant in step 3.1.2.8.

3.1.2.10 Apply pipe dope to breather (10 - 90) threads and install it into the port on top of the reservoir upper end cap (10 - 10).

3.1.2.11 Return the M18 pump control knob to the “Auto” position. With the M18 control knob in the “Auto” position the actuator is ready for service.

3.1.3 Refilling Method Number 2

Refilling the M18 Manual Hydraulic Override System using the M18 pump.

3.1.3.1 Remove breather (10 - 90) from the top of the reservoir end cap (10 - 10).

3.1.3.2 Remove the bleed plugs from the following locations:

NOTE:
Only remove the pipe plugs located at the highest points, in the vertical plane, of the hydraulic override cylinder.

3.1.3.2.1 G-Series Actuators remove plug from the top of the outer and inner end caps of the hydraulic override cylinder.

3.1.3.2.2 T-Series Actuators remove pipe plugs from the top area located on the outer and inner end caps of the hydraulic override cylinder.

3.1.3.2.3 HD-Series Actuators remove pipe plug from the top area on the outer end caps of the hydraulic override cylinder and the cylinder adapter.

3.1.3.3 Place the M18 pump control knob in the counter clockwise (CCW) position.

⚠ CAUTION

Never allow the M18 reservoir to be pumped dry of hydraulic fluid.

3.1.3.4 Fill reservoir to 1 - 1/2 inches from top of reservoir end cap (10 - 10).

NOTE:
Add fluid to the reservoir through the open port left vacant in step 3.1.3.1.

3.1.3.5 Start pumping the hydraulic fluid into the system with the M18 pump handle, switch the control knob to the clockwise (CW) position when hydraulic fluid appears at one of the vacant pipe plug port, refill the reservoir with fluid as needed to prevent the pump being operated without fluid.

3.1.3.6 Stop pumping the M18 pump handle when hydraulic fluid appears at both vacant pipe plug ports located in the actuator's hydraulic override cylinder.

3.1.3.7 Apply pipe dope onto pipe plug threads and install into the vacant pipe plug ports at both vacant pipe plug ports located in the actuator's hydraulic override cylinder.

3.1.3.8 Fill or drain hydraulic fluid in the M18 reservoir to 1 - 1/2 inches from the bottom of the reservoir.

3.1.3.9 Apply pipe dope to the breather (10 - 90) threads and install into the port on top of the reservoir upper end cap (10 - 10).

3.2 Spring-Return Actuators M18 System Fluid Filling

Actuator position as follows:
Apply air to port on power module inner end cap move the actuator to opposition direction and compress the spring.

Use either Refilling Method Number 1 (steps 3.2.1) or Refilling Method Number 2 (steps 3.2.2).

NOTE:
Method Number 1 is the best, most efficient and the recommended method.

For sizes G01 to G5, T, HD series

3.2.1 Refilling Method Number 1

Refilling of the M18 Manual Hydraulic Override System is best accomplished using a pump motor.

NOTE:
If a pump motor is not available go to step 3.2.2 (Method number 2) for the manual field service refilling procedure.

3.2.1.1 Actuator hydraulic override cylinder pipe plug removal.

3.2.1.1.1 G-Series – Remove one pipe plug from the spring cartridge hydraulic override outer end cap.

3.2.1.1.2 HD and T-Series – Remove the pipe plugs from the actuator hydraulic override cylinder outer and inner end.

NOTE:
Only remove the pipe plugs located at the highest points, in the vertical plane, of the hydraulic override cylinder.

3.2.1.2 Connect the pump motor hose to fitting hole located on the reservoir top end cap (10 - 10), keep pipe plug on the other hole.

3.2.1.3 Place the M18 pump control knob in the “Auto” position.

NOTE:
To accelate the filling process, set the pressure pump to 35 to 40 psig when force filling the M18 Hydraulic System or place the control knob in "CW" or "CCW" position when filling the correspondence side of the hydraulic cylinder.

3.2.1.4 Start pumping the hydraulic fluid into the system with the pump motor.

3.2.1.5 Stop the pump motor when hydraulic fluid appears as follows:

3.2.1.5.1 G-Series - At the vacant pipe plug port located in the hydraulic override end cap.

3.2.1.5.2 HD and T-Series - At both vacant pipe plug port located in the actuator's hydraulic override cylinder.

3.2.1.6 Apply pipe dope onto pipe plug threads and install into the vacant pipe plug port as follows:

3.2.1.6.1 G-Series - At the vacant pipe plug port located in the hydraulic override end cap.

3.2.1.6.2 HD and T-Series - At both vacant pipe plug ports located in the actuator's hydraulic override cylinder.

3.2.1.7 Disconnect the pump motor from the M18 reservoir.

3.2.1.8 Fill or drain hydraulic fluid in the reservoir to 1 - 1/2 inches from the bottom of reservoir end cap (10 - 10).

3.2.1.9 Stop the air on the power module, wait the spring back to 0°.

NOTE:

Add fluid to the reservoir through the open port left vacant in step 3.2.1.7.

3.2.1.10 Apply pipe dope to breather threads and install breather (10 - 90) into port vacated in step 3.2.1.7.

3.2.2 Refilling Method Number 2

Refilling the M18 Manual Hydraulic Override System using the M18 pump.

3.2.2.1 Remove breather (10 - 90) from the top of the reservoir end cap (10 - 10).

3.2.2.2 Actuator hydraulic override cylinder pipe plug removal.

3.2.2.2.1 G-Series – Remove one pipe plug from the spring cartridge hydraulic override outer end cap.

3.2.2.2.2 HD and T-Series – Remove the pipe plugs from the actuator hydraulic override cylinder outer and inner end.

NOTE:

Only remove the pipe plugs located at the highest points, in the vertical plane, of the hydraulic override cylinder.

3.2.2.3 Place the M18 pump control knob in the "Manual" position.

⚠ CAUTION

Never allow the M18 reservoir to be pumped dry of hydraulic fluid.

3.2.2.4 Fill reservoir to 1 - 1/2 inches from top of reservoir end cap (10 - 10).

NOTE:

Add fluid to the reservoir through the open port left vacant in step 3.2.2.1.

3.2.2.5 Start pumping the hydraulic fluid into the system with the M18 pump handle.

3.2.2.6 Stop pumping the M18 pump handle when hydraulic fluid appears as follows:

3.2.2.6.1 G-Series - At the vacant pipe plug port located in the hydraulic override end cap.

3.2.2.6.2 HD and T-Series - At both vacant pipe plug ports located in the actuator's hydraulic override cylinder.

3.2.2.7 Apply pipe dope onto pipe plug threads and install into the vacant pipe plug port as follows:

3.2.2.7.1 G-Series - At the vacant pipe plug port located in the hydraulic override end cap.

3.2.2.7.2 HD and T-Series - At both vacant pipe plug port located in the actuator's hydraulic override cylinder.

3.2.2.8 Fill or drain hydraulic fluid in the M18 reservoir to 1 - 1/2 inches from the bottom of the reservoir.

3.2.2.9 Stop the air on the power module, wait the spring back to 0°.

3.2.2.10 Apply pipe dope to the breather (10 - 90) threads and install into the port on top of the reservoir upper end cap (10 - 10).

For sizes G7, G8 and G10

3.2.3 Refilling Method Number 1

Refilling of the M18 Manual Hydraulic Override System is best accomplished using a pump motor.

NOTE:

If a pump motor is not available go to step 3.2.2 (Method number 2) for the manual field service refilling procedure.

3.2.3.1 Remove one pipe plug from the spring cartridge hydraulic override outer end cap.

NOTE:

Only remove the pipe plugs located at the highest point, in the vertical plane, of the hydraulic override cylinder.

3.2.3.2 Stroke actuator using power module operating fluid media to the fully stroked position and lock in place.

3.2.3.3 Connect pump motor hose to fitting hole on the reservoir top end cap (10 - 10), keep pipe plug on the other hole.

3.2.3.4 Place the M18 pump knob in the "Auto" position.

NOTE:

To accelate the filling process, set the pressure pump to 35 to 40 psig when force filling the M18 Hydraulic System or place the control knob in "CW" or "CCW" position when filling the correspondence side of the hydraulic cylinder.

3.2.3.5 Start pumping the hydraulic fluid into the system with the pump motor.

3.2.3.6 Stop the pump motor when hydraulic fluid appears at the vacant pipe plug port located in the hydraulic override end cap.

3.2.3.7 Apply pipe dope onto pipe plug threads and install into the vacant pipe plug port at the vacant pipe plug port located in the hydraulic override end cap.

3.2.3.8 Place the M18 pump control knob in the "Manual" position. Start pump motor to stroke the hydraulic ram to its fully extended position.

3.2.3.9 Install the handle to M18 pump and do 2-3 stroke (priming procedure 3.3 may required), make sure the hydraulic piston rod touches the tension rod. Shut off and exhaust the operating media from the actuator's power cylinder, and check the actuator position indicator if happen changes.

3.2.3.10 Fill or drain hydraulic fluid in the reservoir to 1 - 1/2 inches from the bottom of reservoir end cap (10 - 10).

3.2.3.11 Stop the air on the power module, wait for the spring to return to 0°.

3.3 Priming M18 in the Field

3.3.1 Pull the Quick Release Pin (20 - 10 - 110) connected to Cable Assembly (20 - 10 - 230).

3.3.2 Rotate the Pump Handle Lever (20 - 10 - 90) 180° to get it out of the way.

3.3.3 Use a 13/16" open end wrench to keep the Pump Rod (20 - 50) from rotating while you use a 3/16" hex Allen wrench to loosen 1/8" Pipe Plug (20 - 10 - 210). It needs to be loosened to allow trapped air to be pumped out the Pump Rod (20 - 10 - 50).

3.3.4 Reattach the Pump Handle Lever (20 - 10 - 90) to the Pump Rod (20 - 10 - 50) with the Quick Release Pin (20 - 10 - 110).

3.3.5 Pump until all air is out of the Pump Rod (20 - 10 - 50) and you are getting clear fluid coming out around the Pipe Plug (20 - 10 - 210).

3.3.6 Stop pumping – pull the Quick Release Pin (20 - 10 - 110) – use the 3/16" hex Allen wrench and 13/16" open end wrench to tighten the 1/8" Pipe Plug (20 - 10 - 210).

3.3.7 Reinstall the Quick Release Pin (20 - 10 - 110) connecting the Pump Handle Lever (20 - 10 - 90) to the Pump Rod (20 - 10 - 50).

3.3.8 You should have a good prime now and be able to pump the M18 to complete your override job.

Section 4: M18 Disassembly Instructions

4.1 M18 Pressure Release Instructions

NOTE:
Shut off and exhaust the operating media from both sides of the actuator's power cylinder.

4.1.1 Place the M18 control knob (25 - 200) in the Auto position (middle position).

NOTE:
Control knob (25 - 200) is located in front and at the bottom of the M18 pump manifold (20 - 10 - 10).

NOTE:
Using a means of capturing the hydraulic fluid that will be lost during the following steps. Use a bucket, tub, and large container, etc. For remote mounting option, before removing the pump hose / tube fitting, press and hold plug (90 - 20) to release fluid pressure G and T-Series Actuators there is 250 psi pressure and HD-Series Actuator there is 33 psi pressure.

4.1.2 Remove the 1/4" pipe plug (10 - 80) from the reservoir bottom end cap (10 - 40).

4.1.3 Place the M18 control knob (25 - 200) in the Manual position.

4.1.4 Remove all the M18 pump assembly piping; SS Tubing (50) with male connector (40).

4.2 M18 Reservoir Disassembly Instructions

NOTE:
Review Section 4.1, M18 Pressure Relief Instructions for remote mounting option before proceeding with reservoir disassembly.

4.2.1 Remove piping from port located in bottom end cap (10 - 40).

4.2.2 Remove breather (10 - 90) from upper end cap (10 - 10).

4.2.3 Remove acorn nut (10 - 50) from upper end cap (10 - 10).

4.2.4 Loosen socket cap screws (30 - 20) and remove the M18 reservoir (10) from the M18 mounting bracket (30 - 90).

4.2.5 Remove Thread Seal (10 - 70) and washer (10 - 60) from upper end cap (10 - 10).

4.2.6 Remove the upper end cap (10 - 10) from center bar assembly (10 - 30).

4.2.7 Remove bottom end cap (10 - 40) from M18 cylinder (10 - 20) and center bar assembly (10 - 30).

4.2.8 For remote mounting option, if required for replacement or maintenance remove check valves (90 - 30) and (90 - 60) from housing (90 - 10).

4.3 M18 Pump Disassembly Instructions

NOTE:
Review Section 4.1, M18 Pressure Relief Instructions before proceeding with M18 pump disassembly.

4.3.1 Place the M18 control knob (25 - 200) in the Auto position (middle position).

NOTE:
Control knob (25 - 200) is located in front and at the bottom of the M18 pump manifold (20 - 10 -10).

NOTE:
Using a means of capturing the hydraulic fluid that will be lost during the following steps, i.e. a bucket, tub, large container, etc.

4.3.2 Refer to assembly drawing sheet 1. Remove all the M18 pump assembly piping - male connector (40), and Tubing (50).

NOTE:
If the M18 pump is equipped with Auto Reset, refer to assembly drawing sheet 6 and do steps 4.3.3 and 4.3.4. If not equipped with Auto Reset skip steps 4.3.3 and 4.3.4.

4.3.3 Remove male swivel elbow (80 - 20) from Air Reset Cylinder (80 - 90).

4.3.4 Remove two socket cap screws (80 10) from bracket (80 - 50) and back brace (20 - 10 - 130).

4.3.5 Refer to assembly drawing sheet 1. Remove four socket cap screws (30 - 110) that retains the mounting bracket (30 - 90) to actuator housing and then remove M18 pump assembly / bracket.

4.3.6 Refer to assembly drawing sheet 1. Remove four countersunk socket flat screws (30 - 100) that mounts mounting bracket (30 - 90) to pump manifold (20 - 10 - 10).

4.3.7 Remove the M18 pump assembly from the M18 mounting bracket (30 - 90).

4.3.8 Remove acorn nut (25 - 450) from the control knob (25 - 200) and separate the control knob (25 - 200) from valve stem (20 - 10 - 280).

4.3.9 Refer to assembly drawing sheet 3. Remove four cap screws (25 - 240) from pump cover (25 - 240) and detach the cover from manifold (20 - 10 - 10).

4.3.10 Remove two orifice check valves (20 - 10 - 260) from the manifold (2 - 10 - 10).

4.3.11 Refer to assembly drawing sheet 1. Remove two check valves (20 - 10 - 40) and one check valve (20 - 10 - 270) from the manifold (20 - 10 - 10).

4.3.12 Remove the relief valve (20 - 10 - 30) from bottom of the M18 manifold (20 - 10 -10).

NOTE:

There will be further fluid lost when the valves are removed.

NOTE:

In step 4.3.13 and 4.3.17 pump handle lever (20 - 10 - 90), pump rod (20 - 10 - 50), and associated parts will be removed from pump cylinder (20 - 10 - 20).

4.3.13 Remove quick release pin (20 - 10 - 110) from pump handle lever (20 - 10 - 90) and pump rod (20 - 10 - 50).

4.3.14 Pull the pump rod (20 - 10 - 50) up out of the pump cylinder (20 - 10 - 20) using a slight twisting back and forth motion.

4.3.15 Refer to assembly drawing sheet 3. Remove retainer ring (20 - 10 - 80) from the manifold (20 - 10 -10).

4.3.16 Pull the cylinder pin (20 - 10 - 60) out of from the manifold (20 - 10 - 10) using a 1/4” - 20 UNC screw.

4.3.17 Remove the cylinder (20 - 10 - 20) from the manifold (20 - 10 - 10).

NOTE:

If the M18 pump is equipped with Auto Reset then do steps 4.3.18 and 4.3.19 and refer to assembly drawing sheet 6. If not equipped with Auto Reset skip steps 4.3.18 and 4.3.19.

4.3.18 Remove one retainer ring (80 - 80) from auto reset pivot pin (80 - 70) located on the pump cover (25 - 140).

4.3.19 Remove air reset cylinder (80 - 90) from auto reset pivot pin (80 - 70) located on the pump cover (25 - 140).

4.3.20 Remove the button head screw (25 - 430) and hex nut (25 - 440) from the position label (25 - 160).

4.3.21 Remove position label (25 - 160) from the pump cover (25 - 140).

NOTE:

4.3.20 and 4.3.21 Steps only required if converting from DA to SR, and vice versa.

4.3.22 Remove the screws (20 - 10 - 100) that retain the back brace (20 - 10 - 130) to the M18 manifold (20 - 10 - 10).

4.3.23 Remove pipe plug (20 - 10 - 210), spring (20 - 10 - 360) and ball (20 - 10 - 350) from manifold (20 - 10 - 10)

4.3.24 Remove the control valve stem (20 - 10 - 280), rotor (20 - 10 - 300), and back plate (20 - 10 - 320) from the M18 manifold (20 - 10-10).

NOTE:

Use plastic mallet tap lightly end of the control valve stem (20 - 10 - 280), while holding the back plate (20 - 10 - 320) to prevent it from pop-up by the spring (20 - 10 - 390).

4.3.25 Remove spring pin (20 - 10 - 340) from control valve rotor (20 - 10 - 300).

4.3.26 Refer to assembly drawing sheet 3. Remove flat head screws (20 - 10 - 330) from the M18 manifold (20 - 10 - 10) and remove the control valve disc (20 - 10 - 290) and O-rings (20 - 20 - 40).

Section 5: M18 Reassembly Instructions

5.1 M18 General Reassembly Instructions

⚠ CAUTION

Only new seals that are still within the seal's expectant shelf life should be install into Bettis product being refurbished.

5.1.1 Remove and discard all old seals.

5.1.2 All parts should be cleaned to remove all dirt and other foreign material prior to inspection.

5.1.3 All parts should be thoroughly inspected for excessive wear, stress cracking, galling and pitting. Attention should be directed to threads, sealing surfaces and areas that will be subjected to sliding or rotating motion. Sealing surfaces of the manifold (20 - 10 - 10) and pump rod (20 - 10 - 50) must be free of deep scratches, pitting, corrosion and blistering or flaking coating.

⚠ CAUTION

Parts that reflect any of the above listed characteristics should be replaced with new parts.

5.1.4 Before installation, coat all moving parts with a complete film of lubricant. Coat all seals with a complete film of lubricant, before installing into seal grooves.

NOTE:

The parts and seals used in the actuator will be assembled using lubricant as identified in Section 1, step 1.5.1.

5.2 M18 Reservoir Reassemble Instructions

NOTE:

Review Section 5.1, General Reassembly Instructions before proceeding with reservoir reassembly.

5.2.1 Refer to the assembly drawing sheet 4. If disassembled, reassemble the following item:

5.2.2 Screw bottom end cap (10 - 40) onto center bar assembly (10 - 30).

5.2.3 Install reservoir O-ring (10 - 100) over the lip of bottom end cap (10 - 40).

5.2.4 Install cylinder (10 - 20) over the lip of bottom end cap (10 - 40).

5.2.5 Install reservoir O-ring (10 - 100) over the lip of upper end cap (10 - 10) then install entire upper end cap assembly (10 - 10) over the lubricated center bar assembly (10 - 30) and into the cylinder (10 - 20).

5.2.6 Install thread seal (10 - 70) and countersink washer (10 - 60) onto center bar assembly (10 - 30).

5.2.7 Install and tighten acorn nut (10 - 50) onto center bar assembly (10 - 30).

5.2.8 Apply sealant to breather (10 - 90) and install into upper end cap (10 - 10).

5.2.9 Apply sealant to pipe plug (10 - 80) and install into bottom end cap (10 - 40).

5.3 M18 Pump Reassembly Instructions

NOTE:
Review Section 5.1, General Reassembly before proceeding with M18 pump reassembly.

5.3.1 Install O-ring seals (20 - 20 - 40) into grooves on manifold (20 - 10 - 10).

5.3.2 Install control valve disc (20 - 10 - 290) on manifold (20 - 10 - 10) with flat head screws (20 - 10 - 330).

5.3.3 Insert spring pin (20 - 10 - 340) onto rotor (20 - 10 - 300) and valve stem (20 - 10 - 280).

5.3.4 Install above assembly into manifold (20 - 10 - 10).

5.3.5 Place thrust bearing (20 - 10 - 370) and bearing washer (20 - 10 - 380) on the back surface of the rotor (20 - 10 - 300) with the back of the rotor facing up.

5.3.6 Insert spring (20 - 10 - 390) and valve piston (20 - 10 - 310) into back plate (20 - 10 - 320).

5.3.7 Slightly push above assembly into manifold (20 - 10 - 10) using manual press.

5.3.8 Install back brace (20 - 10 - 130) onto manifold (20 - 10 - 10).

5.3.9 Install ball (20 - 10 - 350) and spring (20 - 10 - 360) and pipe plug (20 - 10 - 210) onto manifold (20 - 10 - 10).

5.3.10 Install check valves (20 - 10 - 40), check valve (20 - 10 - 270), and orifice check valves (20 - 10 - 260) onto manifold (20 - 10 - 10).

5.3.11 Install relief valve (20 - 10 - 30) onto manifold (20 - 10 - 10).

5.3.12 Install Polypak seal (20 - 20 - 10), rod bearing (20 - 20 - 30) and rod wiper (20 - 20 - 20) into the pump cylinder (20 - 10 - 20).

NOTE:
Refer to assembly drawing sheet 3 Detail A for correct orientation for Polypak lips.

5.3.13 Install backup rings (20 - 20 - 70) and O-rings (20 - 20 - 60) onto pump cylinder (20 - 10 - 20).

NOTE:

Refer to assembly drawing sheet 3 Detail D for correct location of these seals.

5.3.14 Install pump cylinder (20 - 10 - 20) onto manifold (20 - 10 - 10).

5.3.15 Install backup ring (20 - 20 - 50) and O-ring (20 - 20 - 40) onto cylinder pin (20 - 10 - 60).

NOTE:

Refer to assembly drawing sheet 3 Detail C for correct location of these seals.

5.3.16 Insert cylinder pin (20 - 10 - 60) into manifold (20 - 10 - 10) and pump cylinder (20 - 10 - 20).

5.3.17 Install retaining ring onto manifold (20 - 10 - 10).

5.3.18 Install position label (25 - 160) onto pump cover (25 - 140) using button head screw (25 - 430) and hex nut (25 - 440).

NOTE:

The label for Spring-Return Actuators will be mounted with the two-position ("AUTO" or "MANUAL") side of the label facing outward. If the actuator is a Double-Acting model then the three-position ("MANUAL CW", "AUTO" and "MANUAL CCW") side of the label will be facing outward.

5.3.19 Install pump cover (25 - 140) onto manifold (20 - 10 - 10) using four screws (25 - 240).

5.3.20 Insert pump rod (20 - 10 - 50) into pump cylinder (20 - 10 - 20).

5.3.21 Install pump handle lever (20 - 10 - 90).

5.3.22 Retain pump handle lever (20 - 10 - 90) to pump rod (20 - 10 - 50) using quick release pin (20 - 10 - 110).

NOTE:

The quick release pin can be installed in position 1, 2 or 3. Select position most appropriate for "effort" desired.

5.3.23 Install the control pointer (25 - 150) onto the control valve stem (20 - 10 - 280).

5.3.24 Install the control knob (25 - 200) onto the control valve stem (20 - 10 - 280).

5.3.25 Retain the control knob (25 - 200) on the control valve stem (20 - 10 - 280) with acorn nut (25 - 450) and lock washer (25 - 460).

5.3.26 Install the manifold (20 - 10 - 10) onto the mounting bracket (30 - 90) using four countersunk flat socket screws to retain the manifold to the mounting bracket.

5.3.27 Install the M18 package/mounting bracket (30 - 90) onto the actuator housing mounting pad using four socket cap screws (30 - 110) and lock washers (30 - 120).

NOTE:

If the M18 pump is equipped with Auto Reset then do steps 5.3.28 and 5.3.29 or if Non-Auto Reset M18 skip steps 5.3.28 and 5.3.29.

5.3.28 Install the male swivel elbow to the air pressure cylinder (80 - 90).

5.3.29 Install the bracket (80 - 50) on the reservoir side of the manifold (20 - 10 - 10) and retaining the bracket with two socket cap screws (80 - 10).

5.3.30 Reinstall any piping that was removed from the M18 package.

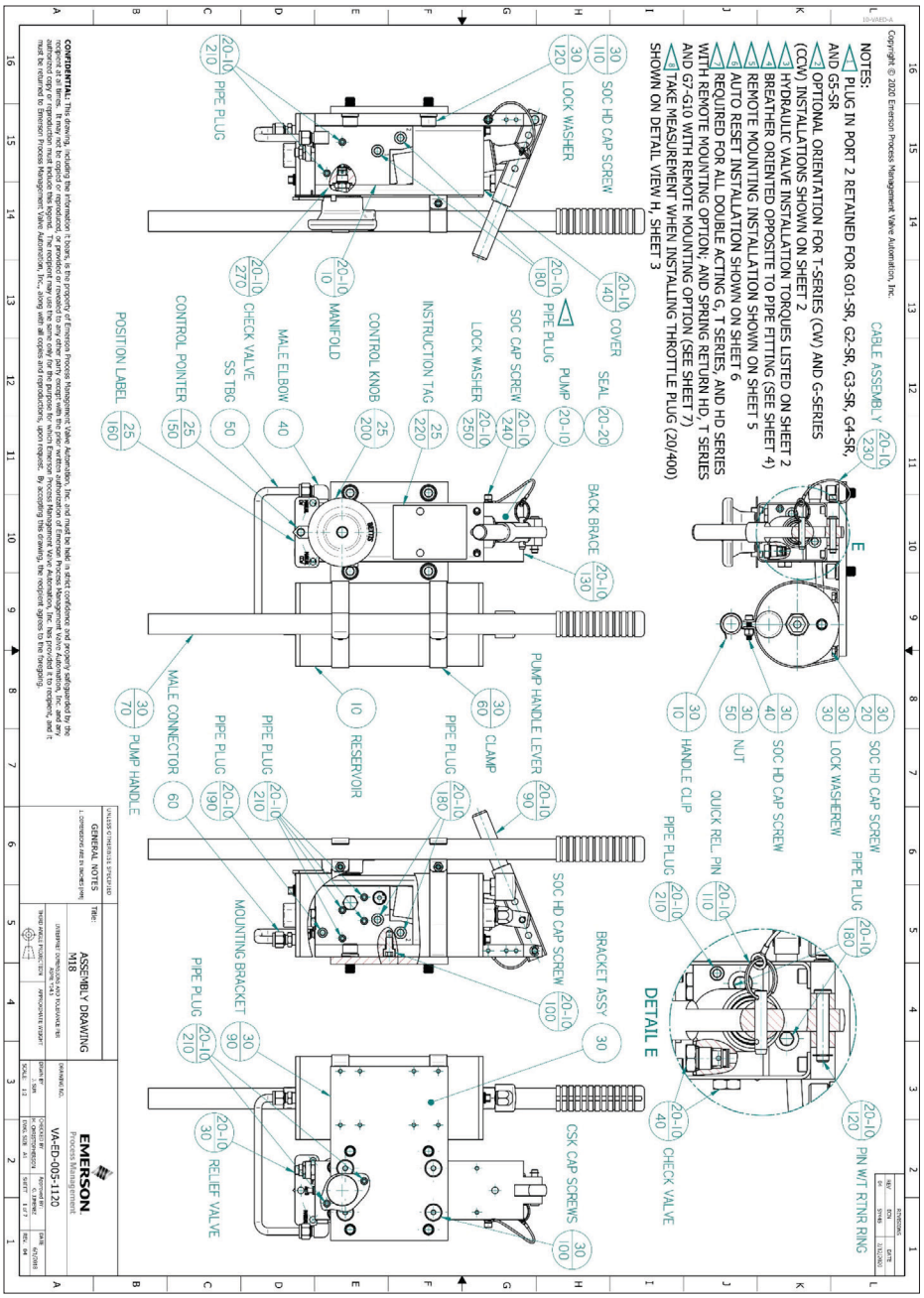
Table 1. M18 Hydraulic Override Stroke

		Pin Postion 1		Pin Postion 2		Pin Postion 3	
		M18		M18		M18	
	Override Module	Outboard Strokes	Inboard Strokes	Outboard Strokes	Inboard Strokes	Outboard Strokes	Inboard Strokes
Double Acting	G01DA-M18	25	20	12	9	9	7
	G2DA-M18	36	31	17	14	13	11
	G3DA-M18	63	53	30	25	23	19
	G4DA-M18	136	117	63	55	50	43
	G5DA-M18	275	231	128	107	100	84
	G7DA-M18	486	418	225	194	176	151
	G8DA-M18	784	663	363	307	283	240
	G10DA-M18	1,700	1,479	787	684	614	534
	G13DA-M18	3,886	3,454	1,798	1,598	1,402	1,246
Spring Return	G01SR-M18	23	N/A	11	N/A	9	N/A
	G2SR-M18	44	N/A	21	N/A	16	N/A
	G3SR-M18	74	N/A	35	N/A	27	N/A
	G4SR-M18	154	N/A	71	N/A	56	N/A
	G5SR-M18	319	N/A	148	N/A	115	N/A
	G7SR-M18	486	N/A	225	N/A	176	N/A
	G8SR-M18	784	N/A	363	N/A	283	N/A
	G10SR-M18	1343	N/A	622	N/A	485	N/A
	G13SR-M18	Consult Factory					

Appendix A: List of Drawings

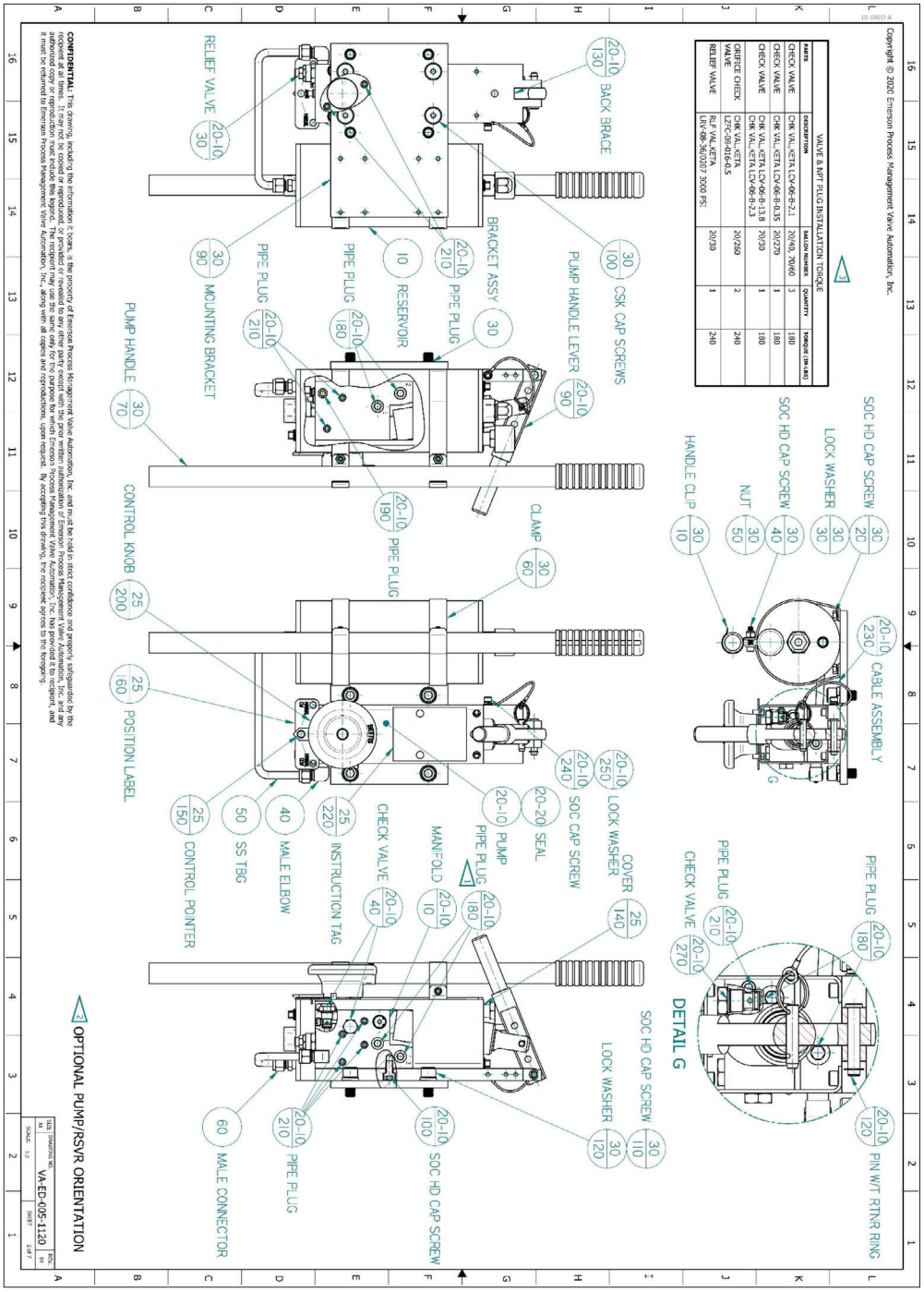
A.1 Part No. VA-ED-005-1120, M18 Assembly Drawing, Sheet 1 of 7

Figure A-1



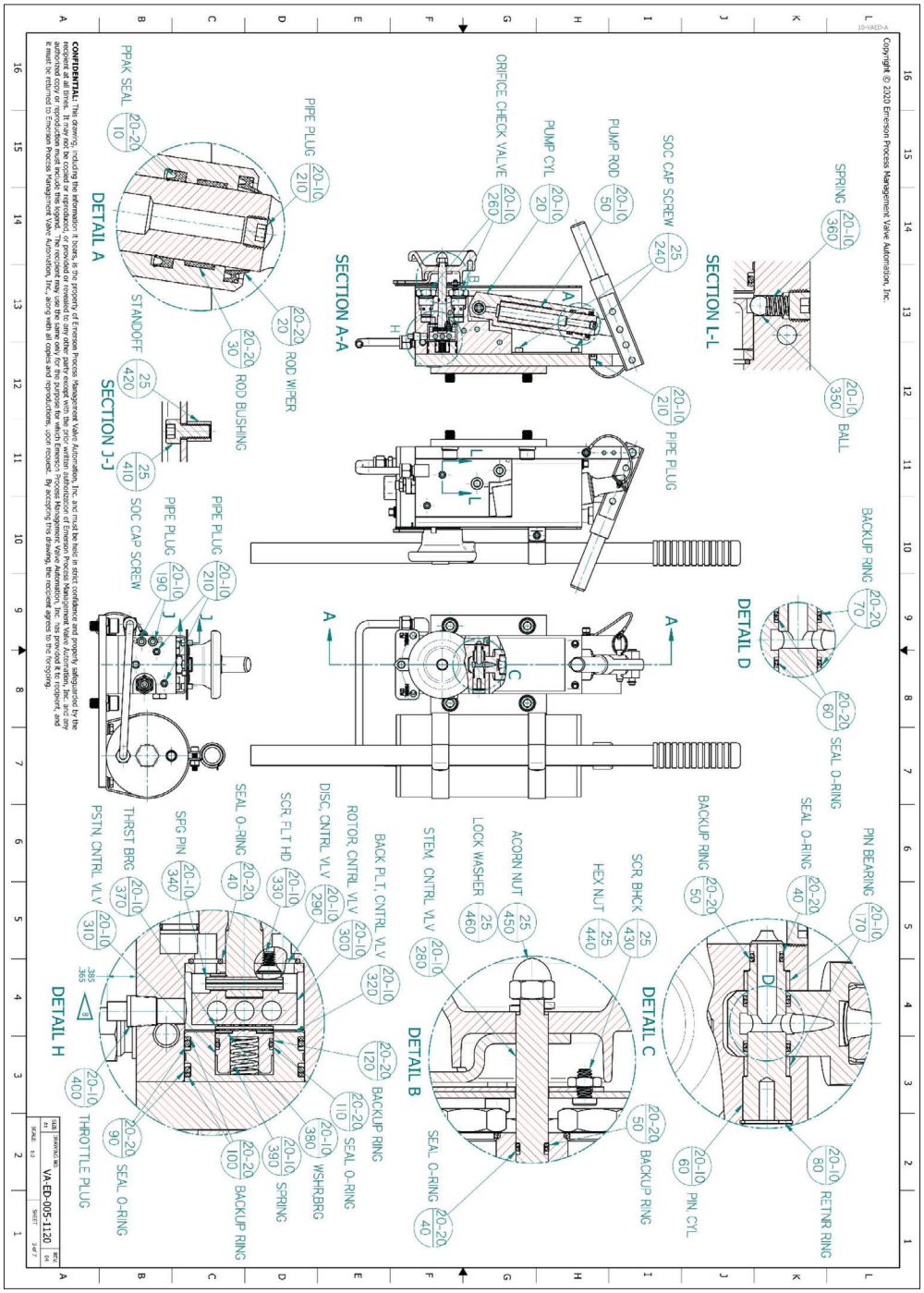
A.2 Part No. VA-ED-005-1120, M18 Assembly Drawing, Sheet 2 of 7

Figure A-2



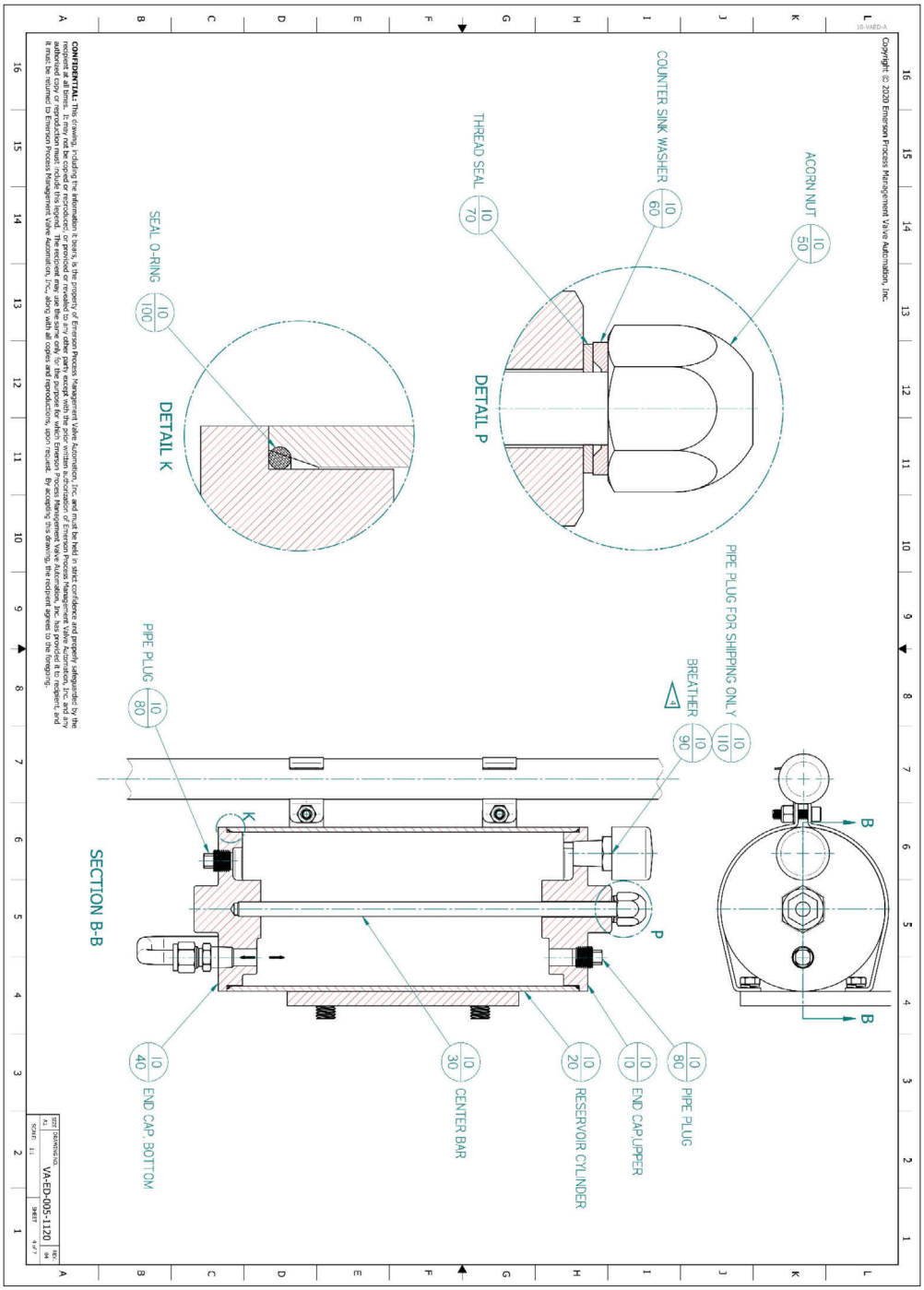
A.3 Part No. VA-ED-005-1120, M18 Assembly Drawing, Sheet 3 of 7

Figure A-3



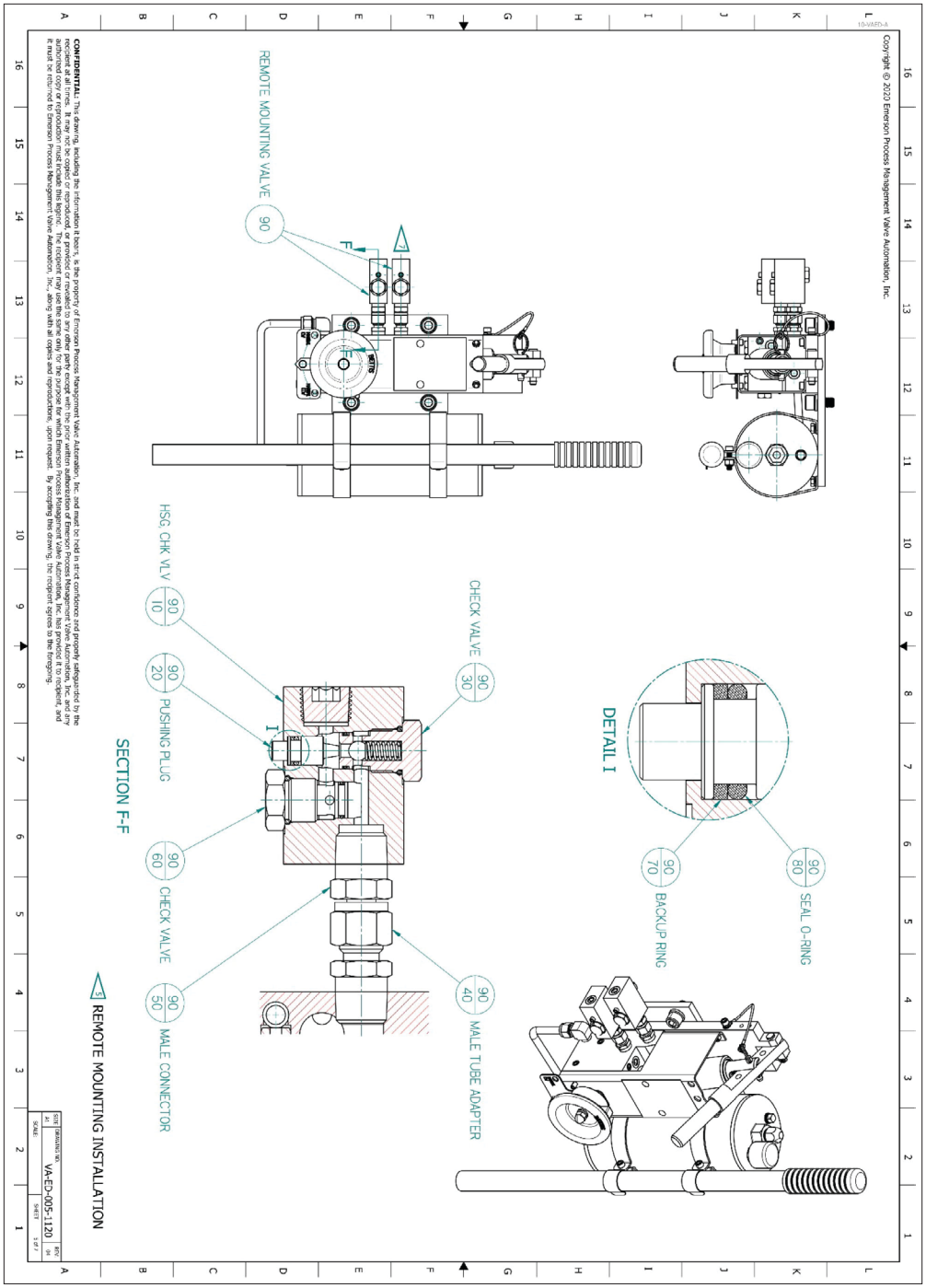
A.4 Part No. VA-ED-005-1120, M18 Assembly Drawing, Sheet 4 of 7

Figure A-4



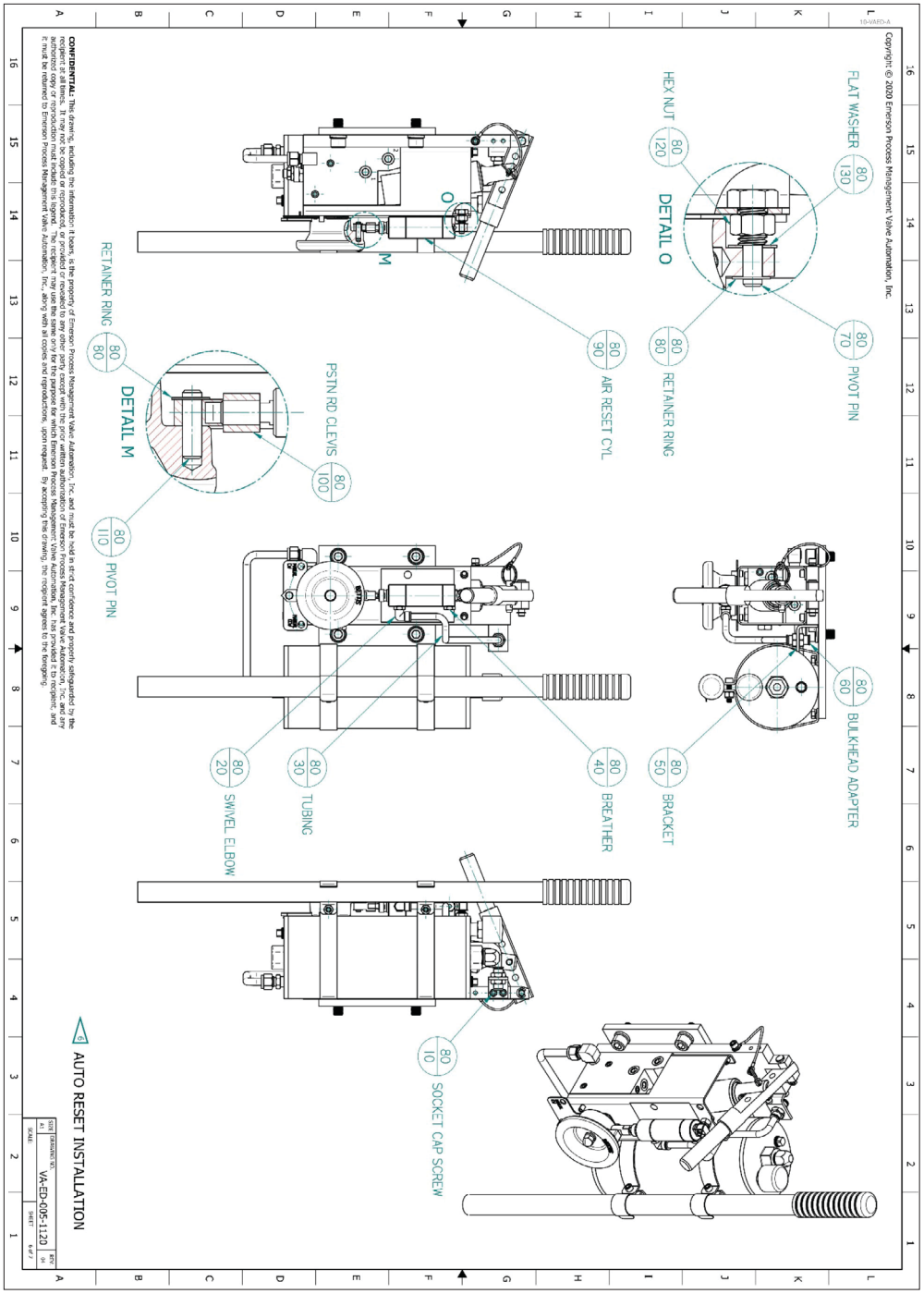
A.5 Part No. VA-ED-005-1120, M18 Assembly Drawing, Sheet 5 of 7

Figure A-5



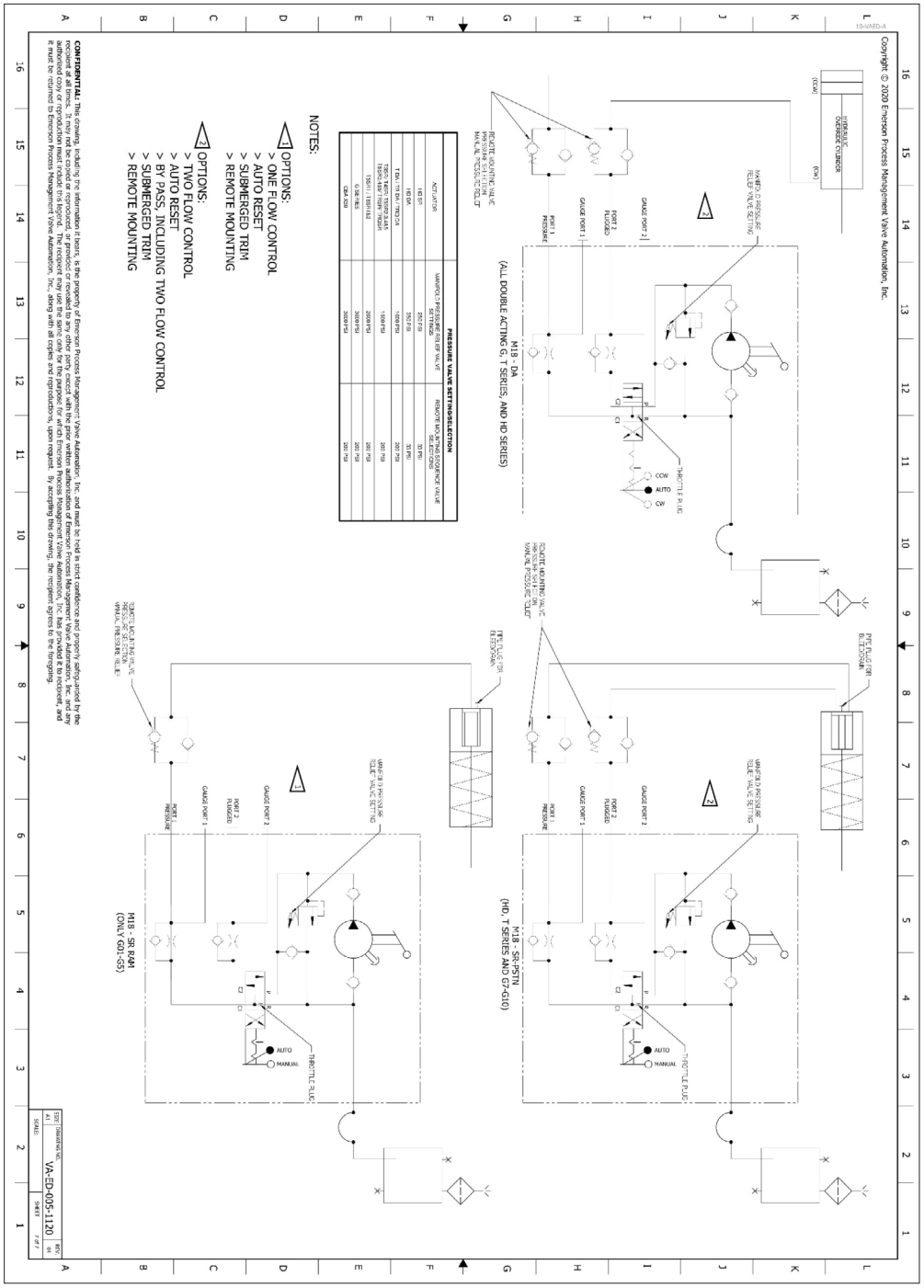
A.6 Part No. VA-ED-005-1120, M18 Assembly Drawing, Sheet 6 of 7

Figure A-6



A.7 Part No. VA-ED-005-1120, M18 Assembly Drawing, Sheet 7 of 7

Figure A-7



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