

BETTIS

CONVERSION INSTRUCTIONS

TO CONVERT HD SERIES

ACTUATORS TO HD-M3, HD-SR-M3

HD-M3HW OR HD-SR-M3HW SERIES

PNEUMATIC ACTUATORS

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1.0 INTRODUCTION

- 1.1 This service procedure is offered as a guide to enable HD Series Double Acting actuator and Spring Return actuators to add jackscrew mechanical override (-M3 or -M3HW) to the pneumatic cylinder(s) or to add the jackscrew to the rod cover on models that are equipped with a rod cover.
- 1.2 The following HD Series actuator models can be converted using this instruction:

ACTUATOR MODEL (1) (2)	
HD521	HD521-SR
HD721	HD721-SR
HD522	HD722-SR
HD722	HD732-SR
HD731	

NOTE: (1) Includes actuator models that have a -10 or -11 suffix at the end of the model number.

(2) When the model number has "-S" as a suffix then the actuator is special and may have some differences that are not included in this procedure.

- 1.3 This procedure is applicable with the understanding that all electrical power and pneumatic pressure has been removed from the actuator.
- 1.4 This procedure should only be implemented by a technically competent technician who should take care to observe good workmanship practices.
- 1.5 Numbers in parentheses, (), indicate the bubble number (item reference number) used on Bettis Assembly Drawing, Exploded Detail Drawing, and Actuator Parts List.
- 1.6 Use a non-hardening thread sealant on all pipe threads.

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

- 1.7 Disassembly of actuator should be done in a clean area on a work bench when possible.

2.0 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.

3.0 **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 disassembly and reassembly. Close attention should be noted to the WARNINGS, CAUTIONS and NOTES contained in this procedure.**

WARNING: **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 customers representative and an authorized Bettis representative.**

4.0 **SUPPORT ITEMS AND TOOLS**

4.1 Support Items - Commercial leak testing solution, and non-hardening thread sealant.

4.2 Tools - All tools are American Standard inch. Mallet (rubber or leather), Chain wrench or Strap wrench.

5.0 **BETTIS REFERENCE MATERIALS**

5.1 Assembly drawing part number 036251 for models HD521 and HD721 Double Acting Series actuators.

5.2 Assembly drawing part number 036223 for model HD731 Double Acting Series actuators.

5.3 Assembly drawing part number 036278 for models HD522 HD722and HD732 Double Acting Series actuators.

5.4 Assembly drawing part number 036292 for HD521/721-SR(CW) fail clockwise Spring Return Series actuators.

5.5 Assembly drawing part number 040905 for HD521/721-SR(CCW) fail counter-clockwise Spring Return Series actuators.

5.6 Assembly drawing part number 036312 for HD522/722/732-SR(CW) fail clockwise Spring Return Series actuators.

5.7 Assembly drawing part number 040906 for HD522/722/732-SR(CCW) fail counter clockwise Spring Return Series actuators.

6.0 **LUBRICATION REQUIREMENTS**

6.1 LUBRICATION REQUIREMENTS: All temperature services use Bettis ESL-4,5 & 10 lubricant.

NOTE: Lubricants other than those listed in step 6.1 should not be used without prior written approval of Bettis Product Engineering.

7.0 CONVERSION INSTRUCTIONS FOR DOUBLE ACTING MODELS HD521, HD721, AND HD731

- 7.1 Use the following steps of this procedure to convert from a non jackscrew Double Acting HD model actuator to a HD Double Acting model with a jackscrew (-M3 or M3HW).
- 7.2 Remove rod cover (2-60) from the actuator using Section 12.0.
- 7.3 Install M3 rod cover to actuator using Section 15.0. NOTE: If M3 is not assembled in the new M3 rod cover do Section 13.0 prior to installing rod cover.
- 7.4 Remove cylinder (3) from the actuator using Section 11.0.
- 7.5 Install M3 cylinder assembly (3-10) to actuator using Section 16.0. NOTE: If M3 is not assembled in the new M3 cylinder assembly (3-10) complete Section 14.0 prior to installing M3 cylinder assembly.

8.0 CONVERSION INSTRUCTIONS FOR SPRING RETURN MODELS HD521-SR AND HD721-SR

- 8.1 Use the following steps of this procedure to convert from a non jackscrew HD Spring Return model actuator to a HD Spring Return model with a jackscrew (-M3 or M3HW).
- 8.2 Remove rod cover (2-60) from the actuator using Section 12.0.
- 8.3 Install M3 rod cover to actuator using Section 15.0. NOTE: If M3 is not assembled in the new M3 rod cover complete Section 13.0 prior to installing M3 rod cover.

9.0 CONVERSION INSTRUCTIONS FOR DOUBLE ACTING MODELS HD522, HD722, AND HD732

- 9.1 Use the following steps of this procedure to convert from a non jackscrew HD Double Acting model actuator to a HD Double Acting model with a jackscrew (-M3 or M3HW).
- 9.2 Remove both cylinders (3) from the actuator using Section 11.0.
- 9.3 Install two M3 cylinder assemblies (3-10) to actuator using Section 16.0. NOTE: If M3 is not assembled in the new M3 cylinder assembly (3-10) complete Section 14.0 prior to installing M3 cylinder assembly.

10.0 CONVERSION INSTRUCTIONS FOR SPRING RETURN MODELS HD722-SR AND HD732-SR

- 10.1 Use the following steps of this procedure to convert from a non jackscrew HD Spring Return model actuator to a HD Spring Return model with a jackscrew (-M3 or M3HW).
- 10.2 Remove cylinder (3) from the actuator using Section 11.0.
- 10.3 Install the M3 cylinder assembly (3-10) to actuator using Section 16.0. NOTE: If M3 is not assembled in the new M3 cylinder assembly (3-10) complete Section 14.0 prior to installing M3 cylinder assembly.

11.0 REMOVAL - PNEUMATIC CYLINDER

CAUTION: If not already removed disconnect all operating pressure from pneumatic cylinder (3).

- 11.1 Secure the chain wrench around cylinder (3) as close to the welded end cap as possible. Using a mallet, break the cylinder loose sufficiently so it can be removed.
- 11.2 Remove cylinder (3) from cylinder adapter (2-30) by rotating in a counter clockwise direction. NOTE: Cylinder (3) will be replaced by new M3 cylinder assembly (3-10).

12.0 REMOVAL - ROD COVER

- 12.1 Unscrew and remove four ferry cap screws (2-100) with seal gaskets (6-80) from rod cover (2-60).
- 12.2 Remove rod cover (2-60) taking care not to scratch the piston rod (2-10) and on HD521 and HD721 models taking care not to disengage the grooved bushing (2-50). NOTE: Rod cover (2-60) will be replaced by new M3 rod cover (2-60).

13.0 PRE-ASSEMBLY - M3 JACKSCREW TO ROD COVER

NOTE: If the M3 jackscrew is already assembled to the rod cover (2-60) then start at Section 15.0.

- 13.1 Apply a light coating of lubricant to the threads of jackscrew assembly (2-120).
- 13.2 Install jackscrew assembly (2-120) through the open end of rod cover (2-60), from the inside. Screw jackscrew into the rod cover end cap until the end of jackscrew assembly protrudes out of the rod cover (2-60).
- 13.3 Turn the jackscrew until the retaining nut comes into contact with the inside of rod cover (2-60).
- 13.4 Install seal nut (2-130) onto outboard end of M3 jackscrew assembly (2-120).
- 13.5 Rotate seal nut (2-130) until it is up against rod cover (2-60).
- 13.6 Rotate the slotted nut onto outboard end of the jackscrew assembly (2-120) with the nut slot facing toward the rod cover. Continue to rotate the slotted nut until one of the slots in the nut is aligned with the cross drilled "through hole" in the jackscrew assembly (2-120).

CAUTION: When aligning the slot and the cross drilled hole make certain that the back of the slot is at least one thread from being aligned with the hole.

- 13.7 Insert the spirol pin through the slotted nut and through jackscrew assembly (2-120).

NOTE: Check to verify that equal amounts of the spirol pin is exposed on both sides of the slotted nut and the jackscrew assembly (2-130).

- 13.8 Turn seal nut (2-130) until fully tight against rod cover (2-60).

NOTE: Lubricant may be left on jackscrew assembly (2-120) to provide additional corrosion protection.

14.0 PRE-ASSEMBLY - M3 JACKSCREW TO PNEUMATIC CYLINDER

NOTE: If the M3 jackscrew is already assembled into the M3 cylinder assembly (3-10) then skip this Section and start at Section 16.0.

- 14.1 Apply a light coating of lubricant to the threads of jackscrew assembly (3-20).
- 14.2 Install jackscrew assembly (3-20) through the open end of cylinder assembly (3-10), from the inside. Screw jackscrew assembly (3-20) into the cylinder end cap until end of the jackscrew assembly protrudes out of the end cap of cylinder assembly (3-10).
- 14.3 Rotate jackscrew assembly (3-20) until the retaining nut comes into contact with the inside of cylinder assembly (3-10).
- 14.4 Install seal nut (3-30) onto the outboard end of M3 jackscrew assembly (3-20). Rotate seal nut (3-30) until it is up against the end cap of cylinder assembly (3-10).
- 14.5 With the nut slot facing toward end cap of cylinder assembly (3-10) rotate the slotted nut onto outboard end of jackscrew assembly (3-20). Continue to rotate slotted nut until one of the slots in the nut is aligned with the cross drilled "through hole" in jackscrew assembly (3-20).

CAUTION: When aligning the slot and the cross drilled hole make certain that the back of the slot is at least one thread from being aligned with the hole.

- 14.6 Insert the spirol pin through the slotted nut and through jackscrew assembly (3-20).

NOTE: Check to verify that equal amounts of the spirol pin is exposed on both sides of the slotted nut and the jackscrew assembly (2-130).

- 14.7 Turn nut seal (3-30) until fully tight against end cap of cylinder assembly (3-10).

NOTE: Lubricant may be left on jackscrew assembly (3-20) to provide additional corrosion protection.

15.0 INSTALLATION - M3 ROD COVER

- 15.1 Install M3 rod cover (2-60) over left end of piston rod (2-10).
- 15.2 Install gasket seals (6-80) onto ferry cap screws (2-100).
- 15.3 Install and tighten ferry cap screws (2-100) into rod cover (2-60).

16.0 INSTALLATION - M3 PNEUMATIC CYLINDER

- 16.4 Push the piston (2-20) in towards the housing as far as it will go.
- 16.5 Coat the outer diameter threads and the entire inner diameter surface of the bore of cylinder assembly (3-10) with lubricant.

CAUTION: When installing the cylinder into the cylinder adapter be careful not to cross the threads. Exercise caution during cylinder installation to prevent pinching lip of the u-cup seal during installation. It is necessary to depress the seal lip while working the cylinder over it.

16.6 Install lubricated cylinder assembly (3-10) over piston (2-20). Rotate the cylinder assembly clockwise and screw into cylinder adapter (2-30).

16.7 Secure the chain wrench around cylinder (3-10) as close to the welded end cap as possible and tighten the cylinder assembly (3-10) into cylinder adapter (2-30).

NOTE: While the chain wrench is still positioned on the cylinder and after the cylinder is tight, take a mallet and rap (hit) the chain wrench handle twice. This will seat the cylinder assembly into the o-ring seal located in the cylinder adapter. Repeat this step if, during testing, the area between the cylinder assembly and the cylinder adapter is leaking.

17.0 INSTALLATION - M3 HANDWHEEL

17.1 For actuators equipped with a M3 jackscrew and require an optional handwheel, install the handwheel using the following procedure.

17.2 Place the handwheel (8-10) onto the M3 jackscrew and over nut (the handwheel hub has a cast hexagon hole that fits over the pinned nut).

17.3 Place lock washer (8-20) onto M3 jackscrew up against handwheel hub.

17.4 Place hex nut (8-30) onto the M3 jackscrew and thread up against lock washer, tighten until lock washer is flat.

18.0 GENERAL ACTUATOR TESTING

18.1 All areas, where leakage to atmosphere may occur, are to be checked using a commercial leak testing solution.

CAUTION: Pressure applied to the actuator is not to exceed the maximum operating pressure rating listed on the actuator name tag.

18.2 Unless otherwise listed all leak testing will use the nominal operating pressure (NOP) as listed on the actuator name tag or the pressure used by the customer to operate actuator during normal operation.

CAUTION: Test the actuator using a properly adjusted self relieving regulator, with gauge.

19.0 HD521, HD721 AND HD731 DOUBLE ACTING ACTUATOR TESTING

19.3 Before testing for leaks, alternately apply and release pressure, as defined in step 18.2, to the pressure side of the piston. Allow each application of pressure to stroke the actuator fully. Repeat this cycle approximately five times. This will allow the new seals to seek their service condition.

19.4 Apply pneumatic pressure, as defined in step 18.2, to the pressure inlet port in cylinder adapter (2-30).

NOTE: If excessive leakage is noted, generally a leak testing solution bubble which is formed over the area that is to be checked and this bubble breaks in three seconds or less after starting to form, the actuator must be disassembled and the cause of leakage must be determined and corrected.

19.5 Apply leak testing solution to the following areas:

19.5.1 Form a leak testing solution bubble over the inlet port hole in the outboard end of cylinder assembly (3-10).

19.5.2 The threaded joint between cylinder assembly (3-10) and cylinder adapter (2-30).

19.5.3 The joint between cylinder adapter (2-30) and housing (1-10).

19.6 Remove pressure from the pressure inlet port in cylinder adapter (2-30).

19.7 Apply pneumatic pressure, as defined in step 18.2, to the inlet port in outboard end of cylinder assembly (3-10).

NOTE: If excessive leakage is noted the actuator must be disassembled and the cause of leakage must be determined and corrected. Generally a leak testing solution bubble is formed over an area that is to be leak checked and the bubble should not break in three seconds or less after starting to form.

19.8 Form a leak testing solution bubble over the inlet port in cylinder adapter (2-30).

19.9 Remove pressure from the inlet port in the outboard end of cylinder assembly (3-10).

19.10 The actuator is now ready for returning to service.

20.0 HD522, HD722 AND HD732 DOUBLE ACTING ACTUATOR TESTING

20.3 Before testing for leaks, simultaneously apply pressure, as defined in step 18.2, to each side of the pistons to stroke the actuator fully in each direction. Repeat this cycle approximately five times. This will allow the new seals to seek their service condition.

20.4 Simultaneously apply pressure, as defined in step 18.2, to the pressure ports in the end of the right side cylinder assembly (3-10) and in the left side cylinder adapter (2-30).

NOTE: If excessive leakage is noted the actuator must be disassembled and the cause of leakage must be determined and corrected. Generally a leak testing solution bubble is formed over an area that is to be leak checked and the bubble should not break in three seconds or less after starting to form.

20.5 Apply leak testing solution to the following areas:

20.5.1 Pressure inlet port in the right side cylinder adapter (2-30).

20.5.2 Pressure inlet port hole in the end of the left side cylinder.

20.5.3 Threaded joint between the left side cylinder and left side cylinder adapter (2-30).

20.6 Remove pressure from the pressure ports in the end of the right side cylinder assembly (3-10) and in the left side cylinder adapter (2-30).

20.7 Simultaneously pressure, as defined in step 18.2, to the pressure ports in the end of the left side cylinder assembly (3-10) and in the right side cylinder adapter (2-30).

NOTE: If excessive leakage is noted the actuator must be disassembled and the cause of leakage must be determined and corrected. Generally a leak testing solution bubble is formed over an area that is to be leak checked and the bubble should not break in three seconds or less after starting to form.

20.8 Apply leak testing solution to the following areas:

20.8.1 Pressure inlet port in the left side cylinder adapter (2-30).

20.8.2 Pressure inlet port hole in the end of the right side cylinder, checks the piston to cylinder wall and piston to piston rod seals.

20.8.3 Threaded joint between the right side cylinder and the right side cylinder adapter (2-30).

20.9 Remove pressure from the pressure ports in the end of the right side cylinder assembly (3-10) and in the left side cylinder adapter (2-30).

20.10 The actuator is now ready for returning to service.

21.0 HD521-SR AND HD721-SR SPRING RETURN ACTUATOR TESTING

21.1 Before testing for leaks, alternately apply and release pressure, as defined in step 18.2, to the pressure side of the piston to stroke the actuator fully. Repeat this cycle approximately five times. This will allow the new seals to seek their service condition.

21.2 Apply pressure, as defined in step 18.2, to pressure inlet port located in cylinder adapter (2-30).

NOTE: If excessive leakage is noted the actuator must be disassembled and the cause of leakage must be determined and corrected. Generally a leak testing solution bubble is formed over an area that is to be leak checked and the bubble should not break in three seconds or less after starting to form.

21.3 Apply leak testing solution to the following areas:

21.3.1 Breather port hole in the end of the SR cylinder (4-10).

21.3.2 Threaded joint between the SR cylinder (4-10) and cylinder adapter (2-30).

21.4 Remove pressure from pressure inlet port located in cylinder adapter (2-30).

21.5 The actuator is now ready for returning to service.

22.0 HD722-SR AND HD732-SR SPRING RETURN ACTUATOR TESTING

22.1 Before testing for leaks, alternately apply and release pressure, as defined in step 18.2, to the pressure side of both pistons. Allow each application of pressure to stroke the actuator fully. Repeat this cycle approximately five times. This will allow the new seals to seek their service condition.

22.2 Simultaneously apply pressure, as defined in step 18.2, to the pressure port in the end of cylinder (3-10) and to the pressure port in the SR cylinder adapter (2-30).

NOTE: If excessive leakage is noted the actuator must be disassembled and the cause of leakage must be determined and corrected. Generally a leak testing solution bubble is formed over an area that is to be leak checked and the bubble should not break in three seconds or less after starting to form.

22.3 Apply leak testing solution to the breather port hole in the cylinder adapter (2-30).

22.4 Remove pressure from the pressure inlet ports.

22.5 The actuator is now ready for returning to service.

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