GH-BETTIS

SERVICE INSTRUCTIONS

DISASSEMBLY AND REASSEMBLY

FOR MODELS

KHD722 AND KHD732

FIREFOXX II K-MASS

DOUBLE ACTING SERIES

PNEUMATIC ACTUATORS

PART NUMBER: 074971

REVISION: "A"

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1.0 INTRODUCTION

1.1 This service procedure is offered as a guide to enable general maintenance to be performed on GH-Bettis KHD722, KHD722-M3, KHD722-M3HW, KHD732, KHD732-M3 and KHD732-M3HW Actuators. 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.

1.2 **SAFETY STATEMENT:** Products supplied by GH-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 GH-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.

1.3 **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.

1.4 **BASIC SERVICE INFORMATION: COMPLETE ACTUATOR REFURBISHMENT REQUIRES THE ACTUATOR BE DISMOUNTED FROM THE VALVE OR DEVICE IT IS OPERATING.**

1.5 The maximum recommended service interval for this actuator series is five years. Storage time is counted as part of the service interval.

1.6 This procedure is applicable with the understanding that all electrical power and pneumatic pressure has been removed from the actuator. Also, it is understood that the actuator has been removed from the valve as well as all piping and accessories that are mounted on the actuator have been removed.

2.0 SUPPORT ITEMS AND TOOLS

2.1 Support Items - Service Kit, commercial leak testing solution, latex window caulking and non-hardening thread sealant.

2.2 Tools - All tools are American Standard inch. Two each medium standard screwdriver, small standard screwdriver with corners rounded, putty knife, rubber or leather mallet and a torque wrench (up to 2,000 in.lbs.). For recommended tool list refer to page 10.

3.0 REFERENCE GH-BETTIS MATERIALS

3.1 Assembly Drawing Part Number 036278 ***** for HD722 and HD732 actuators.
3.2 Exploded Detail Drawing 063353 ***** for HD722 actuators.
3.3 Exploded Detail Drawing 068111 ***** for HD722-M3 and HD722-M3HW actuators.
3.4 Exploded Detail Drawing 063356 ***** for HD732 actuators.
3.5 Exploded Detail Drawing 068112 ***** for HD732-M3 and HD732-M3HW actuators.

***** These drawings will not show the K-Mass coating and related covers and hardware.

4.0 GENERAL

4.1 This procedure should only be implemented by a technically competent technician who should take care to observe good workmanship practices.

4.2 Numbers in parentheses, ( ) indicate the bubble number (reference number) used on the GH Bettis Assembly Drawing, Exploded Detail Drawing, and actuator Part List.

4.3 This procedure is written using the stop screw side of the housing (1-10) as a reference and this side will be considered the front side of the actuator. The housing cover (1-20) will be the top of the actuator.

4.4 To help in correct re-assembly; that is, with power cylinder on same end of housing as was, cylinder to cylinder adapter, cylinder adapter to housing, right and left stop screws, etc.. mark or tag for ease of re-assembly, also mark mating surfaces.

4.5 When removing seals from seal grooves, use a commercial seal removing tool or use a small screwdriver with the sharp edges rounded off.

4.6 Use a non-hardening thread sealant on all pipe threads. **CAUTION: Apply the thread sealant per the manufacture's instructions.**

4.7 Disassembly of actuator should be done in a clean area on a work bench.

4.8 Lubrication Requirements - GH-Bettis ESL-5 (Kronaplate 100). ESL-5 is contained in the GH-Bettis Service/Seal Kit.

4.9 It is a good practice to operate the actuator with the nominal operating pressure (NOP), as listed on the actuator name tag or the pressure used by the customer to operate the actuator during normal operation, before starting the general disassembly of the actuator. Notate and record any abnormal symptoms such as jerky or erratic operation. **NOTE: Pressure is not to exceed the maximum operating pressure rating listed on the name tag.**

5.0 GENERAL DISASSEMBLY

5.1 If not already done remove all operating pressure from actuator cylinder (3) or cylinder assemblies -M3 (3-10).

5.2 Actuators equipped with -M3HW jackscrew with handwheel option, remove hex nut (8-30), lockwasher (8-20), and handwheel (8-10).

5.3 The setting of stop screw (1-60) should be checked and setting recorded before stop screws are loosened or removed.

5.4 Removed the socket cap screws (1-120) from position indicator (1-110) yoke weather cover (6-110) and remove position indicator/yoke weather cover.

5.5 Remove snubber (1-130) from the housing (1-10).

5.6 Remove the latex caulking that covers all the hardware on the housing cover. Cut through the latex caulking that seals all joints where the actuator parts are disassembled.

6.0 PRESSURE CYLINDER DISASSEMBLY

6.1 The following steps may be performed on one cylinder and then on the other cylinder or simultaneously on both cylinders.

6.2 Secure the chain wrench around the cylinder (3) or cylinder assembly -M3 (3-10) as close to the welded end cap as possible. Using the mallet, break the cylinder loose and then remove the cylinder by rotating in a counter clockwise direction. When setting the cylinder aside, care should be taken to protect the chamfered edge and cylinder threads.

6.3 Unscrew and remove piston hex lock nut (2-70).

6.4 Remove the piston (2-20).

6.5 **NOTE: Identify each cylinder adapter (2-30) left or right and record the inlet port locations.** Unscrew and remove the four cylinder adapter ferry screws (2-90) and gasket seals (6-80) from the cylinder adapter (2-30).3

6.6 Remove the cylinder adapter (2-30), taking care not to scratch the piston rod (2-10) or disengage the rod bushings (2-40).

6.7 It is not necessary to disassemble the M3 Jackscrew (3-20) from the cylinder assembly -M3 (3-10) unless it needs maintenance or when replacing the nut seal (3-30). For disassembly of the M3 or M3HW jackscrew refer to section 13.0 M3 Jackscrew Disassembly.

7.0 HOUSING GROUP DISASSEMBLY

7.1 Remove cover screw (1-30) and gasket seals (6-100). On HD732 models the gasket seals will be item (6-80).

7.2 Remove the housing cover (1-20).

7.3 Move the yoke arms to the center position.

7.4 Remove the upper yoke roller (1-50).

7.5 Lift out the yoke pin (1-40).

7.6 Holding rod bushing (2-40) in place, pull the piston rod (2-10) out through the rod bushing (2-40).

7.7 Remove both rod bushings (2-40) from housing (1-10).

7.8 Remove the yoke (1-140) from the housing cavity.

7.9 Remove the lower yoke roller (1-50).

7.10 Remove the stop screws (1-60), jam nuts (1-70), and gasket seals (6-90). Be sure to identify the stop screws.

8.0 GENERAL REASSEMBLY

8.1 Remove and discard all old seals and gaskets, taking care not to scratch or damage seal grooves.

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

8.3 All parts should be thoroughly inspected. Particular attention should be directed to threads, sealing surfaces and areas that will be subjected to sliding motion. Sealing surfaces must be free of deep scratches, pitting, corrosion and blistering or flaking coating.

8.4 All K-Mass coated parts should be inspected for damage to the coating. Replace or repair all K-Mass parts that are damaged.

8.5 Before installing coat all surfaces of actuators moving parts with lubricant.

8.6 Coat all seals with lubricant, before installing into grooves.

9.0 CENTER HOUSING GROUP REASSEMBLY

9.1 If removed, install a pipe plug (1-100) into the drain port of the housing (1-10).

9.2 Coat one of the yoke o-ring seals (6-20) with lubricant and install into the housing (1-10).

9.3 Apply lubricant to the yoke bore in the housing (1-10) and the raised ribs in the bottom of the housing.

9.4 Lubricate the yoke (1-140) with a generous amount of lubricant to all bearing surfaces and yoke slots in the upper and lower arms.

9.5 Install the yoke (1-140) into the housing cavity. **NOTE: The wide yoke arm should be installed toward the top of the housing.**

9.6 Coat the piston rod bushings (2-40) with lubricant and install into both sides of the housing (1-10).

9.7 Coat one of the yoke rollers (1-50) with lubricant and place into the lower yoke arm slot nearest the cylindrical portion of the yoke.

9.8 Apply a light coat of lubricant to the piston rod (2-10) and install thru the bushings (2-40) in the housing (1-10).

9.9 Coat the yoke pin (1-40) with lubricant and install thru the piston rod (2-10) into the lower yoke roller (1-50).

9.10 Coat the remaining yoke roller (1-50) with lubricant and install over the yoke pin and into the slot in the upper yoke arm.

9.11 Install the stop screws (1-60), stop screw gasket seals (6-90), and stop screw jam nuts (1-70).

9.12 Coat the remaining yoke o-ring seal (6-20) with lubricant and install into the housing cover (1-20).

9.13 Coat the yoke bore in the housing cover (1-20) with lubricant.

9.14 Install the housing cover gasket (6-60) onto the top of housing (1-10).

9.15 Install the housing cover (1-20) onto the housing (1-10). Retain the housing cover with four cover screws (1-30) and gasket seals (6-80). **NOTE: For 522/722 actuators, the gasket seals will be item number (6-100).**

10.0 PRESSURE CYLINDER REASSEMBLY

10.1 The following steps may be performed on one cylinder and then on the other cylinder or simultaneously on both cylinders.

10.2 Coat the piston rod seal (6-30) with lubricant and install, lip first, into the cylinder adapter (2-30). **CAUTION: The energizer ring of the rod seal (6-30) must face the cylinder adapter (piston side).**

10.3 Install the adapter gasket (6-70) over the piston rod (2-10), rod bushing (2-40) and up against the housing (1-10).

10.4 **CAUTION: Care should be taken to not scratch or damage the piston rod when installing the cylinder adapter.** Install the cylinder adapter (2-30) over the end of the piston rod (2-10).

10.5 Arrange the position of the cylinder adapter (2-30) per the identification recorded in step 6.5 and retain with the cylinder adapter ferry screws (2-90) and gasket seals (6-80).

10.6 Coat the cylinder adapter o-ring seal (6-40) with lubricant and install into the cylinder adapter (2-30) in the groove at the inner end of the threads.

10.7 Coat the o-ring seal (6-50) with lubricant and install onto the piston rod (2-10).

10.8 Coat one piston u-cup seal (6-10) with lubricant and install into piston seal groove with the lip of the seal pointing outward toward the side of piston (2-20).

10.9 Coat the second u-cup seal (6-10) with lubricant and install into remaining piston seal groove with lip of the seal pointing outward toward the side of the piston (2-20).

10.10 **CAUTION: One side of piston (2-20) has a raised boss in the center that has a seal groove to accept an "O" ring. This side should be installed against the shoulder of the piston rod (2-10) and over o-ring seal (6-50).** Install the piston (2-20) onto piston rod (2-10).

10.11 **CAUTION: When installing hex lock nut (2-70) the teflon insert should rest up against piston (2-20).** Install hex lock nut (2-70) onto piston rod (2-10). Torque the hex lock nut (2-70) to approximately 146 foot pounds.

10.12 If the actuator had the M3 jackscrew removed from the cylinder (3-10), refer to paragraph 14.0 for reassembling the M3 into cylinder (3-10).

10.13 Apply a thin coating of lubricant to the bore of the cylinder (3) or cylinder assembly -M3 (3-10).

10.14 **CAUTION: Exercise care to prevent damage to the piston cup seal lip during cylinder installation. It is necessary to depress the seal lip while working the cylinder over it.** Install the cylinder (3) or cylinder assembly -M3 (3-10) over the piston (2-20).

10.15 **CAUTION: When using the chain wrench on the cylinder it should be secured as close to the welded end cap as possible.** Rotating the cylinder clockwise, screw the cylinder (3) or cylinder assembly -M3 (3-10) into the cylinder adapter and tighten with the chain wrench.

11.0 ACTUATOR TESTING

11.1 All areas, where leakage to atmosphere may occur, are to be checked using a leak testing solution. If excessive leakage is noted (generally a bubble which breaks three seconds or less after starting to form), the actuator must be disassembled and the cause of leakage must be determined and corrected.

11.2 Before leak testing may be accomplished, it will be necessary to provide a piping system whereby pressure may be applied simultaneously to all common pressure ports

11.3 All leak testing will use 65 psig pneumatic pressure.

11.4 Before testing for leaks, alternately apply and release the 65 psig pressure 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.

11.5 Simultaneously apply 65 psig pressure to the pressure ports in the end of the right side cylinder (3) or cylinder assembly -M3 (3-10) and in the left side cylinder adapter (2-30).

11.6 Apply leak testing solution to the following areas:

11.6.1 The pressure inlet port in the right side cylinder adapter (2-30), checks piston to cylinder and piston to piston rod seals.

11.6.2 The pressure inlet port hole in the end of the left side cylinder, checks the piston to cylinder wall and piston to piston rod seals.

11.6.3 The threaded joint between the left side cylinder and left side cylinder adapter (2-30), checks the cylinder to cylinder adapter o-ring seal.

11.6.4 The joint between the left cylinder adapter and the housing.

11.6.5 The snubber port hole located in the housing, checks the cylinder adapter to piston rod seal.

11.7 Remove pressure from the pressure ports in the end of the right side cylinder (3) or cylinder assembly -M3 (3-10) and in the left side cylinder adapter (2-30).

11.8 Simultaneously apply 65 psig pressure to the pressure ports in the end of the left side cylinder (3) or cylinder assembly -M3 (3-10) and in the right side cylinder adapter (2-30).

11.9 Apply leak testing solution to the following areas:

11.9.1 The pressure inlet port in the left side cylinder adapter (2-30), checks piston to cylinder and piston to piston rod seals.

11.9.2 The pressure inlet port hole in the end of the right side cylinder, checks the piston to cylinder wall and piston to piston rod seals.

11.9.3 The threaded joint between the right side cylinder and right side cylinder adapter (2-30), checks the cylinder to cylinder adapter o-ring seal.

11.9.4 The joint between the right side cylinder adapter and the housing.

11.9.5 The snubber port hole located in the housing, checks the cylinder adapter to piston rod seal.

11.10 Remove pressure from the pressure ports in the end of the right side cylinder (3) or cylinder assembly -M3 (3-10) and in the left side cylinder adapter (2-30).

11.11 If an actuator was disassembled and repaired, the above leakage test must be performed again.

12.0 RETURN TO SERVICE

12.1 Replace the software components of the snubber (1-130) and then install the snubber into the housing (1-10).

12.2 Adjust both stop screws (1-60) back to settings recorded in section 5 under General Disassembly.

12.3 Tighten both jam nut (1-70) securely, while holding stop screws (1-60).

12.4 Rotate the yoke to the full clockwise (CW) position. Position the yoke weather cover (6-110) and position indicator (1-110) on the yoke (1-140) with the pointer facing the piston rod and perpendicular to the cylinder assemblies.

12.5 Install and tighten yoke position indicator/yoke weather cover screws (1-120). **NOTE: These screws will need to be rechecked for tightness after the actuator has been cycled.**

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

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

12.6.2 Place lockwasher (8-20) onto M3 up against handwheel hub.

12.6.3 Place hex nut (8-30) onto M3 and thread up against lockwasher.

12.7 Install any K-Mass covers and hardware removed during this procedure.

12.8 Using a tube of latex window caulk, seal all joints that where removed or cut through during disassembly.

12.9 The actuator is now ready for returning to service.

12.10 After the actuator is installed on the valve all accessories should be hooked up and tested for proper operations and replaced, if found defective.

13.0 M3 JACKSCREW DISASSEMBLY

13.1 Refer to Figure M3-3 page 9 for drawing of M3 assembly.

13.1.1 With the cylinder (3-10) on a work bench, lubricate jackscrew assembly (3-20) threads with lubricant.

13.1.2 Using a 3/16 inch pin punch, drive out and remove the spirol pin from the outboard slotted nut.

13.1.3 Remove the slotted nut from the jackscrew assembly (3-20).

13.1.4 Loosen and remove the jam nut (3-30) from jackscrew assembly (3-20).

13.1.5 Screw the jackscrew assembly (3-20) into the cylinder (3-10) until it is disengaged from the cylinder end cap.

13.1.6 Remove the jackscrew assembly (3-20) from the open end of the cylinder (3-10).

14.0 M3 JACKSCREW REASSEMBLY

14.1 Refer to Figure M3-3 on page 9.

14.1.1 Apply a light coating of lubricant to the threads of jackscrew assembly (3-20).

14.1.2 Insert the jackscrew assembly (3-20) through the open end of cylinder (3-10). Screw the jackscrew into the cylinder end cap until the end of the assembly protrudes out of the end cap of the cylinder.

14.1.3 Turn the jackscrew until the M3 retainer comes into contact with the inside of the cylinder end cap.

14.1.4 Install seal nut (3-30) onto the jackscrew assembly (3-20). Screw the seal nut until it is up against the cylinder end cap.

14.1.5 Screw the slotted nut onto the outboard end of the jackscrew stud until one of the slots in the nut is aligned with the cross drilled "thru hole" in the stud. **NOTE: The nut slots will be facing toward the cylinder end cap.**

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.

14.1.6 Insert the spirol pin thru the slotted nut and thru the jackscrew stud making sure that equal amounts of the spirol pin is exposed on both sides of the slotted nut and the jackscrew stud.

14.1.7 Turn nut seal until fully tight against end cap.

14.1.8 If desirable, wipe away excess lubricant on jackscrew after operation. If preferred, lubricant may be left on jackscrew to provide additional corrosion protection.

FIGURE M3-3

KHD522 & KHD722 TOOL STYLE AND WRENCH SIZE

ITEM NO.	WRENCH SIZE	QTY	DESCRIPTION	RECOMMENDED WRENCH STYLE
1-30	9/16"	4	Cover screws	Socket
1-60	1/2"	2	Stop screw	Open end or adjustable
1-70	15/16"	2	Stop screw nut	Open end or adjustable
1-100	7/16"	1	Pipe plug	Open end
1-120	3/16"	4	Weather cover screws	Allen
1-130	7/8"	1	Snubber Valve	Deep Socket
2-70	1-1/4"	2	Piston rod lok nut	Socket
2-90	7/16"	8	Cyl adapter screws	12 Point socket (1)
2-110	7/16"	2	Pipe plugs	Open end
3	(1)	1	Cylinder	Chain (2)
3-10	(1)	1	Cylinder with M3	Chain (2)
3-30	1-13/16"	1	M3 Seal nut	Open end or adjustable
8-30	1-11/16"	1	M3 handwheel jam nut	Open end or adjustable

KHD732 TOOL STYLE AND WRENCH SIZE

ITEM NO.	WRENCH SIZE	QTY	DESCRIPTION	RECOMMENDED WRENCH STYLE
1-30	3/4"	4	Cover screws	Socket
1-60	7/8"	2	Stop screw	Open end or adjustable
1-70	1-5/16"	2	Stop screw nut	Open end or adjustable
1-100	7/16"	1	Pipe plug	Open end
1-120	3/16"	4	Weather cover screws	Allen
1-130	7/8"	1	Snubber Valve	Deep socket
2-70	1-5/8"	2	Piston rod lok nut	Socket
2-90	1/2"	8	Cyl adapter screws	12 Point socket (1)
2-110	7/16"	2	Pipe plugs	Open end
3	(1)	1	Cylinder	Chain (2)
3-10	(1)	1	Cylinder with M3	Chain (2)
3-30	1-13/16"	1	M3 seal nut	Open end or adjustable
8-30	1-11/16"	1	M3 Handwheel jam nut	Open end or adjustable

(1) No alternate style recommended

(2) GH-Bettis recommends a #11 Titan chain wrench with a 40" chain

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