

BETTIS

M11D-S HYDRAULIC CONTROL

SYSTEM OPERATING INSTRUCTIONS

FOR “HD”, “T”, AND “G” SERIES

DOUBLE ACTING PNEUMATIC AND

HYDRAULIC ACTUATORS

PART NUMBER: 121962

REVISION: "A"

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1.0 INTRODUCTION

1.1 **SYSTEM DESCRIPTION:** M11D-S Hydraulic Control System is a compact, modular system designed for use with Bettis Double Acting Actuators. The system incorporates a piston type hand pump and a make-up oil reservoir necessitated by the differential volume of the hydraulic cylinder (the differential volume is due to the inboard piston rod displacement).

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 **SAFETY STATEMENT:** 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.

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

1.4 MAINTENANCE

1.4.1 Bettis does not recommend periodic field maintenance for the M11D-S module and pump.

1.4.2 The only time the M11D-S module or pump should be disassembled is when either the pump or the M11D-S module fails to perform its hydraulic control function. If maintenance is required.

1.4.3 When possible the M11D-S package should be returned to the factory for maintenance.

2.0 GENERAL INFORMATION

CAUTION: The M11D-S package must be mounted with the pump and reservoir upright and vertical. The reservoir fill plug must be removed and replaced, with the breather supplied, before operation.

2.1 Numbers in parentheses (), indicate the bubble number (reference number) used on the Bettis Assembly Drawing.

- 2.2 Bettis M11D-S System Assembly Drawing part number 121090.
- 2.3 M11D-S Hydraulic Control System Fluid Requirements: Hydraulic fluids, other than those listed in steps 2.3.1 and 2.3.2, should not be used without prior written approval of Bettis Product Engineering.
- 2.3.1 Standard and high temperature service (-35°F to +350°F) use Dexron Automatic Transmission Fluid.
- 2.3.2 Low temperature service (-65°F to +180°F) Use Exxon Univis J13 Hydraulic Fluid.

CAUTION: Apply thread sealant per the manufacture's instructions.

- 2.4 Do not use Teflon tape on threads, use a non-hardening thread sealant on all pipe threads.

3.0 **ACTUATOR POWER OPERATION**

- 3.1 Place the M11D-S control valve handle in the Auto position (middle position). NOTE: The control valve handle is located in front and below the M11D-S control block (10).

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

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

4.0 **ACTUATOR M11D-S MANUAL OPERATION**

- 4.1 Shut off and exhaust the operating media from both sides of the actuator's power cylinder.
- 4.2 Select actuator rotation desired by placing the control valve handle in the Manual CW or Manual CCW position.
- 4.3 Operate the M11D-S pump 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 noted. Continued operation of the pump simply circulates fluid through a high pressure relief.

5.0 **SYSTEM REFILLING**

- 5.1 Use either Refilling Method Number 1 (steps 5.2) or Refilling Method Number 2 (steps 5.3). Method number 1 is the best, most efficient and the recommended method.
- 5.2 REFILLING METHOD NUMBER 1. - Refilling of the M11D-S module and actuator hydraulic cylinder is best accomplished using a pressure pump.

NOTE: If a pressure pump is not available go to step 5.3 (method number 2) for the manual field service refilling procedure.

- 5.2.1 Actuator position as follows:
 - 5.2.1.1 Pneumatic and Hydraulic HD and T series actuators: Place the actuator in the counter-clockwise (CCW) position and proceed to step 5.2.2.
 - 5.2.1.2 Hydraulic G series actuators: Place the actuator in the counter-clockwise (CCW) position and proceed to step 5.2.2.
 - 5.2.1.3 Pneumatic G series actuators: Place the actuator in the clockwise (CW) position and proceed to step 5.2.2.
- 5.2.2 Shut off and exhaust the operating media from the actuator's power cylinder.
- 5.2.3 Remove the breather (150) from top of M11D-S module reservoir.
- 5.2.4 Attach the pressure pump discharge line to reservoir breather port.
- 5.2.5 Remove two pipe plugs located at each end and on top of the hydraulic cylinder.
- 5.2.6 Place the control valve handle in the "Auto" position.

WARNING: Step 5.2.7 is to use a self relieving regulator on the pressure pump and is to be set at a maximum of 3 to 5 psi pressure.

- 5.2.7 Slowly pump hydraulic fluid into the reservoir. As the fluid passes through the M11-S module into the cylinder, air will be displaced at the ports opened in step 5.2.5.
- 5.2.8 Continue to pump until all air has escaped from the cylinder and hydraulic fluid appears at the outboard port.
- 5.2.9 When hydraulic fluid appears install pipe plug, removed in step 5.2.5, into the cylinder's outboard port.
- 5.2.10 Continue to pump until hydraulic fluid appears at the cylinder's inboard port.
- 5.2.11 When hydraulic fluid appears install pipe plug, removed in step 5.2.5, into the cylinder's inboard port.
- 5.2.12 Remove the pressure pump.
- 5.2.13 Adjust reservoir fluid level as follows:
 - 5.2.13.1 Pneumatic and Hydraulic HD and T series actuators: Adjust fluid level to 1-1/2" (40mm) from top of reservoir with actuator in the counter-clockwise (CCW) position.
 - 5.2.13.2 Hydraulic G series actuators: Adjust fluid level to 1-1/2" (40mm) from top of reservoir with actuator in the counter-clockwise (CCW) position.
 - 5.2.13.3 Pneumatic G series actuators: Adjust fluid level to 1-1/2" (40mm) from top of reservoir with actuator in the clockwise (CW) position.

- 5.2.14 Re-install breather (150), removed in step 5.2.3, into the top of M11D-S module reservoir.
- 5.3 REFILLING METHOD NUMBER 2. - Refilling the M11D-S Hydraulic Control System during field service often must be done without the use of a pressure pump.
- 5.3.1 Actuator position as follows:
- 5.3.1.1 Pneumatic and Hydraulic HD and T series actuators: Place the actuator in the counter-clockwise (CCW) position and proceed to step 5.3.2.
 - 5.3.1.2 Hydraulic G series actuators: Place the actuator in the counter-clockwise (CCW) position and proceed to step 5.3.2.
 - 5.3.1.3 Pneumatic G series actuators: Place the actuator in the clockwise (CW) position and proceed to step 5.3.2.
- 5.3.2 Remove the breather (150) from top of M11D-S module reservoir.
- 5.3.3 Fill the reservoir approximately three-fourths (3/4) full.
- 5.3.4 Remove pipe plug located at outboard end and on top of the hydraulic cylinder.
- 5.3.5 Control valve position as follows:
- 5.3.5.1 Pneumatic and Hydraulic actuators for HD and T series place the control valve handle in the Manual CW position and proceed to step 5.3.6.
 - 5.3.5.2 Hydraulic G series actuators place the control valve handle in the Manual CW position and proceed to step 5.3.6.
 - 5.3.5.3 Pneumatic G series actuators place control valve handle in the Manual CCW position and proceed to step 5.3.6.
- NOTE: During the fill procedure, it is important that the lowest level be not less than approximately one-fourth (1/4) of the reservoir volume at any time.
- 5.3.6 Operate hand pump slowly. Keep pump handle up for about 4 to 5 seconds before each pressure stroke (not mandatory). This allows time for the pump cylinder to fill in order that full displacement of the pump is utilized.
- 5.3.7 Continue to operate hand pump until all air has escaped from the open port per step 5.3.4.
- 5.3.8 When fluid appears install pipe plug, removed in step 5.3.4, into the cylinder's outboard port.
- 5.3.9 Remove pipe plug located at inboard end and on top of the hydraulic cylinder.

5.3.10 Control valve position as follows:

5.3.10.1 Pneumatic and Hydraulic actuators for HD and T series place the control valve handle in the Manual CCW position and proceed to step 5.3.11.

5.3.10.2 Hydraulic G series actuators place the control valve handle in the Manual CCW position and proceed to step 5.3.11.

5.3.10.3 Pneumatic G series actuators place control valve handle in the Manual CW position and proceed to step 5.3.11.

NOTE: During the fill procedure, it is important that the lowest level be not less than approximately one-fourth (1/4) of the reservoir volume at any time.

5.3.11 Operate hand pump slowly. Keep handle up for about 4 to 5 seconds before each pressure stroke (not mandatory). This allows time for the pump cylinder to fill in order that full displacement of the pup is utilized.

5.3.12 Continue to operate hand pump until all air has escaped from the open port.

5.3.13 When hydraulic fluid appears install pipe plug, removed in step 5.3.9, into the cylinders' inboard port.

5.3.14 Adjust reservoir fluid level as follows:

5.3.14.1 Pneumatic and Hydraulic HD and T series actuators: Adjust fluid level to 1-1/2" (40mm) from top of reservoir with actuator in the counter-clockwise (CCW) position.

5.3.14.2 Hydraulic G series actuators: Adjust fluid level to 1-1/2" (40mm) from top of reservoir with actuator in the counter-clockwise (CCW) position.

5.3.14.3 Pneumatic G series actuators: Adjust fluid level to 1-1/2" (40mm) from top of reservoir with actuator in the clockwise (CW) position.

5.4 Additional M11D-S Instructions These steps are to be performed to insure air is removed from the system and to test the operation of M11D-S hydraulic control system.

5.4.1 Control valve position as follows:

5.4.1.1 Pneumatic and Hydraulic actuators for HD and T series place the control valve handle in the Manual CW position and proceed to step 5.4.2.

5.4.1.2 Hydraulic G series actuators place the control valve handle in the Manual CW position and proceed to step 5.4.2.

5.4.1.3 Pneumatic G series actuators place control valve handle in the Manual CCW position and proceed to step 5.4.3.

5.4.2 Operate M11D-S pump handle and the actuator should move clockwise (CW). Skip step 5.4.3 and continue at step 5.3.4.

- 5.4.3 Operate M11D-S pump handle and the actuator should move counter-clockwise (CCW).

CAUTION: Before pipe plug removal in step 5.4.4 have the ability to capture any fluid that might flow from the pipe plug hole, i.e. pan, rags, ect. Fluid will be under pressure.

- 5.4.4 Remove outboard pipe plug to release any trapped air from system and then replace the pipe plug.

- 5.4.5 Control valve position as follows:

5.4.5.1 Pneumatic and Hydraulic actuators for HD and T series place the control valve handle in the Manual CCW position and proceed to step 5.4.6.

5.4.5.2 Hydraulic G series actuators place the control valve handle in the Manual CCW position and proceed to step 5.4.6.

5.4.5.3 Pneumatic G series actuators place control valve handle in the Manual CW position and proceed to step 5.4.7.

- 5.4.6 Operate M11D-S pump handle and the actuator should move counter-clockwise (CCW). Skip step 5.4.7 and continue at step 5.4.8

- 5.4.7 Operate M11D-S pump handle and the actuator should move clockwise (CW).

CAUTION: Before pipe plug removal in step 5.4.8 have the ability to capture any fluid that might flow from the pipe plug hole, i.e. pan, rags, ect. Fluid will be under pressure.

- 5.4.8 Remove outboard pipe plug to release any trapped air from system and then replace the pipe plug.

- 5.4.9 Using M11D-S Hydraulic Module manually stroke the actuator full 90° degrees clockwise (CW) and then manually stroke the actuator full 90° degrees counter-clockwise (CCW).

- 5.4.10 Remove the breather (150) from top of M11D-S module reservoir.

- 5.4.11 Add fluid to reservoir so that level is within approximately 1 inch through 1-1/2 inches of fluid from the top of the reservoir.

- 5.4.12 Re-install breather (150), removed in step 5.4.8, into the top of M11D-S module reservoir.

- 5.4.13 Connect power supply lines back to the actuator control system or power cylinder and cycle the actuator using available power media.

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