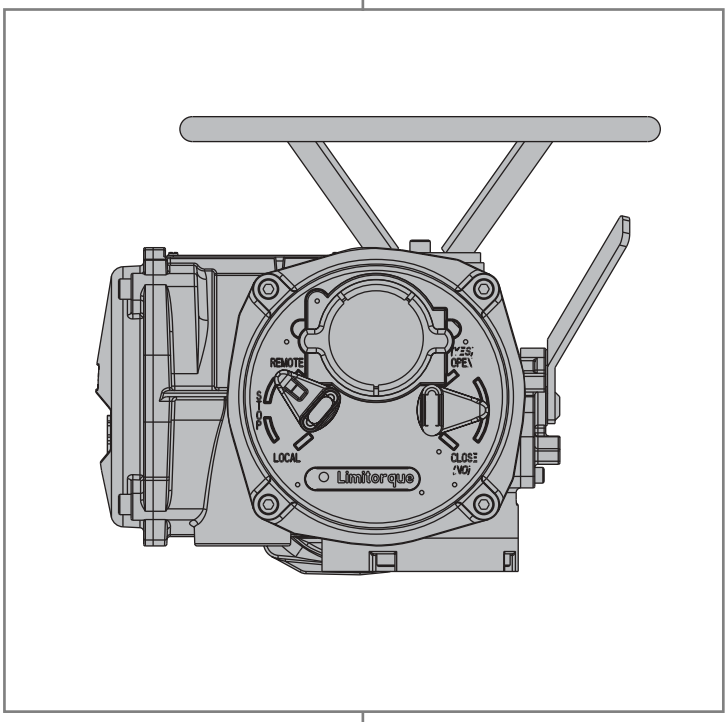
FLOWSERVE

Limitorque Actuation Systems

130-12000
Rev. B
11/02



Limitorque®

Accutronix MX

Maintenance & Spare Parts Manual

Accutronix MX Maintenance & Spare Parts Manual

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1 Introduction

1.1 Premise

The MX actuator components are separated into subassembly groupings. This manual covers the **Removal** and **Remounting** procedures for each subassembly group. Use these instructions when disassembly is required for servicing, maintenance, or parts replacement.

1.2 Important Notes & Warning Statements

Please read this Maintenance & Spare Parts Manual carefully and completely before attempting to store or perform maintenance on your Limitorque valve actuator. Further installation, setup, and operation instructions are available in the Installation & Operation manual (130-11000) located in the actuator terminal compartment at shipment.

> ⚠ **WARNING: Be aware of electrical hazards within the actuator and high-pressure hazards of the attached valve or other actuated device when installing or performing maintenance on your MX actuator. Failure to observe these precautions could result in serious bodily injury, damage to the equipment, or operational difficulty.**

> ⚠ **WARNING: Do not manually operate actuator with devices other than installed handwheel and declutch lever. Using additive force devices (cheater bars, wheel wrenches, pipe wrenches, or other devices of this nature) on the actuator handwheel or declutch lever may cause serious personal injury and/or damage to the actuator or valve.**

1.3 Procedure Emphasis

Please refer to the following methods used to emphasize text throughout this manual. Safety warnings, cautions, and notes present material that is important to user-safety. Be sure to read any safety notices you see as they could prevent equipment damage, personal injury, or even death to you or a co-worker.

Safety notices are presented in this manual in three forms:

> ⚠ **WARNING: Refers to personal safety. Alerts the user to potential danger. Failure to follow warning notices could result in personal injury or death.**

> **CAUTION: Directs the user's attention to general precautions that, if not followed, could result in personal injury and/or equipment damage.**

> **NOTE**: Highlights information critical to the user's understanding of the procedure.

Bold text stresses attention to the details of the procedure.

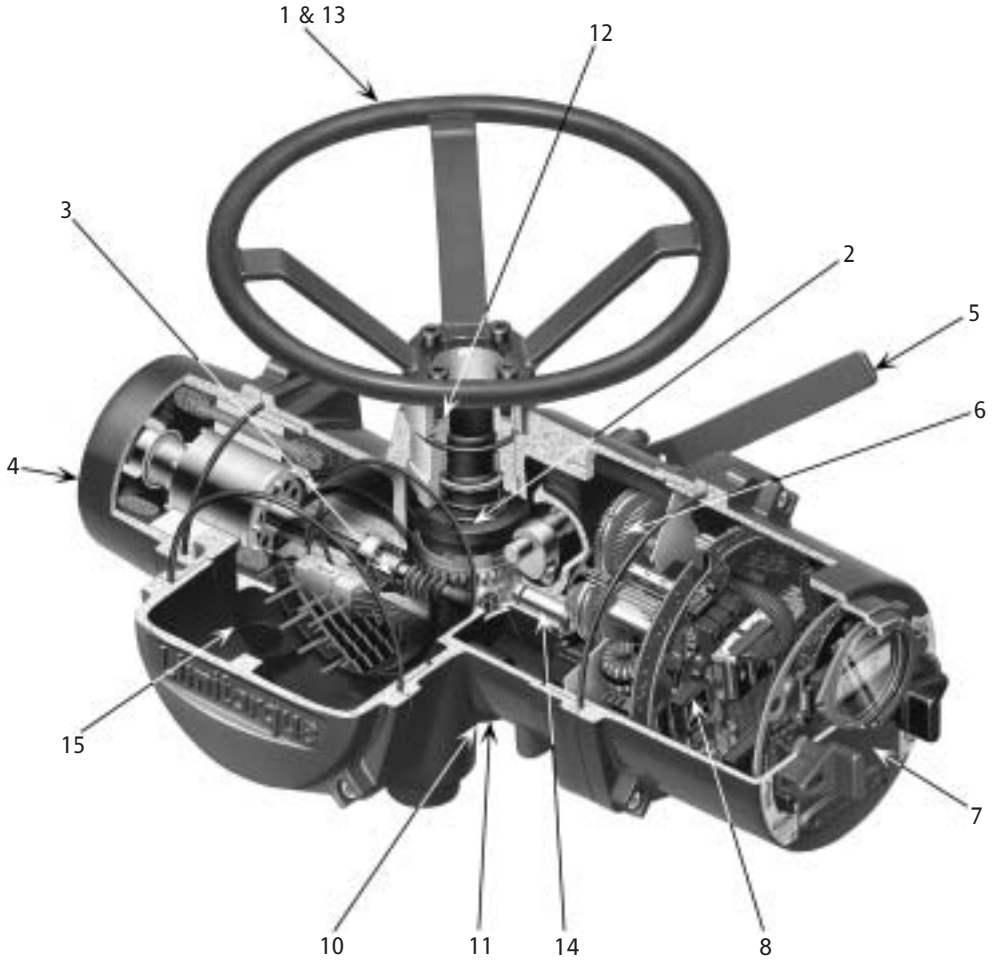
1.4 Reference Documents

- Accutronix Protection, Control & Monitoring features of MX Electric Actuators (Bulletin 130-00500)
- Accutronix MX Control, Performance & Value in Multi-turn Electric Valve Actuators (Bulletin 130-10500)
- Accutronix MX Installation Manual (Bulletin 130-11000)

The latest revisions to these documents are available on-line from Limitorque's web site, www.limitorque.com.

2 Accutronix MX Actuator Subassembly

Figure 2.1 – Accutronix MX-05 Actuator



2.1 MX Actuator Subassembly Components

1. Top-mounted handwheel
2. Drive sleeve
3. Worm shaft
4. Motor
5. Declutch Lever
6. Encoder
7. Accutronix Control Panel (ACP)
8. Control module
10. Optional bases
    Torque Base type:
    - B1 = ISO 5210 base (fixed bore & key)

    Thrust Base type:
    - A1 = Standard thrust base
    - A1E = Entended-reach thrust base

11. Baseplate-type B4 with stem nut options type:
    - B4 = stem nut with variable bore and key
    - B4E = extended-reach stem nut with variable bore and key
    - BL = splined stem nut (SAE or Involute)
12. Handwheel adapter/handwheel worm gear
13. Side-mounted handwheel (not shown)
14. Encoder drive cartridge
15. Terminal block

2.2 Product Information

2.2.1 Product Description

Your MX actuator controls the opening and closing travel of valves and other actuated devices. OPEN and CLOSED limits are protected by an absolute encoder that provides optical sensing of valve position and measures valve position in both motor and handwheel operation. No battery or backup power supply is required. Output torque is derived from motor speed, temperature, and voltage. If the preset torque is exceeded, the motor shuts off. As a result of this reliable and advanced protection technology, all valve and other actuated devices are protected from potential damage from overload, improper seating, and foreign obstructions.

A range of control and network options are available and very simply added to the control capabilities already available on a standard actuator. Contact your local Limitorque distributor or Limitorque sales office for further information.

2.2.2 Storage

Storage Recommendations

Your MX actuator is double-sealed and weatherproof as shipped providing all compartment covers and cable entry plugs are left intact. Actuators should be stored in a clean, dry, protected warehouse until ready for wire-up. If actuators must be stored outdoors, they should be stored off the ground, high enough to prevent being immersed in water or buried in snow.

If your unit incorporates a rising stem application, it may be shipped with a plastic cap over the drive sleeve. If so, install a pipe plug or protective stem cover to protect the drive sleeve from possible corrosion.

Preferred Storage Orientation

Your MX actuator should be stored with the motor and terminal compartment in the horizontal position to obtain optimum service life.

2.2.3 Unit Weights

Table 2.1 – Unit weights

Unit	Lbs	Kg
MX-05	52	24
MX-10	65	29
MX-20	109	49
MX-40	133	60
MX-85	259	117
MX-140	300	136

NOTE: Weights include stem nut and lubricant.

2.3 Product Identification

2.3.1 Initial Inspection & Recording Suggestions

Upon receipt of the actuator, several steps should be initially followed to ensure condition of equipment and to establish proper record keeping.

1. After removing the actuator from the shipping carton or skid, thoroughly examine it for any physical damage which may have occurred during shipment. If you note any damage, immediately report the damage to the transport company and call Limitorque for further assistance.

2. A nameplate with important information is attached to each actuator. Record the following information for use when you need to contact Limitorque with any questions about your actuator:

- Unit type/size
- Limitorque order number
- Serial number

Figure 2.2 – Accutronix MX Nameplate



2.4 Maintenance

2.4.1 Recommended Maintenance

Under normal operating conditions, the MX is a maintenance-free actuator. Therefore, for normal applications, no formal actuator maintenance is required; although visual inspection for oil leakage and excessive noise is recommended every 1 million drive sleeve turns or every 3000 cycles. When conditions are severe, due to frequent operation or high temperatures, inspect the oil level and oil quality more often. Replace any seals that permit oil leakage or water ingress. When installing pipe plugs, use Teflon® tape or paste to achieve a proper seal.

2.4.2 Unit Lubrication

Check for proper oil level every 1 million drive sleeve turns (reference Installation & Operation Manual - Diagnostics Section to learn how to view drive sleeve turns data). **Change oil every 6000 unit cycles** or if water or other foreign material is found during oil inspection.

Oil Level Inspection & Fill Criteria
(Reference Lubrication Data tables on pages 2-4 & 2-5 for oil capacities when mounted in varying positions)

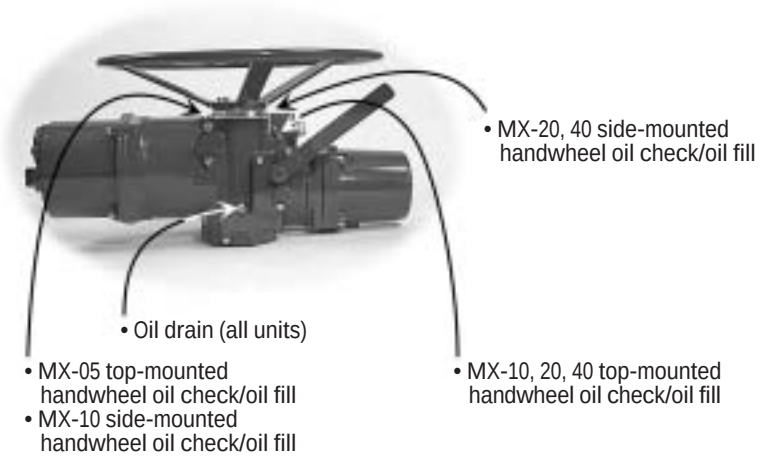
- Actuator viewed in upright position (top-mounted handwheel up)
  Oil level should be approximately 1 inch (25.4 mm) below the outer surface of the housing at the oil fill port.

  NOTE: Do not overfill with oil because oil will expand during actuator operation. Actuators are shipped with an oil volume suitable for any mounting position. When checking the factory-supplied oil level, excess oil may drain from the highest oil fill port due to the various mounting orientations of each application.

- Actuator viewed in side-mounted position (terminal compartment up)
  Oil level should be up to the bottom of the oil fill plug.

- Actuator viewed in all other positions than described previously should have the oil capacities maintained. Fill through the highest oil fill port until the oil is at a level that will contact the bottom of the pipe plug when installed in oil fill port.

Figure 2.3 – Oil Fill/Plug Locations



Lubrication Data

• Oil Specifications

MX actuators are oil-filled using Mobile SHC-632, which is a synthetic oil suitable for ambient temperatures of -22˚F to 250˚F (-30˚C to 120˚C). For extreme low temperature conditions, alternative lubricants are available – consult factory for further information.

Table 2.2 – MX-05 & 10 Oil Capacities when using Oil Fill/Plug Ports

Nominal Oil Capacities	oz.	liters
MX-05	10	0.3
MX-10	16	0.5

Table 2.3 – MX-20 Oil Capacities when using Oil Fill/Plug Ports

Nominal Oil Capacities	oz.	liters
Top-mounted handwheel with handwheel up	38	1.1
Top-mounted handwheel with terminal compartment up	47	1.4
Side-mounted handwheel with terminal compartment up	43	1.3

Table 2.4 – MX-40 Oil Capacities when using Oil Fill/Plug Ports

Nominal Oil Capacities	oz.	liters
Top & side-mounted handwheel with handwheel up	40	1.2
Top-mounted handwheel with terminal compartment up	53	1.6
Side-mounted handwheel with terminal compartment up	53	1.6

Table 2.5 – MX-85 & 140 Oil Capacities when using Oil Fill/Plug Ports

Nominal Oil Capacities	oz.	liters
All Configurations	192	5.7

2.4.3 O-Ring & Lubrication

O-rings and seals should be replaced anytime an actuator is disassembled. Lubricate with a substance that is compatible with Buna N seals.

2.5 Subassembly Removal & Remounting Procedures

This manual divides each MX actuator subassembly into a **Removal** and **Remounting** procedure. Use the following procedures to remove subassemblies for inspection, repair or replacement. Some subassemblies require prior subassembly removal before allowing the desired subassembly removal. Note the **First Remove** instructions at the beginning of each subassembly removal procedure. Remove these subassemblies first, then remove the desired subassembly according to the instructions. Once removed, evaluate subassembly components to determine requirement for a new subassembly. If a new subassembly is required, see **Section 2.6, How to Order Replacement Subassemblies.** Once components have been identified and replaced, remount following the appropriate **Remounting** procedures.

2.6 How to Order Replacement Subassemblies

2.6.1 Replacement Parts

Replacement parts are sold in modular subassemblies; therefore, when part replacement is required, order parts at the subassembly levels as shown in this manual. Parts may be ordered from your local Limitorque representative (see web site at http://www.limitorque.com) or direct from the factory:
Telephone: 1-434-528-4400
Fax: 1-434-845-9736

Please have the following information, found on the actuator nameplate, available to help us facilitate your order:
- Unit type/size
- Limitorque order number
- Serial number

2.6.2 Return Procedure

When parts are identified for warranty or other component replacement, a Return Material Authorization (RMA) must be obtained from Limitorque. **All returned parts must be accompanied by documentation with the following information to obtain credit for returned goods:**

- Return Material Authorization (RMA)
- Unit type/size
- Limitorque order number
- Serial number

Return parts to the address listed below:
Limitorque
5114 Woodall Road
Lynchburg, VA 24502

3 Remove Actuator from Mounting Adapter

3.1 Actuator Removal with Type B1/B4/B4E Base (Torque)

3.1.1 Removal (Type B1/B4/B4E Base)

STEP 1

⚠ WARNING Hazardous Voltage! Turn off all power sources to actuator before removing actuator from mounting plate. Power sources may include: Main power or control power. If necessary, disconnect incoming power leads L1, L2, L3, and control wiring from the terminal block.

Remove the bolts that secure the actuator to the mounting adapter. If type B1 or B4E base is used in addition to the standard type B4 baseplate, you may leave the B1 base attached to the mounting adapter and remove the actuator only. Or if required, you may remove the bolts that mount type B1 base to mounting adapter. This will allow actuator removal along with optional B1 base.



STEP 2

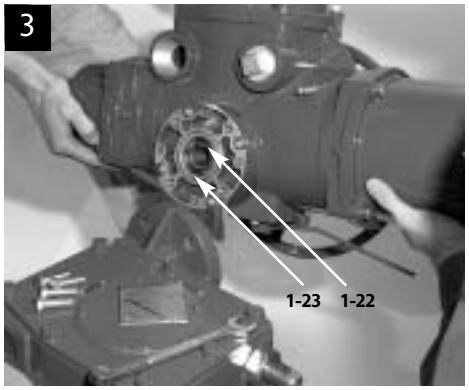
⚠ WARNING Potential high pressure vessel! Before disassembling your actuator, ensure that the valve or other actuated device is isolated and is not under pressure.

Lift actuator from mounting adapter.



3.1.2 Remounting (Type B1/B4/B4E Base)

STEP 3
Ensure stem nut (#1-22) is secured inside actuator drive sleeve with retaining ring (#1-23). Lower actuator onto the mating component, making sure to align stem nut key and keyway with mating component.



STEP 4
Ensure that the actuator and mounting adapter flange mating holes are aligned correctly.



STEP 5
⚠ **WARNING: Hazardous Voltage! Turn off all power sources before rewiring incoming power leads L1, L2, L3, and control wiring in the terminal block.**

Secure the actuator to the mounting adapter with mounting bolts.



STEP 6
Reconnect incoming power leads L1, L2, L3, and control wiring to the terminal block. Restore power source when ready for operation.

3.2 Actuator Removal with Type A1/A1E Base (Thrust)

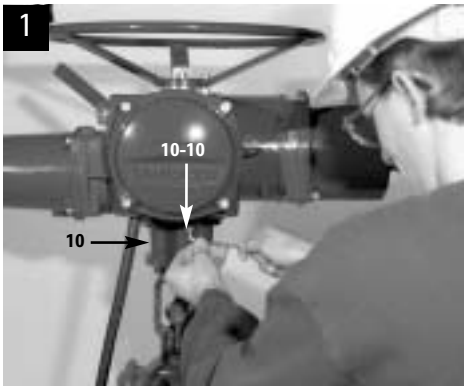
NOTE: Two procedure options are available for removing the actuator and thrust base:
1. Remove actuator from thrust base, leaving thrust base mounted to mounting flange or removing thrust base separately.
2. Remove actuator and thrust base as a unit from mounting flange.

3.2.1 Removal (Type A1/A1E Base)— Actuator removal separate from thrust base

STEP 1

⚠ **WARNING Hazardous Voltage! Turn off all power sources to actuator before removing actuator from mounting plate. Power sources may include main power or control power. If necessary, disconnect incoming power leads L1, L2, L3, and control wiring from the terminal block.**

Remove the bolts (#10-10) that secure the actuator to the thrust base assembly (#10).



STEP 2

⚠ **WARNING Potential high-pressure vessel! Before disassembling your actuator, ensure that the valve or other actuated device is isolated and is not under pressure.**

Lift actuator from thrust base assembly (#10).



STEP 3

⚠ WARNING Potential for actuated device to change position! The thrust base will maintain position only if non-backdriving thread lead is used. Ensure proper thread lead is used in your application before allowing thrust base to be used for maintaining position when actuator is removed.

Thrust base removal (if required)

The valve position will be maintained if a locking thread lead is used on the valve stem. If thrust base removal is required, use the following removal procedure.

Remove the bolts that secure the thrust base to the mounting adapter.



STEP 4

Rotate the thrust base (#10) until it feeds off the threaded stem.



3.2.2 Remounting (Type A1/A1E Base)— Actuator remounting separate from thrust base

STEP 5

Thrust base remounting (if required)

Ensure the thrust base stem nut has the two lugs positioned upward to engage with the drive sleeve slots when actuator is reinstalled onto thrust base. Thread thrust base back onto mounting adapter.



STEP 6
Secure thrust base to mounting adapter with mounting bolts.



STEP 7
Actuator remounting
Lower the actuator onto the thrust base, making sure thrust nut lugs align and properly engage with drive sleeve slots.



STEP 8
Install bolts (#10-10) to secure the actuator to the thrust base assembly (#10).



STEP 9
⚠ **WARNING: Hazardous Voltage! Turn off all power sources before rewiring incoming power leads L1, L2, L3, and control wiring in the terminal block.**

Reconnect incoming power leads L1, L2, L3, and control wiring to the terminal block. Restore power source when ready for operation.

3.2.3 Removal (Type A1/A1E Base)—Actuator & thrust base as a unit

STEP 1

⚠ WARNING Hazardous Voltage! Turn off all power sources to actuator before removing actuator from mounting plate. Power sources may include main power or control power. If necessary, disconnect incoming power leads L1, L2, L3, and control wiring from the terminal block.

Actuator + thrust base removal

Remove the bolts that secure the actuator and thrust base (#10) to the mounting adapter.



STEP 2

⚠ WARNING Potential high-pressure vessel! Before disassembling your actuator, ensure that the valve or other actuated device is isolated and is not under pressure.

Declutch the actuator to manual mode.



STEP 3

Rotate the handwheel until the actuator lifts off the threaded stem.



3.2.4 Remounting (Type A1/A1E Base)—Actuator & thrust base as a unit

STEP 4
Actuator + thrust base remounting
Declutch the actuator to manual mode. Lift actuator up to the threaded stem and carefully align threads with thrust base threaded stem nut.



STEP 5
Rotate the handwheel to lower the actuator along the threaded stem and onto the mounting adapter plate.



STEP 6
Install the mounting bolts to secure the actuator and thrust base (#10) to the mounting adapter.



STEP 7
⚠ **WARNING Hazardous Voltage! Turn off all power sources before rewiring incoming power leads L1, L2, L3, and control wiring in the terminal block.**

Reconnect incoming power leads L1, L2, L3, and control wiring to the terminal block. Restore power source when ready for operation.

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4 Mechanical Assemblies

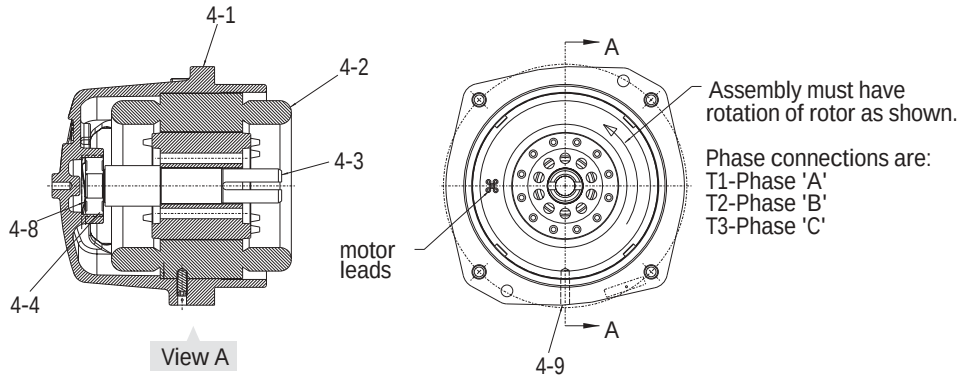
4.1 Motor (MX-05, 10, 20, 40, 85, & 140)

NOTE: Proper motor testing is required when replacing motor. Consult your Limitorque representative or the Limitorque factory to replace with correct motor.

Table 4.1 – Motor Parts List

Part Number	Description	Qty.
4-1	Motor Cover	1
4-2	Stator	1
4-3	Rotor Assembly	1
4-4	Bearing	1
4-8	Bearing Preload Spring	1
4-9	Setscrew	1

Figure 4.1 – Motor (MX-05, 10, 20, & 40)



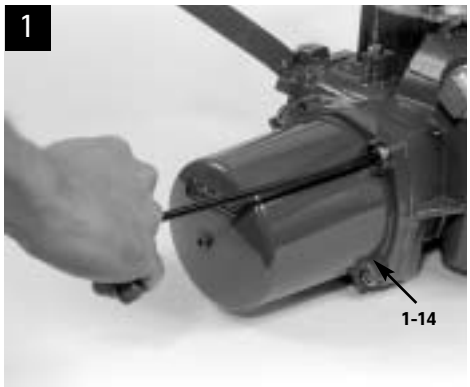
4.1.1 Removal

STEP 1

⚠ **WARNING Hazardous Voltage! Turn off all power sources to actuator before removing motor assembly. Power sources may include main power or control power.**

Using an M6 hex key, remove the four M8 screws (#1-14) that mount the motor assembly to the MX-05 thru MX-40 actuator.

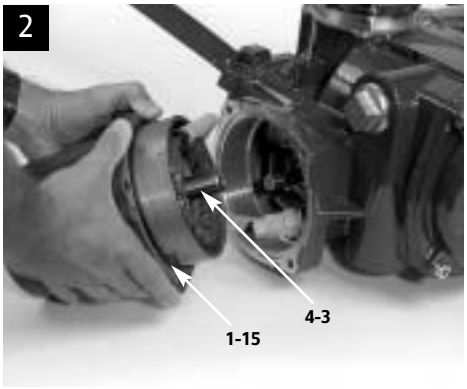
MX-85 requires an M8 hex key and uses an M10 screw.



STEP 2

CAUTION The rotor is not connected to the motor housing; when removing the motor, ensure the rotor is carefully removed and not dropped from the motor housing.

Withdraw the complete motor (subassembly #4), including the rotor (#4-3), until the wiring harness is accessible. Note the O-ring (#1-15) on the spigot/pilot of the motor assembly; replace at remounting.



STEP 3

Disconnect the motor power plug from the motor power socket connector.

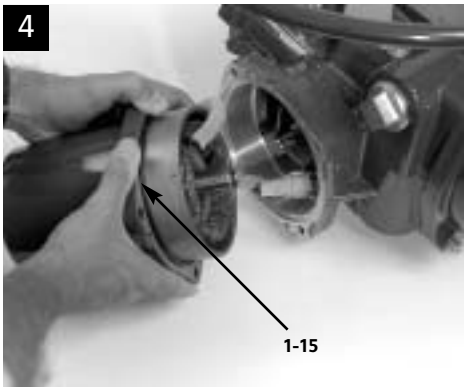


4.1.2 Remounting

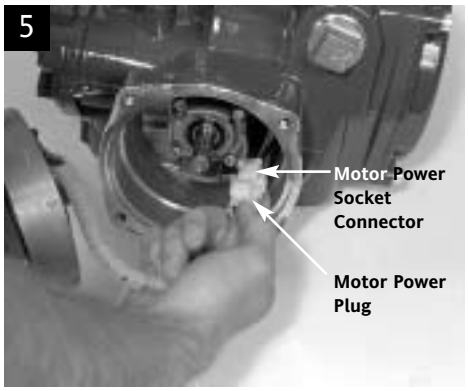
STEP 4

⚠ WARNING Hazardous Voltage! Turn off all power sources to actuator before removing motor assembly. Power sources may include main power or control power.

Lightly lubricate o-ring (#1-15) that is installed around the motor spigot/pilot (subassembly #4).



STEP 5
Hold the motor assembly (housing/stator/rotor) close to the actuator housing and reconnect the motor power plug to the motor power socket connector.



STEP 6
Coil the spiral-wrapped motor power wiring inside the motor cavity and around the motor bearing housing to ensure that it does not come into contact with the rotor shaft.
MX-05 through 40 motor wiring will wrap around about 360˚. MX-85/140 motor wiring will wrap around about 180˚.



STEP 7
Push the rotor shaft onto the protruding worm shaft, aligning the rotor shaft slots with the worm shaft pin. Slide the motor housing spigot/pilot into the actuator housing.



STEP 8
Fit the four screws (#1-14) into the motor subassembly mounting holes and tighten.



4.2 Declutch (MX-05, 10, 20, 40, 85, & 140)

Table 4.2 – Declutch Parts List (MX-05 & 10)

Part Number	Description	Qty.
5-1	Declutch Cover	1
5-2	Declutch Shaft	1
5-3	Declutch Cam	1
5-4	Declutch Spring	1
5-5	Cam Spring	1
5-6	Declutch Latch	1
5-7	Latch Spring	1
5-8	Cam Plate	1
5-9	Retaining Ring	2
5-10	Socket Head Cap Screw	1
5-11	O-Ring	1
5-12	Socket Head Cap Screw	2
5-13	Dowel Pin	1
5-14	Roll Pin	1
5-15	O-Ring	1

Figure 4.2 – Declutch (MX-05 & 10)

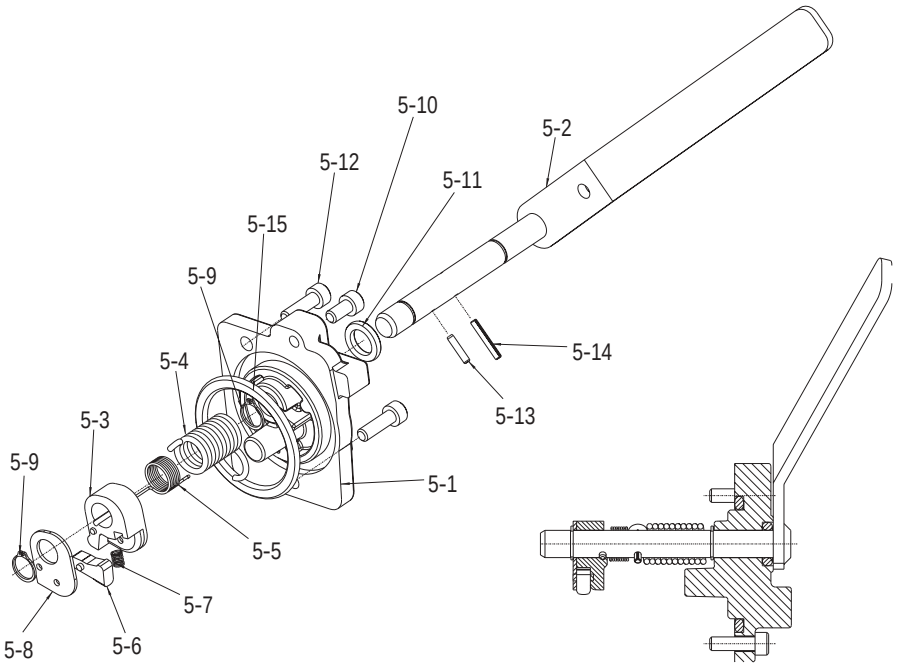


Table 4.3 – Declutch Parts List (MX-20 & 40)

Part Number	Description	Qty.
5-1	Declutch Cover	1
5-2	Declutch Shaft	1
5-3	Declutch Cam	1
5-4	Declutch Spring	1
5-5	Cam Spring	1
5-6	Declutch Latch	1
5-7	Latch Spring	1
5-8	Cam Plate	1
5-9	Retaining Ring	2
5-10	Socket Head Cap Screw	1
5-11	O-Ring	1
5-12	Socket Head Cap Screw	2
5-13	Dowel Pin	1
5-14	Roll Pin	1
5-15	O-Ring	1
5-16	Dowel Pin	1

Figure 4.3 – Declutch (MX-20 & 40)

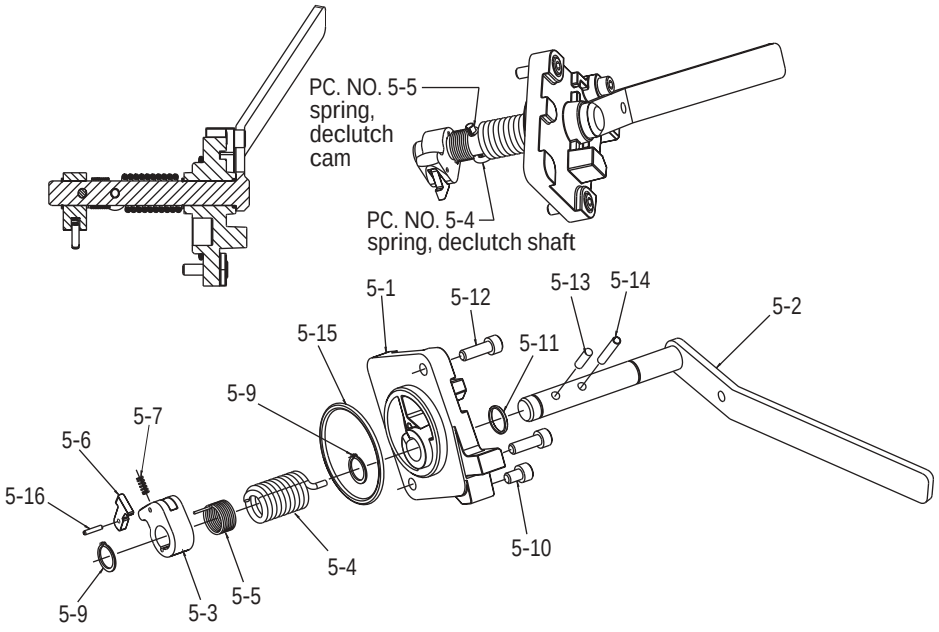
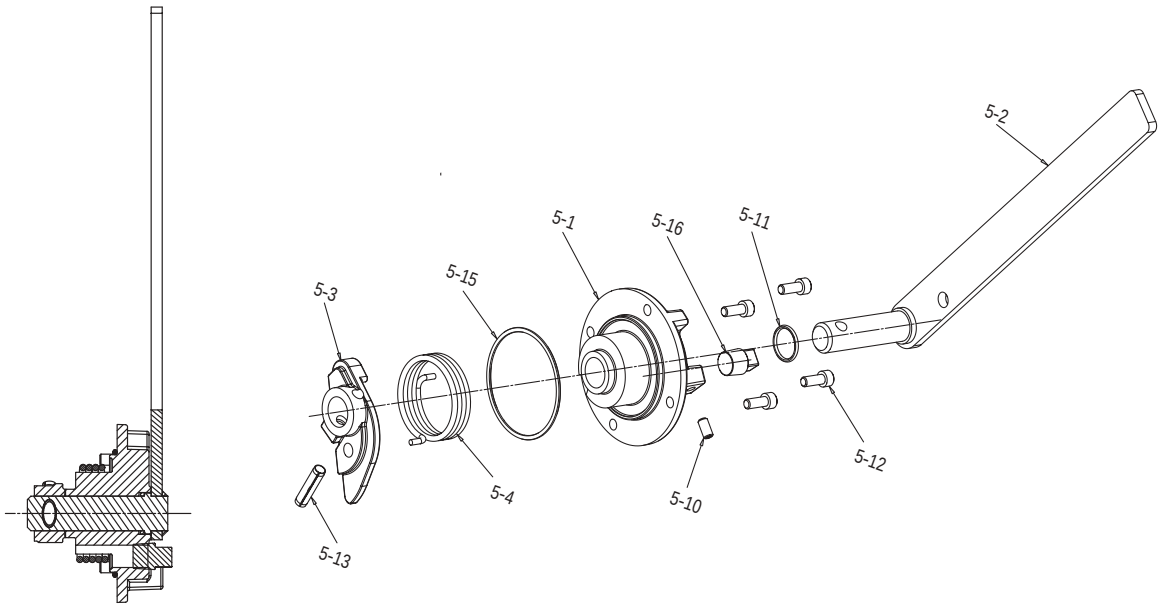


Table 4.4 – Declutch Parts List (MX-85 & 140)

Part Number	Description	Qty.
5-1	Declutch Cover	1
5-2	Declutch Shaft	1
5-3	Declutch Cam	1
5-4	Declutch Spring	1
5-9	Retaining Ring	2
5-10	Socket Head Set Screw	1
5-11	O-Ring	1
5-12	Socket Head Set Screw	2
5-13	Spiral Pin	1
5-15	O-Ring	1
5-16	Pipe Plug	1

Figure 4.4 – Declutch (MX-85 & 140)



4.2.1 Removal

NOTE: (MX-05, 10, 85 &140) The MX-05, 10, 85 and 140 declutch assembly may be removed and remounted without other subassembly removal.

NOTE: (MX-20 & 40) The MX-20 and 40 declutch assembly may be removed without other subassembly removal, but remounting requires removing the following subassemblies:

1. Handwheel (Subassembly #13)
2. Handwheel adapter (Subassembly #12)
3. Clutch and clutch ring (Subassembly #16)

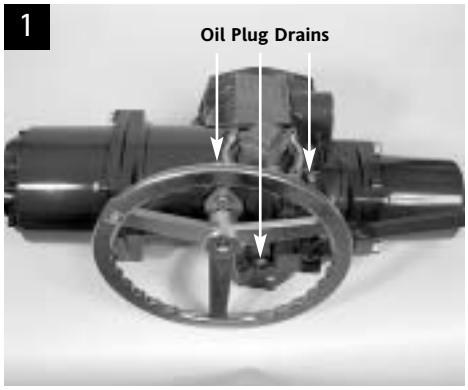
STEP 1

⚠ WARNING Potential to operate while dangerous mechanical parts are exposed during subassembly removal. To prevent injury, turn off all power sources to actuator before removing side-mounted and top-mounted handwheel assembly. Power sources may include: main power or control power.

Drain oil from actuator using the lowest of 3 plugs in your application mounting orientation.

NOTE: Oil removal is not necessary on MX-05, 10, 85 & 140 if actuator is mounted with declutch lever up.

1

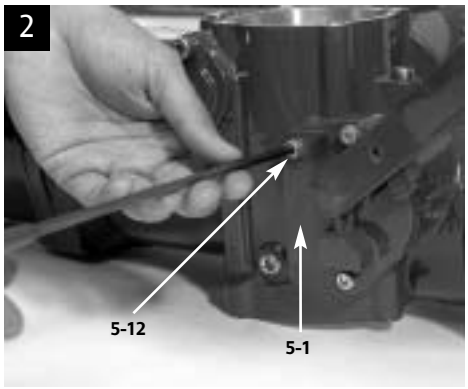


STEP 2

⚠ WARNING Potential to operate while dangerous mechanical parts are exposed during subassembly removal. To prevent injury, turn off all power sources to actuator before removing declutch assembly. Power sources may include: main power or control power.

Using a 5 mm (MX-05 & 10) or 6 mm (MX-20, 40, 85 & 140) hex key, remove the two M6 (MX-05 & 10) screws (#5-12), M8 (MX-20 & 40) or the four M8 (MX-85 & 140) screws that retain the declutch assembly cover (#5-1) on the actuator housing.

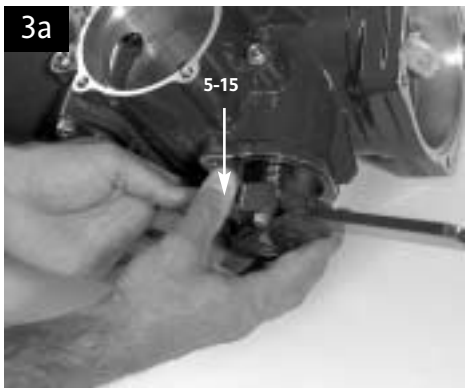
2



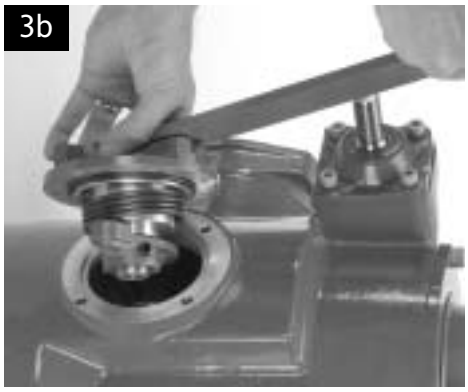
STEP 3

Withdraw the complete declutch assembly, slightly twisting, if necessary, to remove. Note the o-ring (#5-15) with the declutch assembly cover (#5-1). Replace at remounting. Picture 3a is typical MX-05 through 40. Picture 3b is typical MX-85/140.

3a



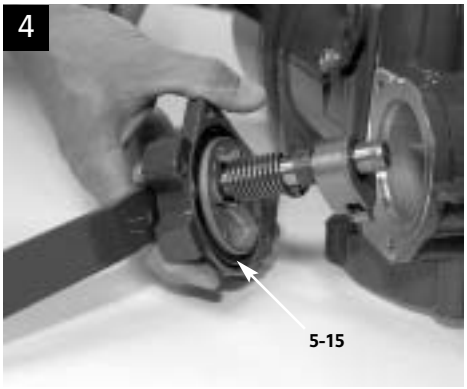
3b



4.2.2 Remounting

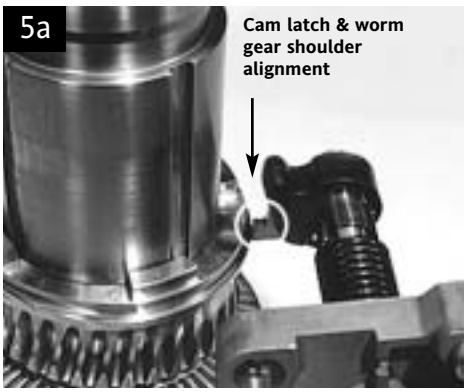
STEP 4
(MX-20 & 40 only) Remove the following subassemblies before remounting the declutch assembly. (See corresponding referenced sections for removal information.)
1. Handwheel (subassembly #13). (See **Section 4.3.1**.)
2. Handwheel adapter (subassembly #12). (See **Section 4.13.1**.)
3. Clutch and clutch ring (subassembly #16). (See **Section 4.15.1**.)

Lightly lubricate the o-ring (#5-15) and fit it to the inner ace of the declutch cover (#5-1).

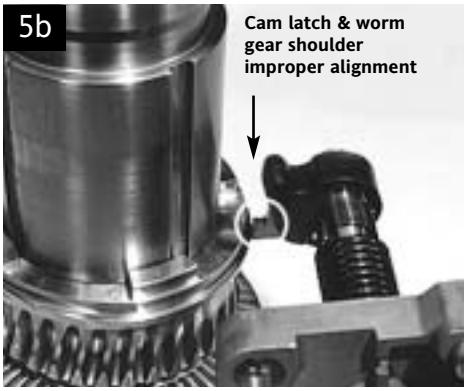


STEP 5
CAUTION (MX-20 & 40 only) To create proper mating between the cam latch (#5-6) and the shoulder on the worm gear, ensure cam latch is positioned below the worm gear shoulder (see Picture 5a).

Tip: (MX-20 and 40 only) – Picture 5a shows proper alignment between the cam latch (#5-6) and the shoulder on the worm gear.



Tip: (MX-20 & 40 only) – Picture 5b shows improper alignment between the cam latch (#5-6) and the shoulder on the worm gear. Improper alignment could cause the cam latch to be broken off by the worm gear lug.

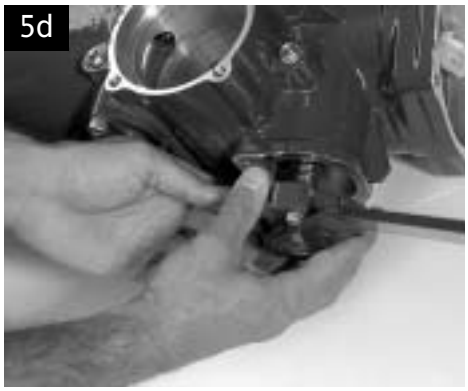


Tip: (MX-85 & 140 only) – Picture 5c shows proper alignment between the cam and the clutch ring roller.



Fit the complete declutch assembly into the actuator housing, slightly twisting, if necessary, to remount into actuator.

5d



STEP 6

Set screw adjustment. Install drive sleeve, baseplate, clutching and handwheel worm gear components. Assure the clutch lugs are fully engaged to the motor worm gear lugs before the adjustment. With declutch lever resting on cap pad (not the set screw) place declutch cap assembly (1-4) into housing without mounting screws. Rotate cap assembly clockwise until declutch cam is resisted by the roller, clutch ring and clutch combination. Holding the declutch lever, rotate the set screw clockwise thru declutch cap, (this will rotate the cap counterclockwise) until the cap mounting holes are inline with the taps in the housing. Install declutch assembly mounting screws. Then rotate set screw counterclockwise 1/4 plus or minus 1/8 turn. Adjustment is complete.

STEP 7

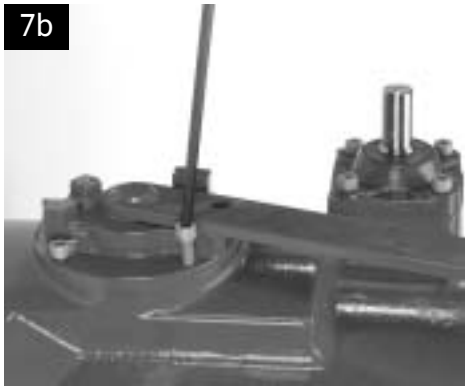
Fit the two M6 (MX-05 & 10) screws (#5-12), M8 (MX-20 & 40) screws to retain the declutch assembly cover (#5-1) on the housing. Tighten using a 5 mm (MX-05 & 10) or 6 mm (MX-20, 40 & 85) hex key. Picture 7a shows the 2 screws for the MX-20 & 40. Picture 7B shows the 4 screws for the MX-85.

See picture 7a for MX-05, 10, 20 & 40. See picture 7b for MX-85 & 140.

7a



7b



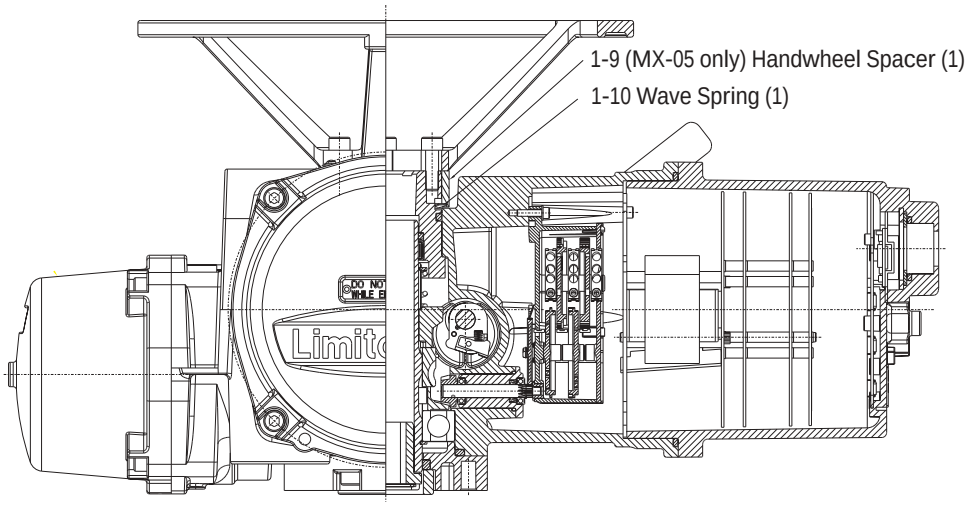
STEP 8 (MX-20 & 40 ONLY)
Remount the following subassemblies after remounting the declutch assembly.
(See corresponding referenced sections for remounting information.)
1. Handwheel (subassembly #13). (See **Section 4.3.2**.)
2. Handwheel adapter (subassembly #12).
   (See **Section 4.14.2, 4.4.2, and 4.5.2**.)
3. Clutch and clutch ring (subassembly #16).
   (See **Section 4.15.2**.)

4.3 Top-Mounted Handwheel (MX-05, 10, 20, & 40)

Table 4.5 – Top-Mounted Handwheel Parts List (MX-05, 10, 20, & 40)

Part Number	Description	Qty.
1-8	Handwheel	1
1-11	Socket Head Cap Screw	4

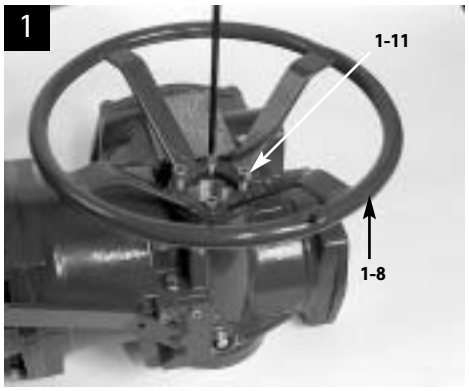
Figure 4.5 – Top-Mounted Handwheel (MX-05, 10, 20, & 40)



4.3.1 Removal

STEP 1
⚠ **WARNING Potential to operate while dangerous mechanical parts are exposed during subassembly removal. To prevent injury, turn off all power sources to actuator before removing top-mounted handwheel assembly. Power sources may include: main power or control power.**

Using a 6 mm (MX-05 & 10) hex key or 8 mm (MX-20 & 40) hex key, remove the four screws (#1-11) that secure the handwheel (#1-8) to the handwheel adapter assembly (#1-1).

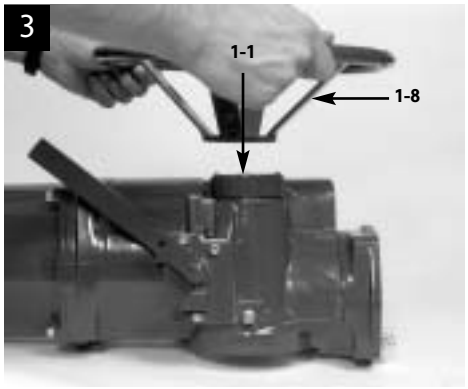


STEP 2
Lift the handwheel (#1-8) off the handwheel adapter (#1-1).



4.3.2 Remounting

STEP 3
Install handwheel (#1-8) onto handwheel adapter assembly (#1-1).



STEP 4
Align the handwheel slots with the mounting holes. Fit the four screws (#1-11) in handwheel mounting holes and tighten.

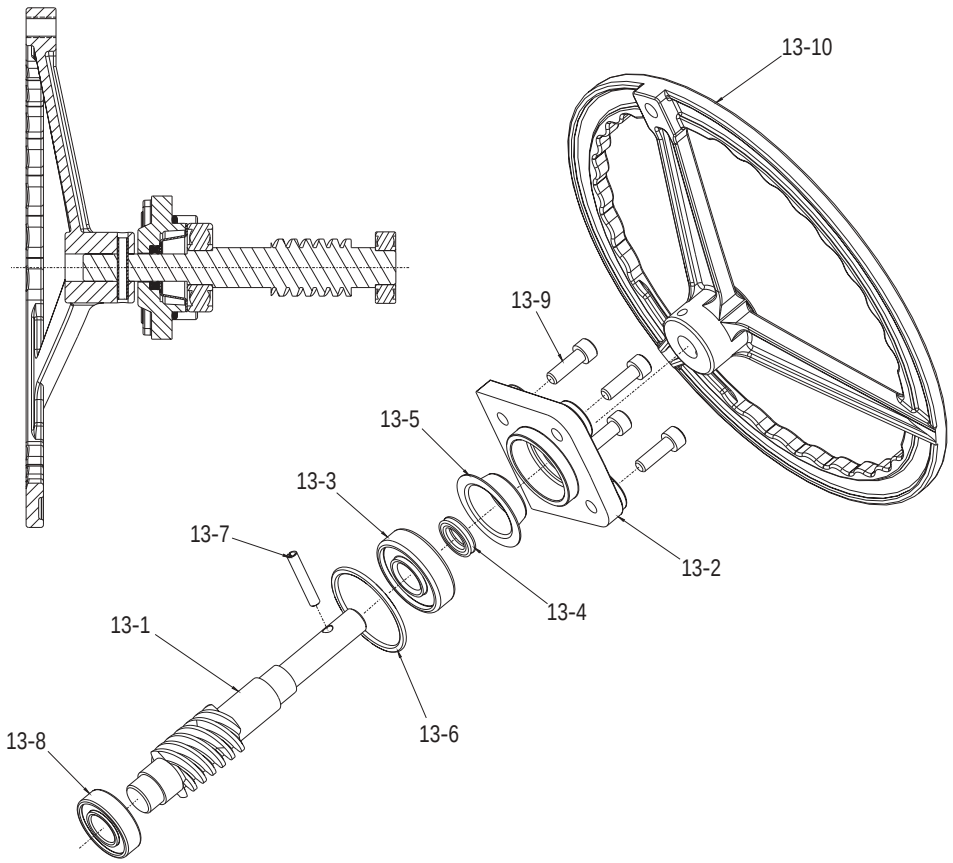


4.4 Side-Mounted Handwheel Without Spur Gear Attachment (MX-10, 20, 85 & 140)

Table 4.6 – Side-Mounted Handwheel Parts List (MX-10 & 20)

Part Number	Description	Qty.
13-1	Handwheel Wormshaft	1
13-2	Handwheel Worm Cap	1
13-3	Ball Bearing	1
13-4	Quad Ring	1
13-5	Seal Retainer	1
13-6	O-Ring	1
13-7	Roll Pin	1
13-8	Ball Bearing	1
13-9	Socket Head Cap Screw	2 (MX-10), 4 (MX-20)
13-10	Side-Mounted Handwheel	1

Figure 4.6 – Side-Mounted Handwheel (MX-10 & 20)

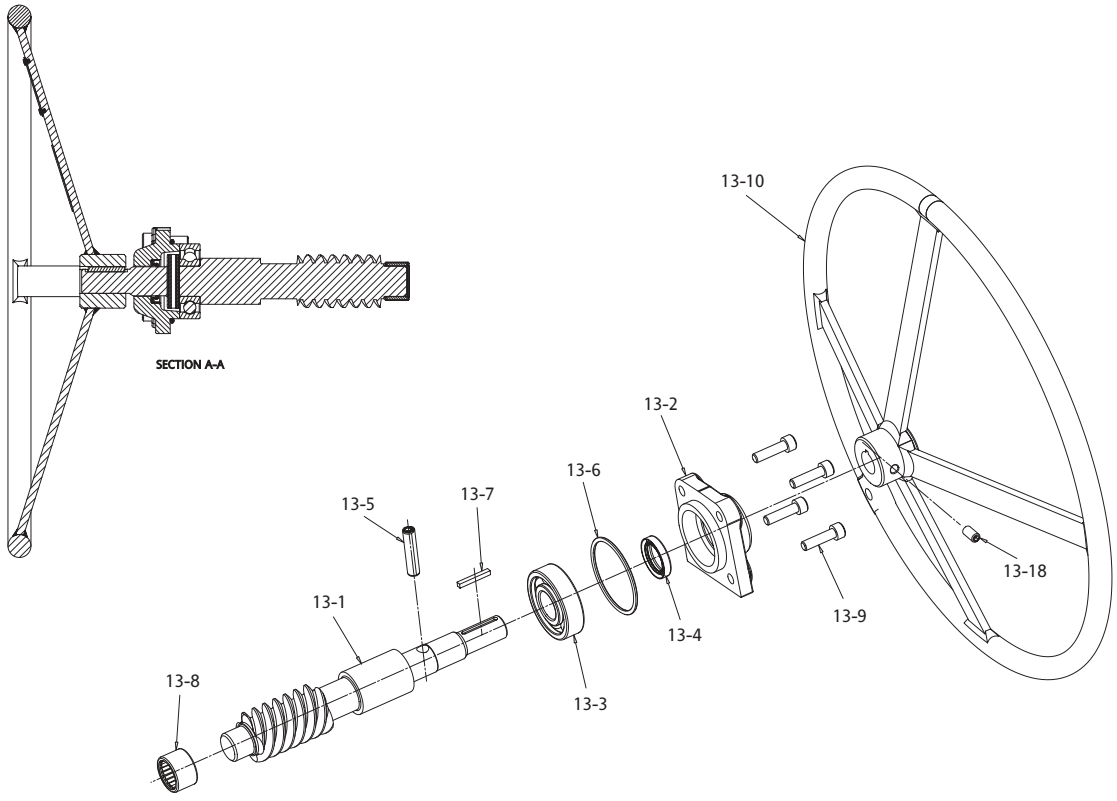


4.4.a Side-Mounted Handwheel Without Spur Gear Attachment (MX-85 & 140)

Table 4.7 – Side-Mounted Handwheel without Spur Gear Attachment Parts List (MX-85 & 140)

Part Number	Description	Qty.
13-1	Handwheel Wormshaft	1
13-2	Handwheel Worm Cap	1
13-3	Ball Bearing	1
13-4	Quad Ring	1
13-5	Roll Pin	1
13-6	O-Ring	1
13-7	Key	1
13-8	Needle Bearing	1
13-9	Socket Head Cap Screw	4
13-10	Side-Mounted Handwheel	1
13-18	Socket Head Set Screw	1

Figure 4.7 – Side-Mounted Handwheel (MX-85 & 140)



4.4.1 Removal of Side-Mounted Handwheel for MX-20 & 40

NOTES:

The MX-10 & 20 Handwheel is mounted with a roll pin (13-7). If removal of the handwheel from the worm shaft is necessary, remove the handwheel and worm shaft assembly from unit before removing roll pin. Removing the roll pin before disassembly of worm shaft will damage the ball bearing
(13-3).

a



The MX-85 & 140 Handwheel is mounted with a key (13-7) and a set screw (13-18). See pictures a & b.

b



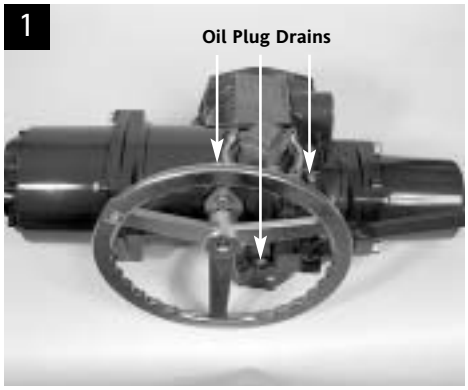
4.4.2 Removal

STEP 1

⚠ WARNING Potential to operate while dangerous mechanical parts are exposed during subassembly removal. To prevent injury, turn off all power sources to actuator before removing side-mounted handwheel assembly. Power sources may include: main power or control power.

Drain oil from actuator using the lowest of 3 plugs in your application mounting orientation.

NOTE: Oil removal is not necessary if the actuator is mounted on valve or other device with the drive sleeve in a vertical position.

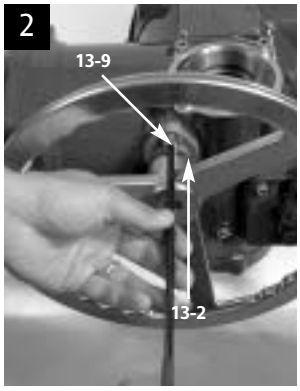


STEP 2
(MX-10 & 20)

CAUTION Be aware of inner bearing (#13-8) when removing the side-mounted handwheel. It may stay in the actuator housing or come out with the side-mounted handwheel assembly. Ensure it is inserted back in actuator housing before remounting side-mounted handwheel assembly.

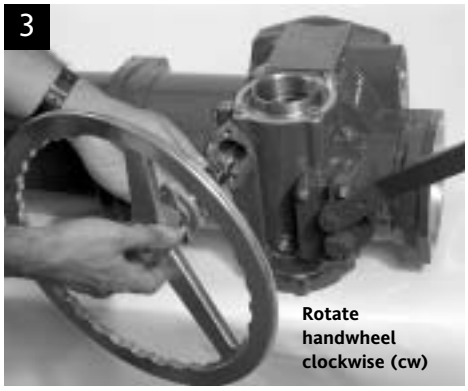
Tip: (MX-85 & 140 only) – Needle bearing (#13-8) is pressed into housing.

Using a 6 mm hex key, remove the M8 screws (#13-9) from the handwheel worm shaft cap (#13-2).



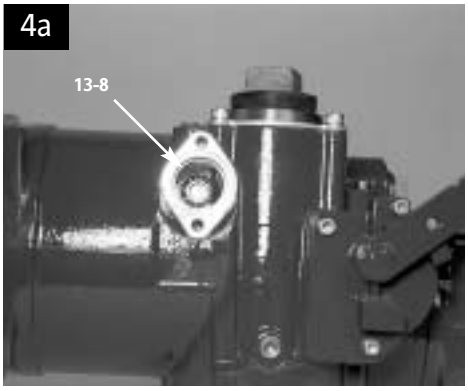
STEP 3

Rotate the handwheel assembly clockwise (CW) to withdraw the complete subassembly (#13) from the actuator housing.

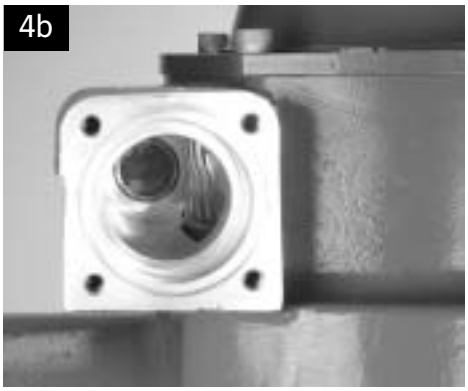


4.4.3 Remounting

STEP 4
Check that bearing (#13-8) is correctly in place in the actuator housing.
The MX-10 & 20 is a slip fit (4a).
The MX-85 & 140 is a press fit (4b).

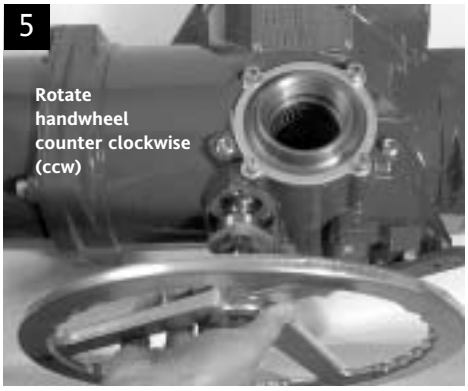


MX-10 & 20



MX-85 & 140

STEP 5
Insert the complete subassembly into the actuator housing, rotating counterclockwise (CCW) to properly mesh the gearing. Ensure the end of the worm shaft is seated in the inner bearing (#13-8).



STEP 6
Position the worm shaft cap (#13-2) back on the actuator housing. Using a 6 mm hex key, fit the (#13-9) screws onto the worm shaft cap to secure side-mounted assembly to the actuator housing.

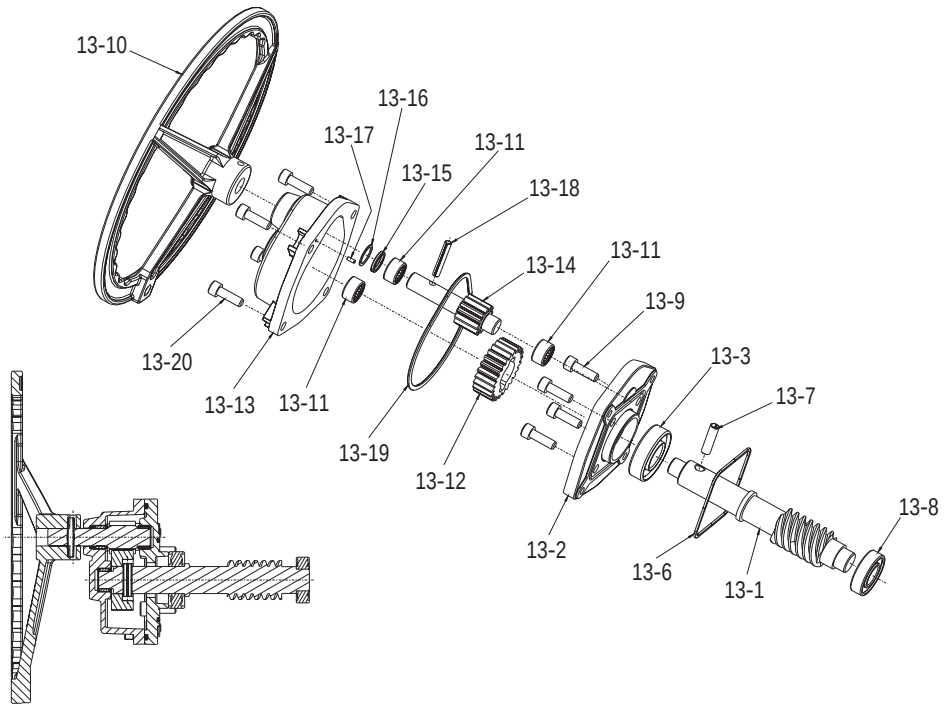


4.5 Side-Mounted Handwheel With Spur Gear Attachment (MX-40,85 &140)

Table 4.8 – Side-Mounted Handwheel Parts List (MX-40)

Part Number	Description	Qty.
13-1	Handwheel Worm Shaft	1
13-2	Spur Adapter Plate	1
13-3	Ball Bearing	1
13-6	O-Ring	1
13-7	Roll Pin	1
13-8	Ball Bearing	1
13-9	Socket Head Cap Screw M8x25	4
13-10	Side-Mounted Handwheel	1
13-11	Needle Bearing	3
13-12	Handwheel Input Gear	1
13-13	Spur Adapter Cap	1
13-14	Handwheel Input Pinion	1
13-15	Quad Ring	1
13-16	O-Ring Spacer	1
13-17	Dowel Pin	1
13-18	Roll Pin	1
13-19	O-Ring	1
13-20	Socket Head Cap Screw M8x20	4

Figure 4.8 – Side-Mounted Handwheel with SGA (MX-40)

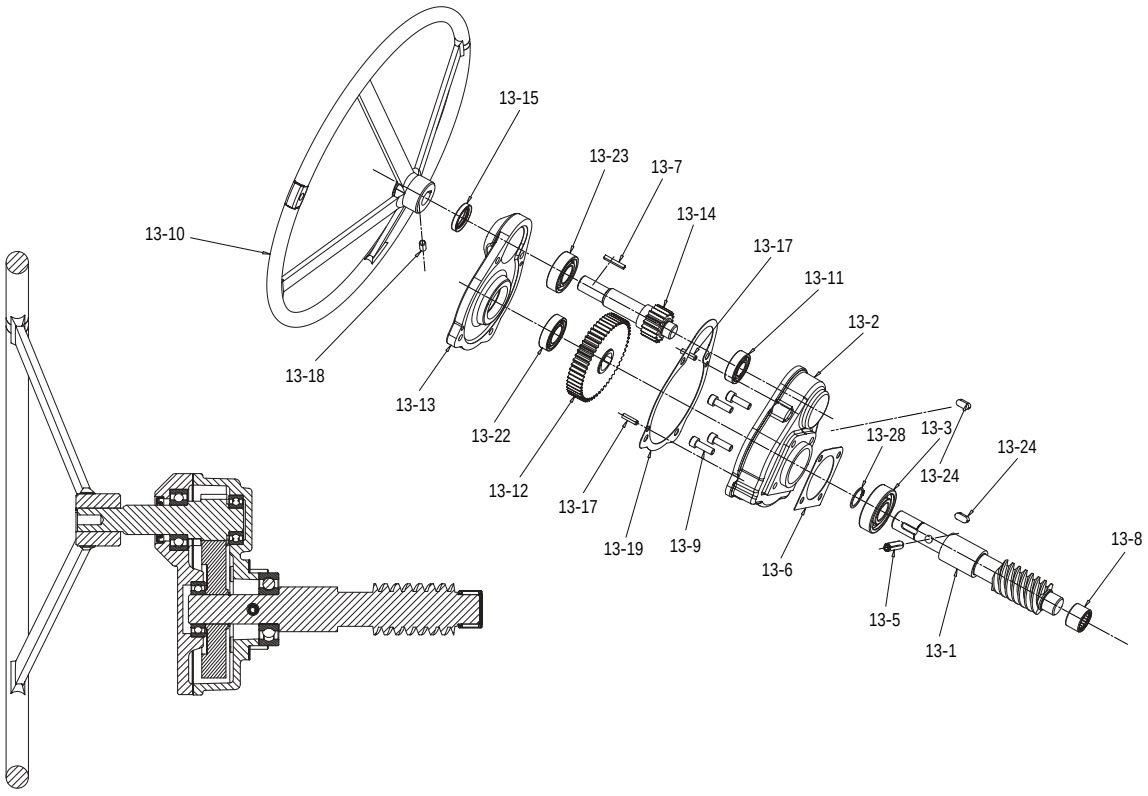


4.5.a MX-85 & 140 Handwheel with SGA

Table 4.9 – Side-Mounted Handwheel Parts List (MX-85 & 140)

Part Number	Description	Qty.
13-1	Handwheel Worm Shaft	1
13-2	Spur Adapter Plate	1
13-3	Ball Bearing	1
13-5	Spiral Pin	1
13-6	Gasket	1
13-7	Key	1
13-8	Needle Bearing	1
13-9	Socket Head Cap Screw M8x25	4
13-10	Side-Mounted Handwheel	1
13-11	Ball Bearing	1
13-12	Handwheel Input Gear	1
13-13	Spur Adapter Cap	1
13-14	Handwheel Input Pinion	1
13-15	Oil Seal	1
13-17	Dowel Pin	1
13-18	Set Screw	1
13-19	Gasket	1
13-20	Socket Head Cap Screw M8x20	4
13-22	Ball Bearing	1
13-23	Ball Bearing	1
13-24	Key	2
13-28	Retaining Ring	1

Figure 4.9 – Side-Mounted Handwheel With SGA (MX-85 & 140)



4.5.1 Removal of Handwheel

NOTES:

The MX-40 Handwheel is mounted with a roll pin (#13-7). If removal of the handwheel from the worm shaft is necessary, remove the handwheel and worm shaft assembly from unit before removing roll pin. Removing the roll pin before disassembly of worm shaft will damage the ball bearing (#13-3).



The MX-85 & 140 Handwheel is mounted with a key (#13-7) and a set screw (#13-18). See pictures a & b.



STEP 4

Remove the four M6 screws (#13-9) from the worm shaft plate (#13-2).

.

4.5.2 Removal

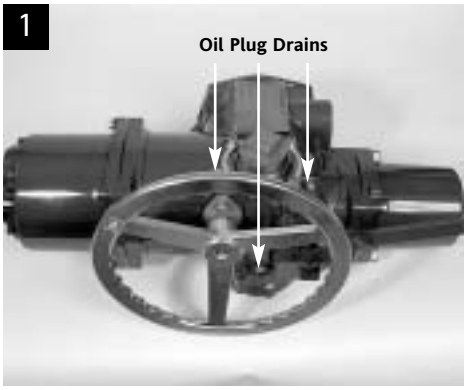
STEP 1

⚠ WARNING Potential to operate while dangerous mechanical parts are exposed during subassembly removal. To prevent injury, turn off all power sources to actuator before removing side-mounted handwheel assembly. Power sources may include: main power or control power.

Drain oil from actuator using the lowest of 3 plugs in your application orientation.

NOTE: Oil removal is not necessary if the actuator is mounted on valve or other device with the drive sleeve in a vertical position.

1

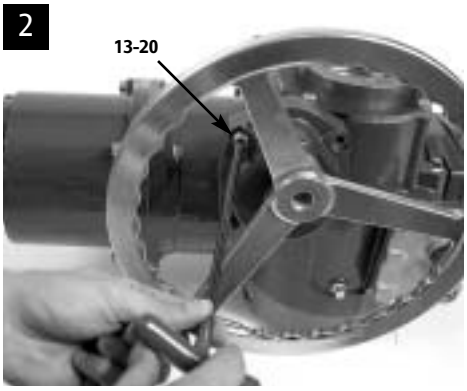


STEP 2

CAUTION Be aware of inner bearing (#13-8) when removing the side-mounted handwheel. It may stay in the actuator housing or come out with the side-mounted handwheel assembly. Ensure it is inserted back in actuator housing before remounting side-mounted handwheel assembly.

Remove the four screws (#13-20) from the handwheel spur gear cap (#13-13).

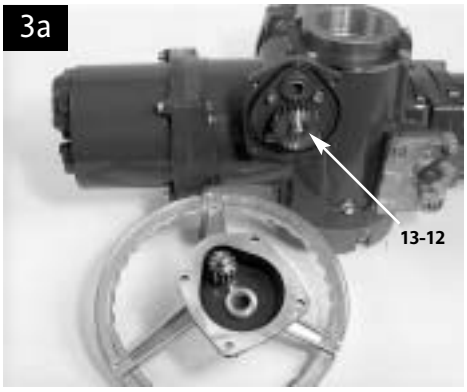
2



STEP 3

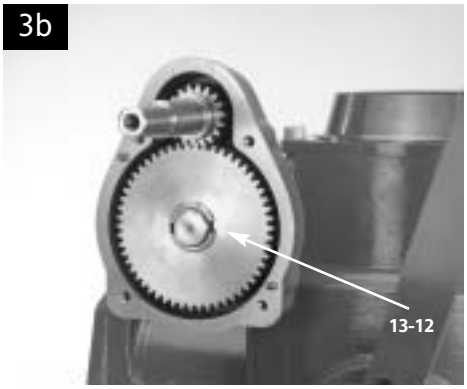
Remove handwheel spur gear cap assembly. Note when assembly is removed, the spur gear (#13-12) is loose in spur gear cap. Remove spur gear.

3a



MX-40

3b

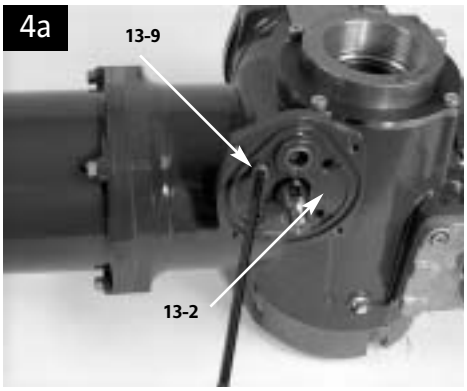


MX-85/140

STEP 4

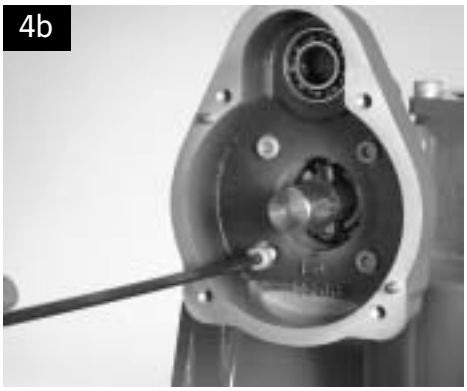
Remove the four M6 screws (#13-9) from the worm shaft plate (#13-2).

4a



MX-40

4b



MX-85/140

STEP 5
Removing worm shaft assembly.
MX-40 Remove adapter plate and worm assembly together (5a).
MX-85/140 Remove adapter plate, then remove worm assembly (5b).

NOTE: When removing the side-mounted handwheel, the inner bearing (#13-8) should remain in place in the housing.

Rotate the handwheel assembly clockwise (CW) to withdraw the complete worm shaft plate subassembly.

5a



MX-40

5b



MX-85/140

STEP 6
If needed, remove the handwheel worm gear assembly (#12).
(See **Section 4.14.1** for removal procedure) MX-40.
(See **Section 4.16.2** for removal procedure) MX-85/140.

6

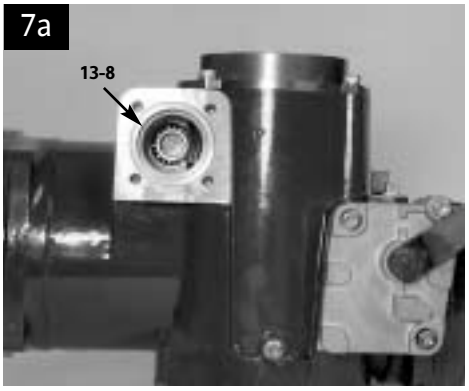


Handwheel Worm Gear Adapt. (12-1)

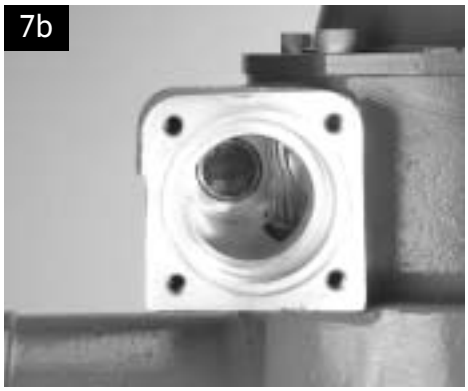
4.5.3 Remounting

STEP 7
Check that bearing (#13-8) is correctly in place in the actuator housing.
MX-40 is slip fit in housing (7a).
MX-85 is press fit in housing (7b).

7a



7b



STEP 8
If previously removed, install handwheel worm gear assembly (#12). (See **Section 4.14.2** for remounting procedure for MX-40.)
(See **Section 4.16.2** for remounting procedure for MX-85 & 140).

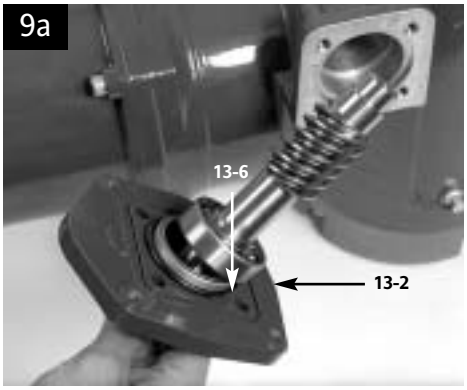
8



Handwheel Worm Gear Adapt. (12-1)

STEP 9
Ensure o-ring (MX-40) (#13-6) is in place on worm shaft plate.
MX-40, 85, & 140 Insert worm shaft assembly into actuator housing. Rotate assembly in counterclockwise (CCW) direction to properly mate with handwheel worm gear assembly (#12)(9b).

9a

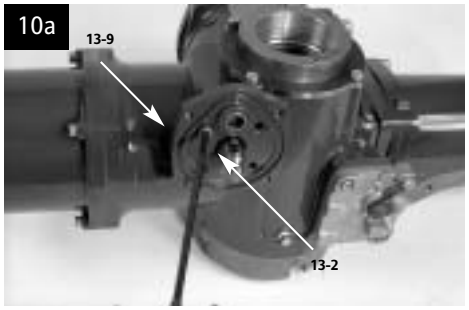


9b



STEP 10a - MX-40
Secure with four M8 screws (#13-9) to secure the adapter plate (#13-2).
STEP 10a & b - MX-85 & 140
Ensure gasket (#13-6) is placed on adapter (#13-2) and install adapter to housing and secure with four M8 screws (#13-9).

10a



10b

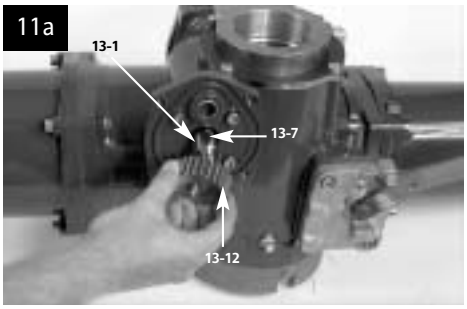


10c

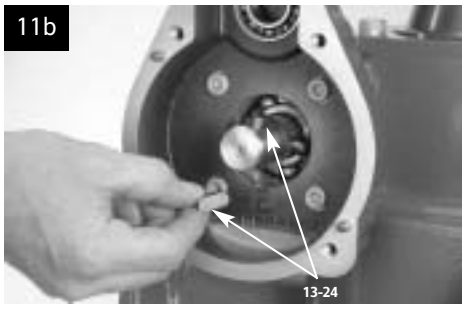


STEP 11 - MX-40 (11a)
Fit gear (#13-12) onto end of worm shaft (#13-1). Ensure gear slot is fitted into pin (#13-7).
MX-85 & 140 (11b & 11c)
Fit gear (#13-12) onto end of worm shaft. Ensure both keys (#13-24) are in place in worm shaft.

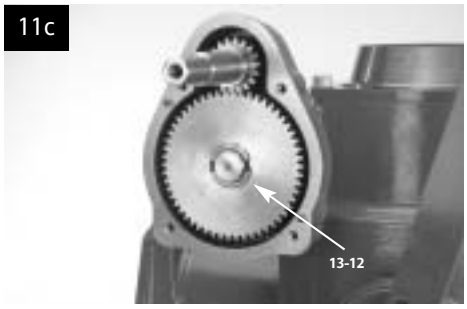
11a



11b

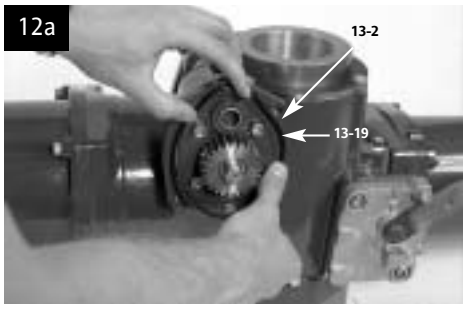


11c



STEP 12 - MX-40 (12a)
Ensure o-ring (#13-19) is in place on worm shaft plate (#13-2).
MX-85 & 140 (12b)
Ensure gasket (#13-19) is in place on adapter (#13-2).

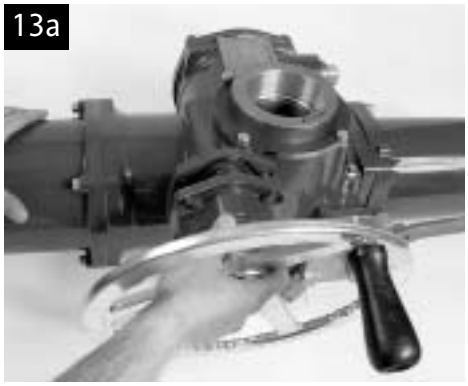
12a



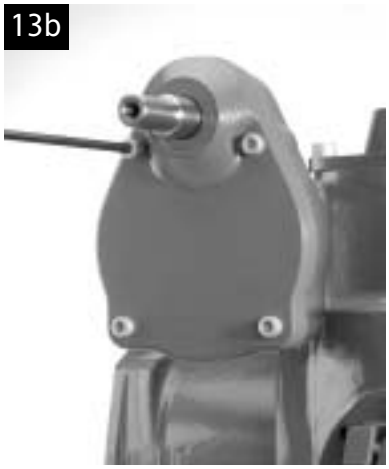
12b



STEP 13a - MX-40
Check that quad ring (#13-15), spacer (#13-16) and needle bearing (#13-11) are correctly placed in plate (#13-2) and cap (#13-13).
Install handwheel spur cap assembly, secure with screws (#13-20).



STEP 13b - MX-85 & 140
Check that seal (#13-15), and ball bearings (#13-11, 13-22, & 13-23) are correctly placed in adapter (#13-2) and cap (#13-13).
Install handwheel spur cap assembly. Secure with screws (#13-20). Remount handwheel (#13-10) if removed with key (#13-7) and set screw (#13-18).



4.6 Converting Top-Mounted Handwheel to Side-Mounted Handwheel (MX-10, 20, & 40)

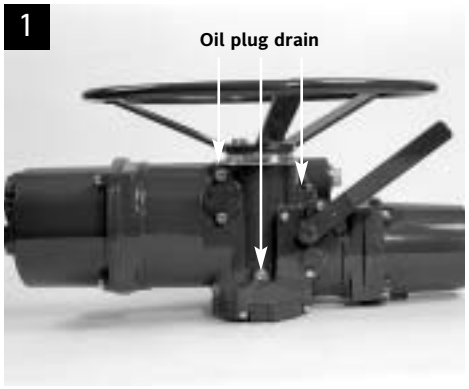
4.6.1 Removing Top-Mounted Handwheel

STEP 1

⚠ WARNING Potential to operate while dangerous mechanical parts are exposed during subassembly removal. To prevent injury, turn off all power sources to actuator before removing side-mounted and top-mounted handwheel assembly. Power sources may include: main power or control power.

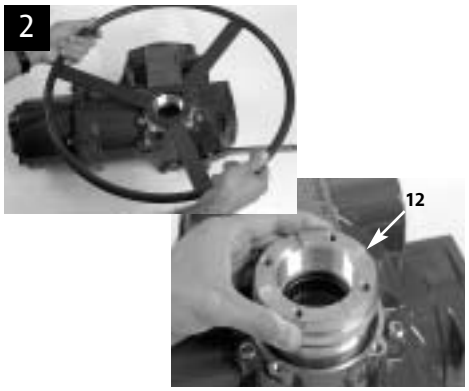
Drain oil from actuator using the lowest of 3 plugs in your application mounting orientation.

NOTE: Oil removal is not necessary if actuator is mounted on valve or other device with the drive sleeve in a vertical position.

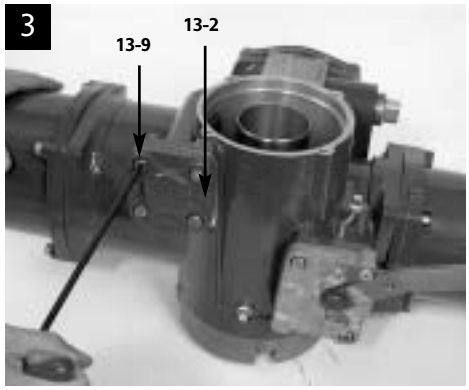


STEP 2

Remove top-mounted handwheel assembly (#1) and handwheel adapter assembly (#12) using disassembly instructions detailed in **Sections 4.3.1 and 4.13.1** respectively.

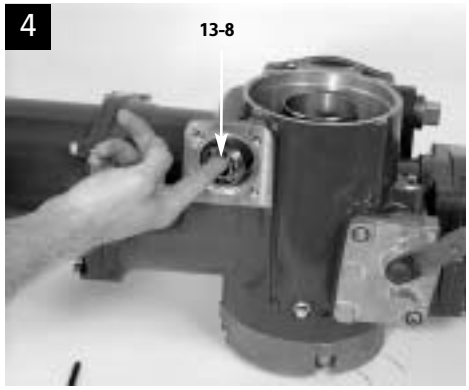


STEP 3
Using a 6 mm hex key, remove the M8 screws (#13-9) from the handwheel worm shaft cap (#13-2).

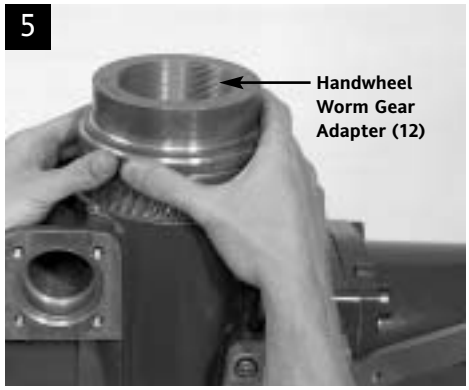


4.6.2 Installing Side-Mounted Handwheel

STEP 4
Install bearing (#13-8) from side-mounted handwheel adapter kit into the actuator housing.
MX-10, 20 & 40 – the bearing is a slip fit into the housing.
MX-85 & 140 is a press fit into the housing.



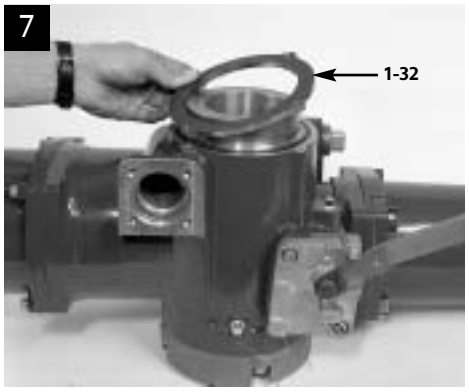
STEP 5
Replace the handwheel adapter (#12) with the handwheel worm gear (#12) that is included in the side-mounted handwheel adapter kit.



STEP 6 (MX-20 & 40 ONLY)
Place o-ring (#12-4) around handwheel adapter; pressing the o-ring into the slot between the handwheel worm gear adapter assembly (#12) and the actuator housing (approximately every 15˚ to 30˚ until o-ring seats into slot).



STEP 7
Place the retainer plate (#1-32) on the top of the actuator housing. Align the mounting taps and secure with screws (#1-33).



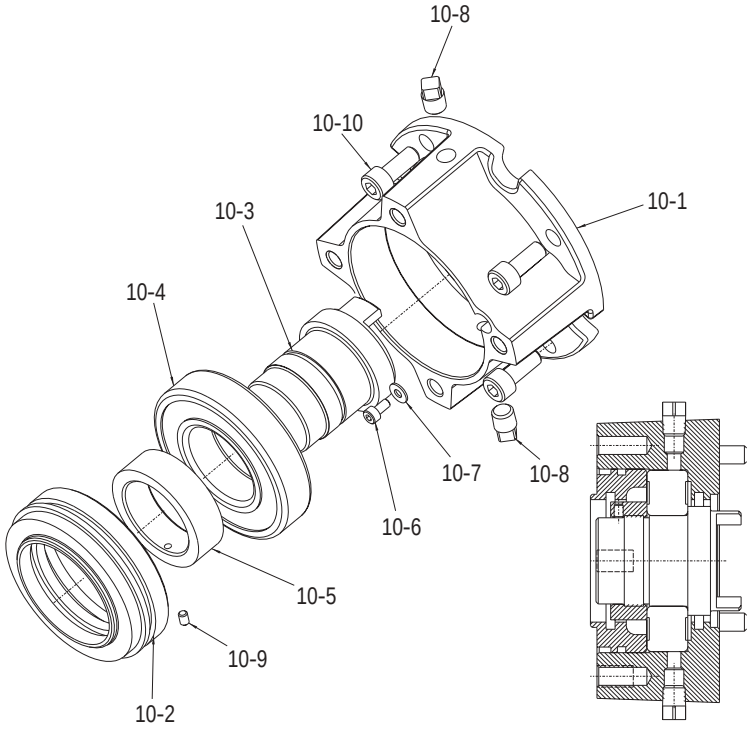
STEP 8
Complete the remounting procedure for side-mounted handwheel assembly #13A (MX-10 & 20) or #13B (MX-40) as detailed in **Section 4.4.2 or Section 4.5.2**.

4.7 Thrust Base Type A1/A1E

Table 4.10 – Type A1 Thrust Base Parts List (MX-05)

Part Number	Description	Qty. (MX-05)	Qty. (MX-10)
10-1	Thrust Base Housing	1	1
10-2	Thrust Pilot	1	1
10-3	Thrust Nut (A1 or A1E)	1	1
10-4	Bearing	1	1
10-5	Bearing Retainer	1	1
10-6	Socket Head Cap Screw	1	1
10-7	Washer	1	1
10-8	Pipe Plug	1	1
10-9	Socket Head Setscrew	1	1
10-10	Socket Head Cap Screw	4	4

Figure 4.10 – Type A1 Thrust Base (MX-05)

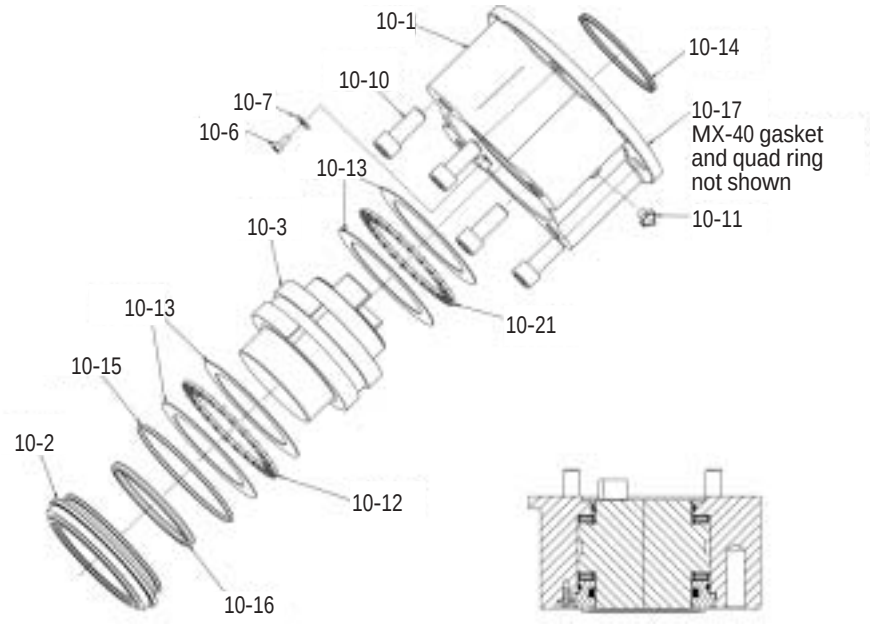


NOTE: The MX-05 A1/A1E thrust base uses sealed bearings, lubrication is not required.

Table 4.11 – Type A1 Thrust Base Parts List (MX-10, 20, 40 & 140)

Part No.	Description	Qty. (MX-10)	Qty. (MX-20)	Qty. (MX-40)	Qty. (MX-140)
10-1	Thrust Base Housing	1	1	1	1
10-2	Thrust Pilot (Threaded on MX-40)	1	1	1	1
10-3	Thrust Nut (A1 or A1E)	1	1	1	1
10-6	Socket Head Cap Screw	1	1	N/A	2
10-7	Washer	1	1	N/A	2
10-8	Pipe Plug	1	N/A	N/A	N/A
10-10	Socket Head Cap Screw	4	4	4	1
10-10	Hex Head Cap Screws	N/A	N/A	N/A	2
10-11	Grease Fitting	1	1	1	4
10-12	Thrust Bearing	2	2	2	2
10-13	Thrust Washer	4	4	4	1
10-14	Quad Ring	1	1	N/A	N/A
10-15	O-Ring	1	1	1	N/A
10-16	Quad Ring	1	1	1	8
10-17	Gasket	N/A	N/A	1	1

Figure 4.11 – Type A1 Thrust Base (MX-10, 20, & 40)



CAUTION: The MX-10 through 40 A1/A1E thrust base contains lubrication. Ensure that a quality Calcium-based lubricant with EP additive is replaced when reassembling a thrust base.

Table 4.12 – Type A1 Thrust Base Parts List (MX-85)

Part Number	Description	Qty.
10-1	Thrust Base Housing	1
10-2	Thrust Base	1
10-3	Thrust Nut (A1 or A1E)	1
10-10	Socket Head Cap Screw	1
10-11	Grease Fitting	1
10-12	Thrust Bearing	2
10-13	Thrust Washer	4
10-14	Quad Ring	2
10-15	O-Ring	1
10-17	Socket Head Cap Screw	6

Figure 4.12 – Type A1 Thrust Base (MX-85) - F16 Flange

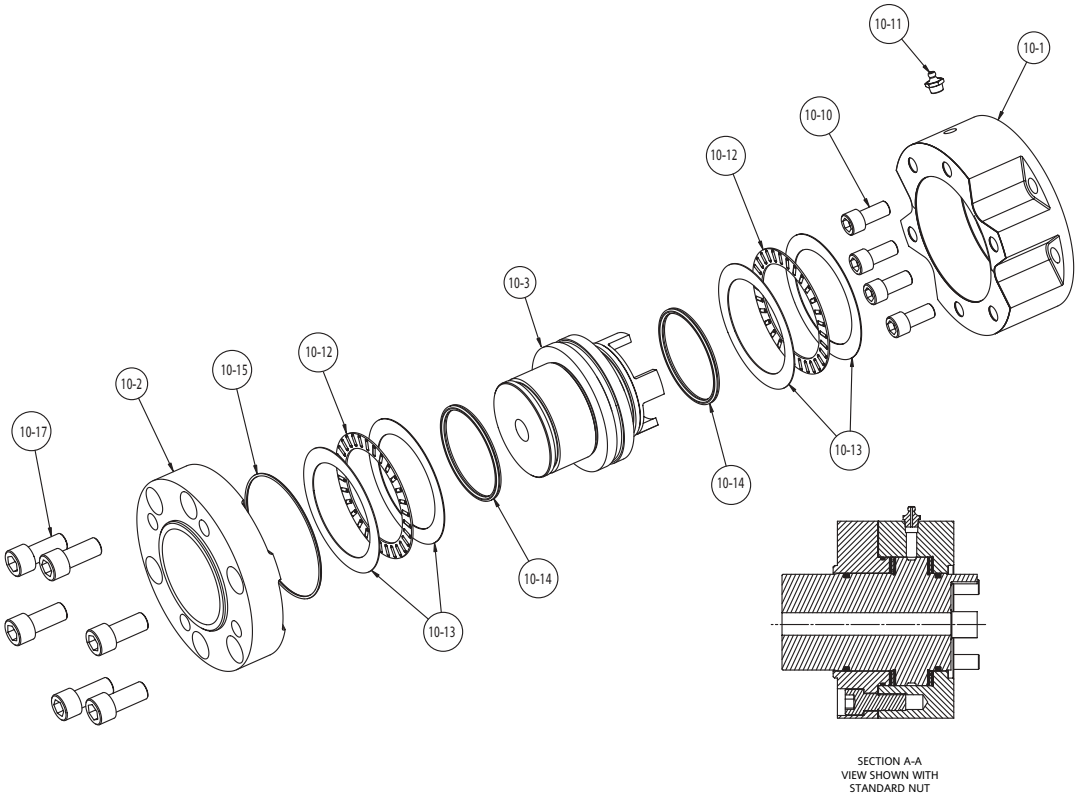
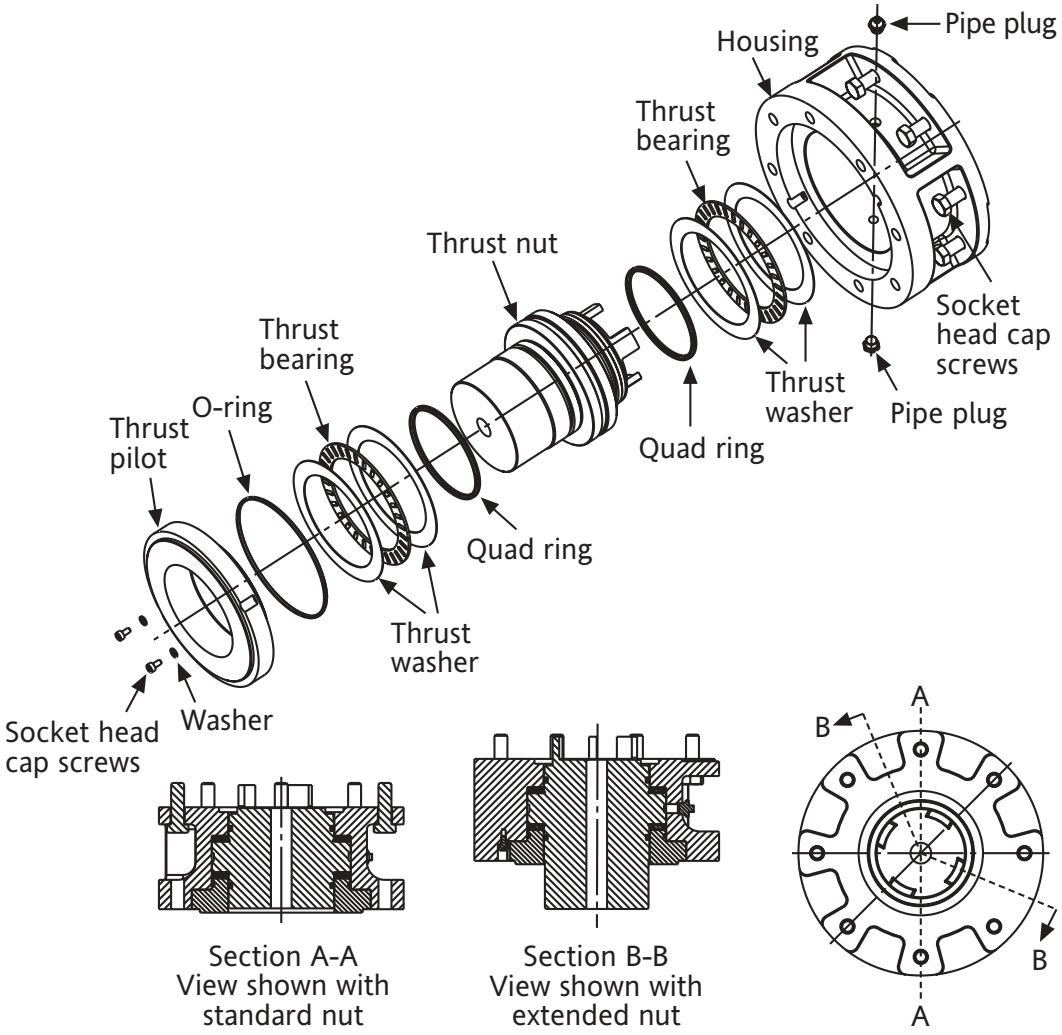


Figure 4.13 – Type A1 Thrust Base (MX-140) - F25 Flange



4.7.1 Removal

FIRST REMOVE
1. Remove actuator from mounting adapter.

STEP 1
⚠ WARNING Potential to operate while dangerous mechanical parts are exposed during subassembly removal. To prevent injury, turn off all power sources to actuator before removing thrust base assembly. Power sources may include: main power or control power.

Remove the four screws (#10-10) and pull the thrust base assembly off the actuator.



4.7.2 Remounting

STEP 2
Secure the thrust base with the four screws (#10-10).

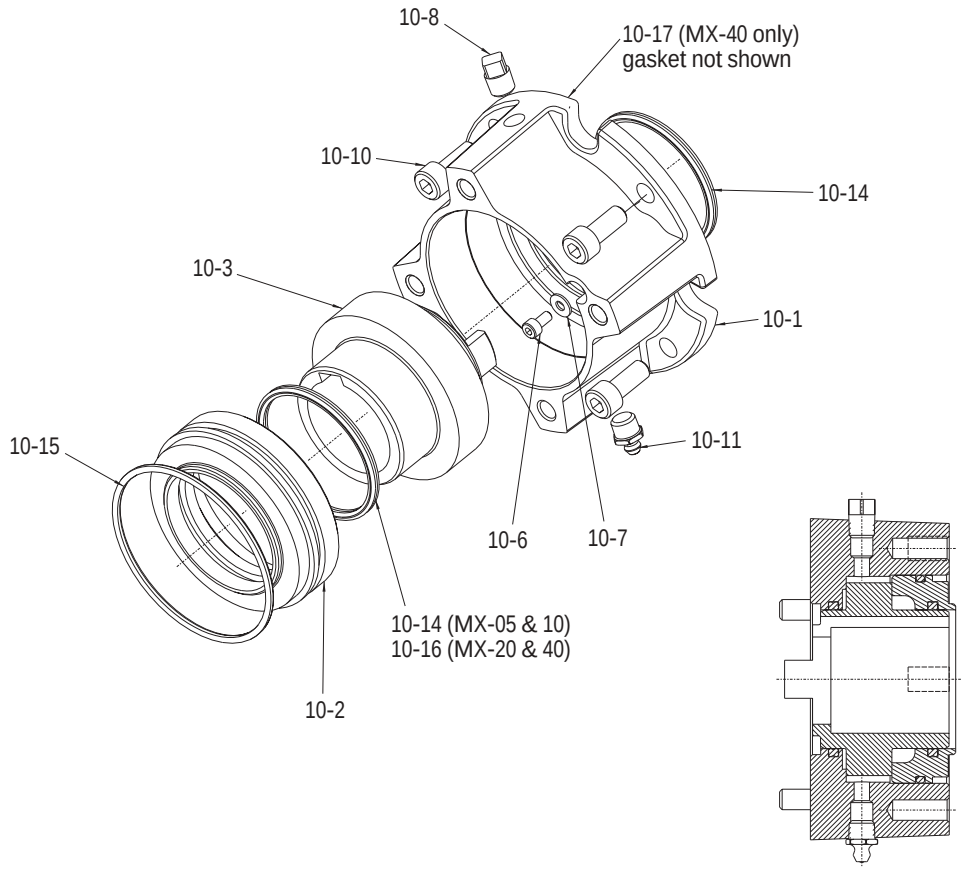


4.8 Torque Base Type B1

Table 4.14 – Type B1 Torque Base Parts List (MX-05, 10, 20, & 40)

Part Number	Description	Qty. MX-05	Qty. MX-10	Qty. MX-20	Qty. MX-40
10-1	Torque Housing	1	1	1	1
10-2	Torque/Thrust Pilot	1	1	1	1
10-3	Torque Nut (B1)	1	1	1	1
10-6	Socket Head Cap Screw	1	1	1	N/A
10-7	Washer	1	1	1	N/A
10-8	Pipe Plug	2	2	N/A	N/A
10-10	Socket Head Cap Screw	4	4	4	4
10-11	Grease Fitting	1	1	1	1
10-14	O-Ring	2	2	1	N/A
10-15	O-Ring	1	1	1	1
10-16	O-Ring	N/A	N/A	1	1
10-17	Gasket	N/A	N/A	N/A	1

Figure 4.14 – Type B1 Torque Base (MX-05, 10, 20, & 40)

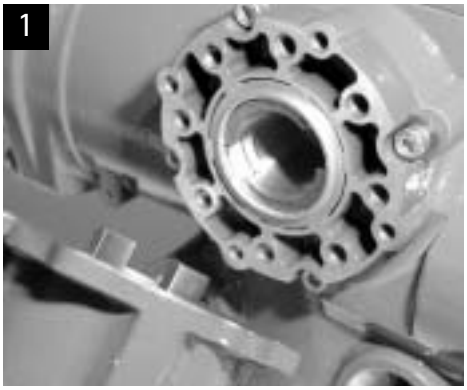


4.8.1 Removal

FIRST REMOVE
1. Remove actuator from mounting adapter.

STEP 1
⚠ **WARNING Potential to operate while dangerous mechanical parts are exposed during subassembly removal. To prevent injury, turn off all power sources to actuator before removing torque base assembly. Power sources may include: main power or control power.**

Remove the four screws (#10-1) and pull the torque base assembly off the actuator.



4.8.2 Remounting

STEP 2
Secure the torque base with the four screws (#10-1).



4.9 Baseplate Type B4 (MX-05, 10, 20, 40, 85 & 140)

Table 4.15 – Type B4 Baseplate Parts List (MX-05, 10, 20, & 40)

Part Number	Description	Qty. (MX-05, 10, 20 & 40)	Qty. (MX-85/140
11-1	Baseplate	1	1
11-2	Pilot	1	N/A
11-3 Seal (85/140)	Quad Ring	1	1
11-4	O-Ring	1	1
11-5	Socket Head Cap Screw	4	8

Figure 4.15 – Type B4 Baseplate (MX-05, 10, 20, & 40)

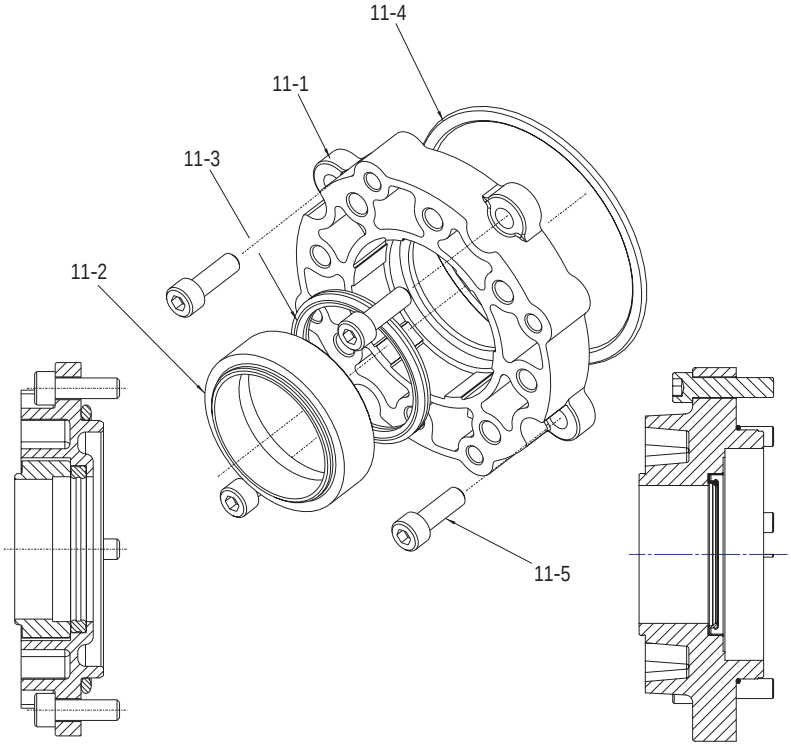
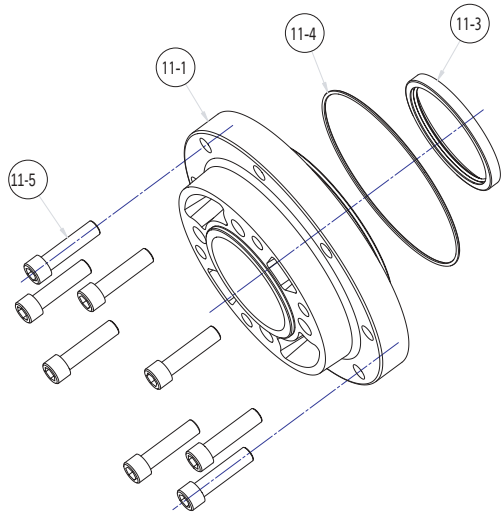
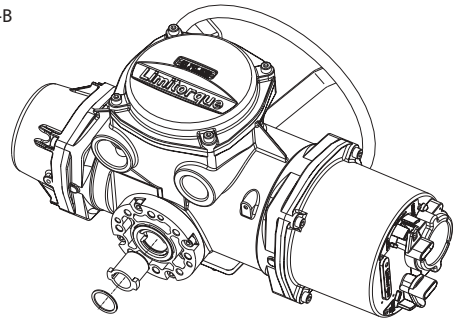


Figure 4.16 – Type B4 Baseplate (MX-85 & 140)



Stem Nuts (B4, B4E, and BL) Various stem nuts are used with the B4 baseplate:
1. B4 stem nut with variable bore and key
2. B4E stem nut for extended reach and variable bore and key
3. BL stem nut (6 or 36 splines)

The B4 stem nut is secured by a snap ring and the B4E and BL stem nuts are secured by a spiral-wound ring. Reference the **MX Installation Manual 130-11000** for more information about stem nut options.



Typical MX actuator with standard B4 stem nut and snap ring

4.9.1 Removal

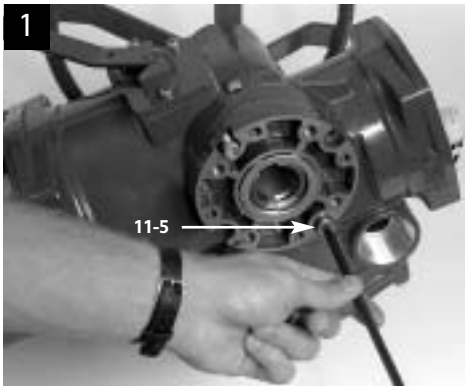
FIRST REMOVE

1. Remove actuator from mounting adapter.
2. Drain oil.
3. Remove thrust base (subassembly #10) - if fitted.
4. Remove stem nut.

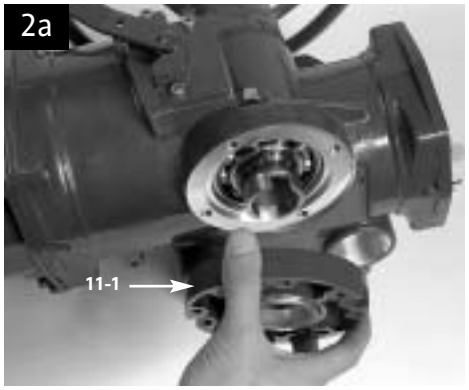
STEP 1

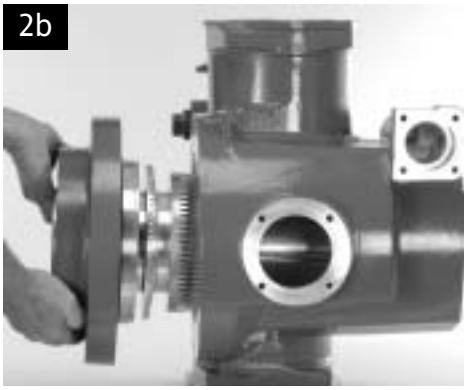
⚠ WARNING Potential to operate while dangerous mechanical parts are exposed during subassembly removal. To prevent injury, turn off all power sources to actuator before removing base plate assembly. Power sources may include: main power or control power.

Using a hex key, remove the four or eight screws (#11-5).



STEP 2





Pull the baseplate (#11-1) off the drive sleeve.

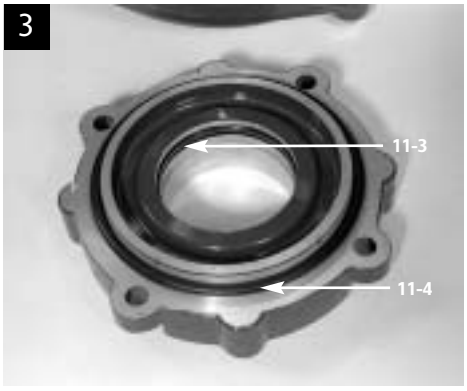
⚠ WARNING MX-85 & 140. If handwheel worm gear assembly has previously been removed,the drive sleeve assembly may slip and fall out of housing. Hold drive sleeve assembly in from opposite end. See Section 4.12.A & B for optional removal & remounting.

4.9.2 Remounting

STEP 3

CAUTION To ensure actuator is fully secured on mounting plate, ensure baseplate (#11-1) is tightened with the following torque values on mounting screws (#11-5):
MX-05 and 10 = 12 ft. lbs. (16 Nm)
MX-20 and 40 = 24 ft. lbs. (32 Nm)
MX-85 & 140 = 90 ft. lbs. (114 Nm)

Lightly lubricate the outside of the drive sleeve, the quad ring or seal (#11-3), and o-ring (#11-4) before remounting baseplate.



STEP 4
NOTE: (MX-20 only) Match outer bosses of baseplate with outer bosses of actuator housing before mounting baseplate assembly.
NOTE: (MX-85 & 140) Match mounting holes in baseplate to housing taps. Baseplate and housing has one hole/tap that is not equally spaced.

Carefully push the baseplate assembly onto the end of the drive sleeve, ensuring that the quad ring or seal (#11-3) is not damaged. Align the mounting holes and secure the baseplate with the screws (#11-5).

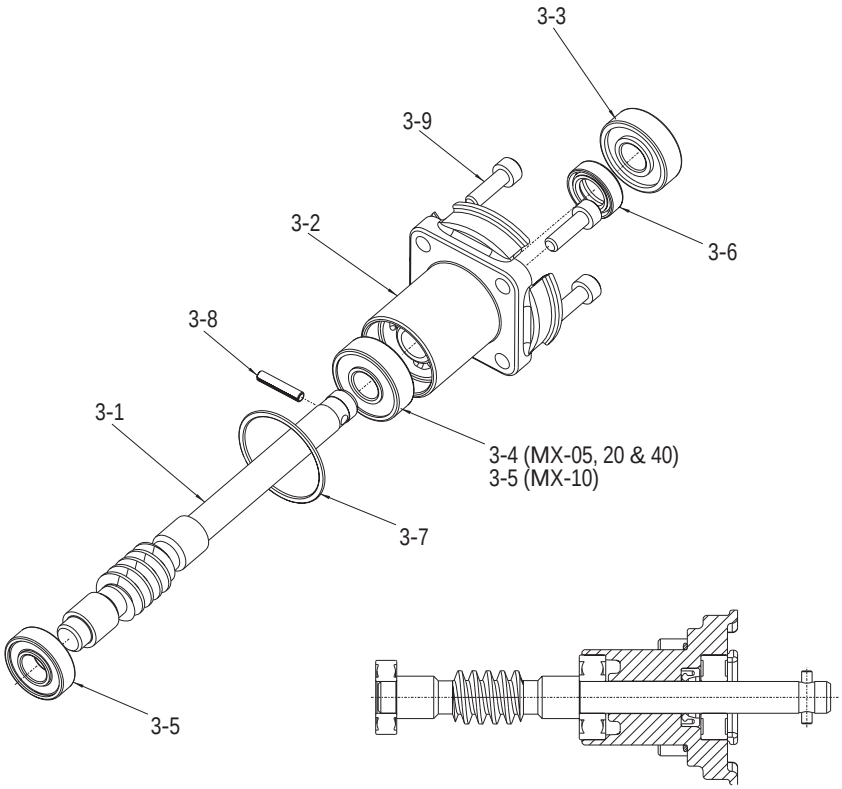


4.10 Worm Shaft (MX-05, 10, 20, 40, 85 & 140)

Table 4.16 – Worm Shaft Parts List (MX-05, 10, 20, 40, 85 & 140)

Part Number	Description	Qty. (MX-05, 10, 20 & 40)	Qty. (MX-85 & 140)
3-1	Worm	1	1
3-2	Worm Shaft Cap	1	1
3-3	Ball Bearing	1	1
3-4	Ball Bearing	1	2
3-5	Ball Bearing	1	N/A
3-6	Oil Seal	1	1
3-7	O-Ring	1	1
3-8	Pin	1	2
3-9	Socket Head Cap Screw	4	4

Figure 4.17 – Worm Shaft (MX-05, 10, 20, & 40)



4.10.1 Removal

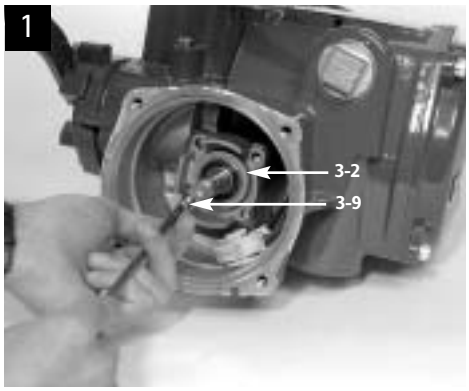
FIRST REMOVE

1. Remove actuator from mounting adapter.
2. Drain oil.
3. Remove motor (subassembly #4). (See **Section 4.1.1**.)

STEP 1

⚠ **WARNING Potential to operate while dangerous mechanical parts are exposed during subassembly removal. To prevent injury, turn off all power sources to actuator before removing worm shaft assembly. Power sources may include: main power or control power.**

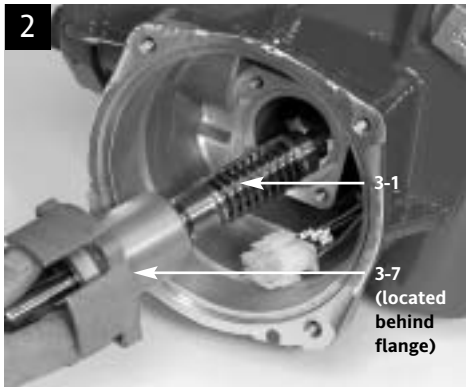
Remove the four screws (#3-5) that secure the worm shaft cap (#3-2) to the actuator housing.



STEP 2

NOTE: The inboard bearing (#3-5 for MX-05, 20, 85 & 140), at the end of the worm shaft (#3-1) should remain in the actuator housing. If it falls out while removing the worm shaft assembly, ensure it is replaced during remounting process.

Withdraw the complete worm shaft assembly from the actuator housing, turning/rotating it if necessary to free the worm from the worm gear. Note the o-ring (#3-7) that is on the worm shaft assembly. Replace at remounting.



4.10.2 Remounting

STEP 3

Check that the bearing (#3-5) is seated firmly in the actuator housing.

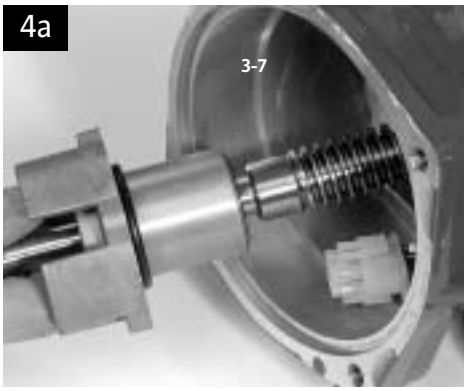


STEP 4
NOTE: Lightly lubricate o-ring (#3-7) before remounting worm shaft (subassembly #3).

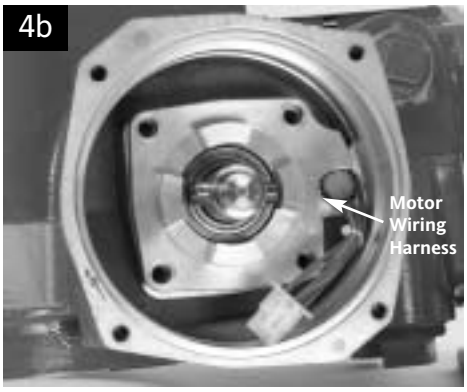
Lightly lubricate o-ring (#3-7) on the worm shaft (subassembly #3). Push the complete worm shaft assembly into the actuator housing until the worm contacts the worm gear. Turn the worm so it engages the worm gear and continue rotating until the end of the worm shaft is isolated in the inboard bearing (#3-4).

MX-85 & 140 only:
Be sure the motor wiring harness is pushed in, then rotate worm shaft cap (#3-2) around so that tab is holding wiring harness in place. See **Section 5.8** for motor wiring harness installation.

4a

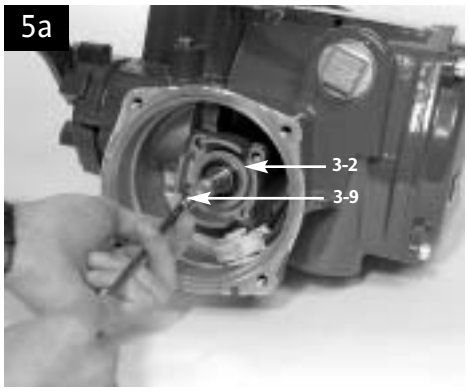


4b

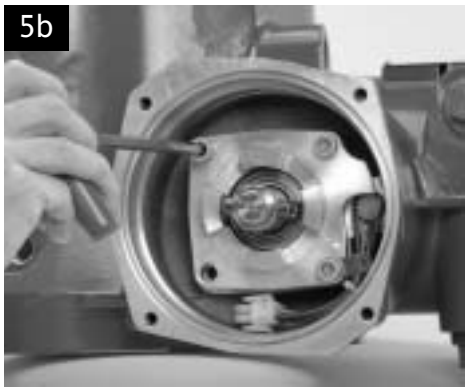


STEP 5
Using a hex key, fit the four M6, M8, or M10 screws (#3-9) into worm shaft cap (#3-2) mounting holes and tighten.

5a



5b

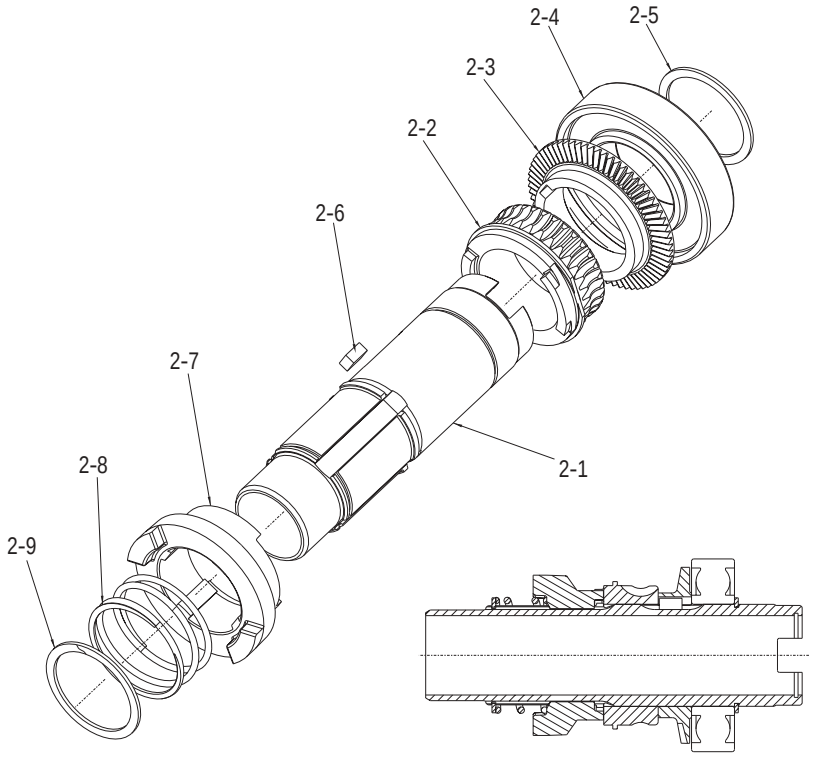


4.11 Drive Sleeve (MX-05 & 10)

Table 4.17 – Drive Sleeve Parts List (MX-05 & 10)

Part Number	Description	Qty.
2-1	Drive Sleeve	1
2-2	Worm Gear	1
2-3	Encoder Drive Gear	1
2-4	Ball Bearing	1
2-5	Retaining Ring	1
2-6	Drive Sleeve Key	1
2-7	Clutch	1
2-8	Clutch Spring	1
2-9	Retaining Ring	1

Figure 4.18 – Drive Sleeve (MX-05 & 10)



4.11.1 Removal

FIRST REMOVE

1. Remove actuator from mounting adapter.
2. Drain oil.
3. Remove thrust base (subassembly #10) - if fitted.
4. Remove motor (subassembly #4). (See **Section 4.1.1**.)
5. Remove worm shaft (subassembly #3). (See **Section 4.10.1**.)
6. Remove base plate (subassembly #11). (See **Section 4.9.1**.)

STEP 1

⚠ **WARNING Potential to operate while dangerous mechanical parts are exposed during subassembly removal. To prevent injury, turn off all power sources to actuator before removing drive sleeve assembly. Power sources may include: main power or control power.**

Once all other subassemblies are removed, pull out the drive sleeve assembly (#2) until the lower bearing (#2-4) is released from the actuator housing. Remove drive sleeve assembly from actuator.

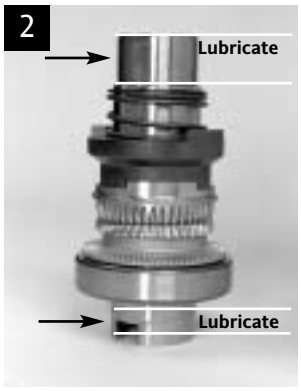


4.11.2 Remounting

STEP 2

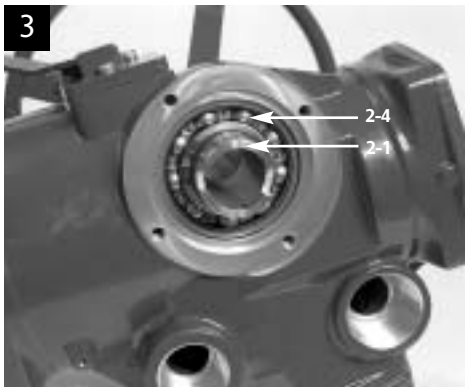
CAUTION The drive sleeve surface serves as an oil sealing surface. Use caution not to scratch the drive sleeve while completing removal and remounting.

Lightly lubricate the top and bottom of the drive sleeve assembly as shown.



STEP 3

Insert the drive sleeve assembly into the actuator housing base until the lower bearing (#2-4) is fully engaged in the housing (seated on actuator shoulder). If the bearing is a tight fit, gently tap the bottom of drive sleeve (#2-1) with a mallet to properly seat.



STEP 4

Remount all removed subassemblies according to their remounting instructions in the following order:

1. Base plate (subassembly #11). (See **Section 4.9.2**.)
2. Worm shaft (subassembly #3). (See **Section 4.10.2**.)
3. Motor (subassembly #4). (See **Section 4.1.2**.)
4. Thrust base (subassembly #10) - if fitted. (See **Section 4.7.2**.)

4.12 Drive Sleeve (MX-20, 40, 85 & 140)

Table 4.18 – Drive Sleeve Parts List (MX-20 & 40)

Part Number	Description	Qty. (MX-20/40)	Qty. (MX-85 & 140)	Qty. (MX-85 & 140) 10:1 & 13:1 Ratio
2-1	Drive Sleeve	1	1	1
2-2	Worm Gear	1	1	1
2-3	Encoder Drive Gear	1	1	1
2-4	Ball Bearing	1	1	1
2-5	Retaining Ring	1	N/A	N/A
2-6	Drive Sleeve Key	1	1	1
2-7	Spacer	N/A	N/A	3
2-8	Ball Bearing	N/A	N/A	2
2-9	Retaining Ring	N/A	N/A	1

Figure 4.19 – MX-20 & 40 Drive Sleeve

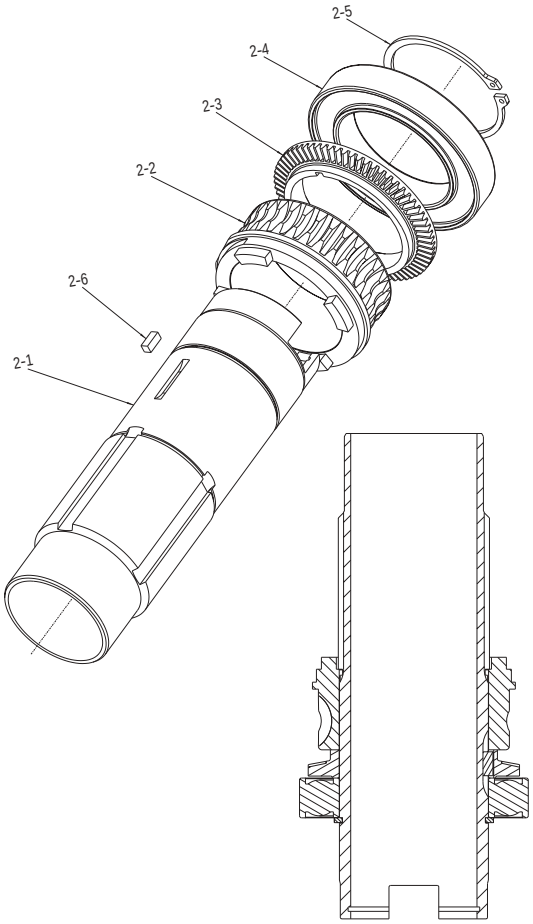
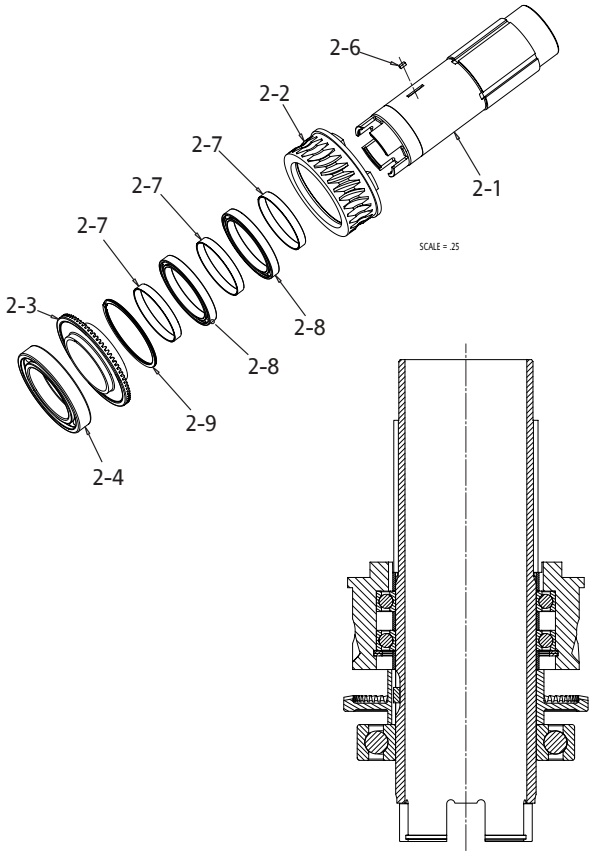


Figure 4.20 – MX-85 & 140
10 & 13 to 1 ratio



4.12.1 Removal

FIRST REMOVE

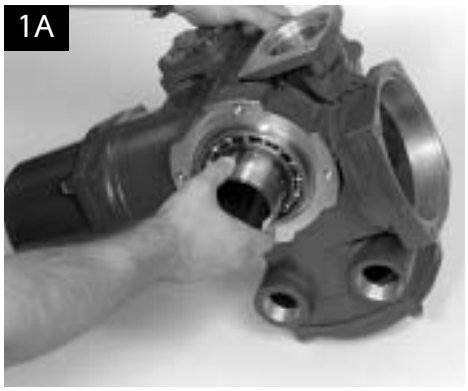
1. Remove actuator from mounting adapter.
2. Drain oil.
3. Remove thrust base (subassembly #10) - if fitted. (See **Section 4.8.1**.)
4. Remove motor (subassembly #4). (See **Section 4.1.1**.)
5. Remove worm shaft (subassembly #3). (See **Section 4.10.1**.)
6. Remove top-mounted handwheel (#1-8) or side-mounted handwheel (subassembly #16). (See **Section 4.3.1 or 4.4.1**.)
7. Remove handwheel adapter (subassembly #12). (See **Section 4.14.1**.)
8. Remove clutch and clutch ring (subassembly #16). (See **Section 4.15.1**.)
9. Remove handwheel declutch (subassembly #5). (See **Section 4.2.1**.)
10. Remove base plate (subassembly #11). (See **Section 4.9.1. or Section 4.12.a** for MX-85 & 140)

⚠ WARNING (MX-85 & 140)
The drive sleeve assembly may slip and fall out of housing when removing baseplate assembly. Hold drive sleeve assembly in from opposite end when removing baseplate assembly. See optional drive sleeve and baseplate removal Section 4.12.a & 4.12.b.

STEP 1

⚠ WARNING Potential to operate while dangerous mechanical parts are exposed during subassembly removal. To prevent injury, turn off all power sources to actuator before removing drive sleeve assembly. Power sources may include: main power or control power.

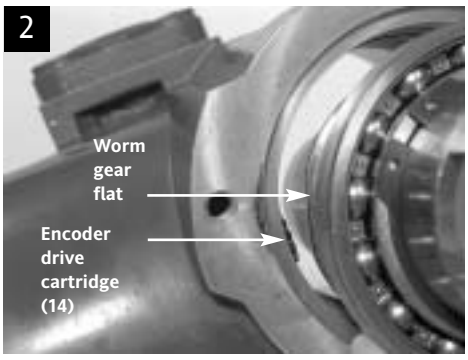
Once all other subassemblies are removed, pull out the drive sleeve assembly (#2) until the lower bearing (#2-4) is released from the actuator housing. Remove drive sleeve assembly from actuator.
MX-85 & 140: Optional drive sleeve and baseplate removal instructions.



STEP 2 *(VIEWED FROM BASEPLATE SIDE OF ACTUATOR)*

CAUTION (MX-20 & 40) The drive sleeve surface serves as an oil sealing surface. Use caution not to scratch the drive sleeve while completing removal and remounting.

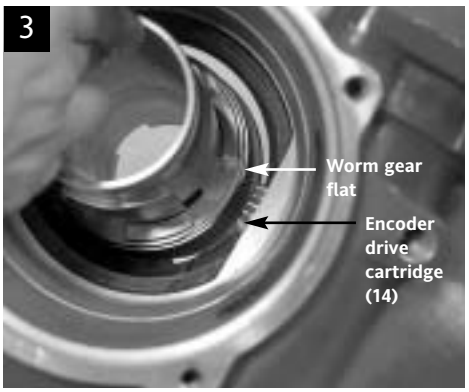
Tip To avoid interference between drive sleeve assembly and encoder drive cartridge (subassembly #14), turn flat on worm gear to be parallel and on same side as encoder bevel gear.



STEP 3 ***(VIEWED FROM TOP-MOUNTED HANDWHEEL SIDE OF ACTUATOR)***

CAUTION (MX-20 & 40 ONLY) When removing or remounting drive sleeve assembly, take precaution not to bump drive sleeve assembly against encoder drive cartridge (subassembly #14).

Tip: Worm gear flat turned parallel with encoder drive cartridge (subassembly #14) to permit drive sleeve assembly removal.

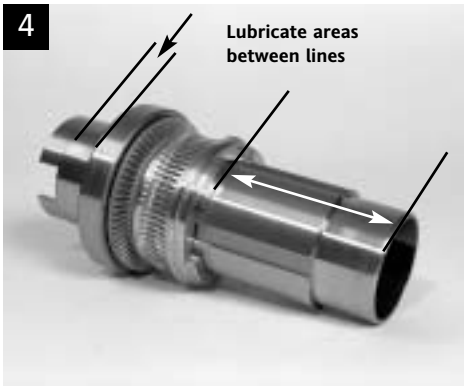


4.12.2 Remounting

STEP 4

NOTE: Before remounting drive sleeve assembly, ensure that bearing (#3-5) is in place in the actuator housing. (Refer to motor subassembly #3 Step 1 for details.)

Lightly lubricate the top and bottom of the drive sleeve assembly as shown.



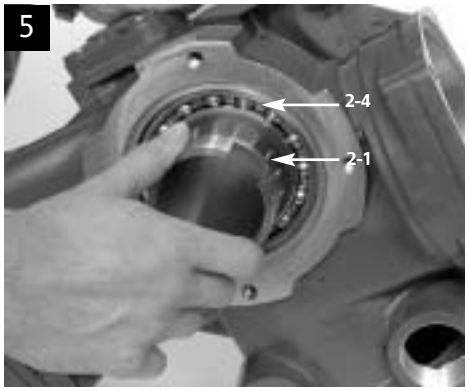
STEP 5

CAUTION (MX-20 & 40 ONLY) When removing or remounting drive sleeve assembly, take precaution not to bump drive sleeve assembly against encoder drive cartridge (subassembly #14).

Push the drive sleeve assembly into the base of the actuator housing until the lower bearing (#2-4) is fully engaged in the housing up to the shoulder. If the bearing is a tight fit, gently tap the bottom of the drive sleeve (#2-1) with a mallet to properly seat.

MX-85 & 140

See **Section 4.12.b** for optional remounting of drive sleeve and baseplate.



4.12.a MX-85 & 140 Optional Drive Sleeve and Baseplate Removal

FIRST REMOVE

1. Remove actuator from mounting adapter.
2. Drain oil.
3. Remove thrust base (subassembly #10) - if fitted. (See **Section 4.8.1**.)
4. Remove motor (subassembly #4). (See **Section 4.1.1**.)
5. Remove worm shaft (subassembly #3). (See **Section 4.10.1**.)
6. Remove top-mounted handwheel (#1-8) or side-mounted handwheel (subassembly #16). (See **Section 4.3.1 or 4.4.1**.)
7. Remove handwheel adapter (subassembly #12). (See **Section 4.14.1**.)
8. Remove clutch and clutch ring (subassembly #16). (See **Section 4.15.1**.)
9. Remove handwheel declutch (subassembly #5). (See **Section 4.2.1**.)

STEP 1

Lay actuator on its side with the drive sleeve horizontal. Using a hex key, remove seven of the baseplate screws (#11-5).



STEP 2

Lay actuator on a table or suitable structure with one of the screws (#11-5) hanging over the edge. Remove screw. If needed, rotate actuator around and remove all other screws.



STEP 3

With help, lift housing straight up and off baseplate and drive sleeve assemblies.

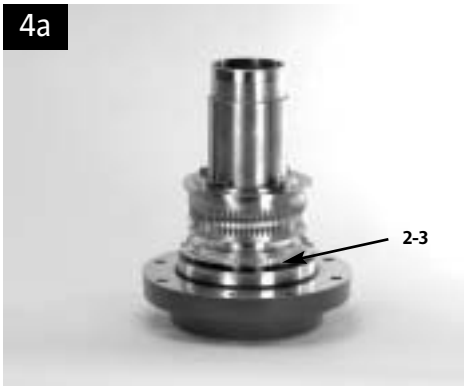


STEP 4

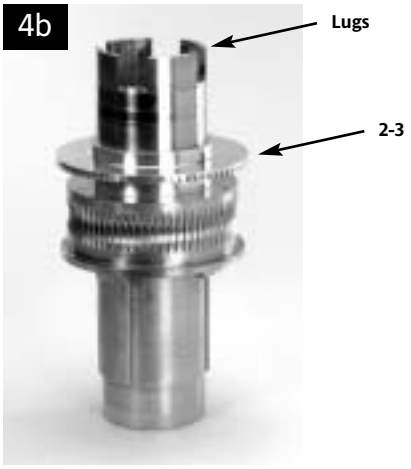
Using the encoder gear (#2-3), lift drive sleeve assembly out of the baseplate assembly. Turn the drive sleeve assembly over (lugs of drive sleeve up) and set down on table.

NOTE: The drive sleeve assembly is not held together and will fall apart if set down on a lug end of drive sleeve.

4a



4b



4.12.b MX-85 & 140 Optional Drive Sleeve and Baseplate Remounting

STEP 1

Assemble drive sleeve assembly with drive sleeve lying on opposite end of lugs. Place worm gear (#2-2), key (#2-6) and encoder derive gear (#2-3) onto the drive sleeve (#2-1). Place the ball bearing (#2-4) into the baseplate assembly. See **picture 4b**.

Lightly lubricate the bottom of the drive sleeve (#2-1) and the baseplate seal (#11-3).

Lift the drive sleeve assembly up, and holding the encoder drive gear (#2-2), turn the drive sleeve over and place into the baseplate assembly. See **picture 4a**.

STEP 2

With help, lift housing and place over the drive sleeve and baseplate assemblies. Match up the mounting holes in the baseplate and housing. With the actuator sitting on the baseplate, slide the unit over to the edge and mount one or two of the baseplate screws (#11-5). Turn unit over on its side with the drive sleeve horizontal and secure the baseplate with the rest of the mounting screws.

NOTE: The drive sleeve is held in from the top by the handwheel worm gear. Without the handwheel worm gear, the drive sleeve may slip out of position. Push the drive sleeve back into position form the handwheel worm gear end. See **picture 3, 2, and 1**, in that order from **Section 4.12.a**.

STEP 6

Remount all removed subassemblies according to their remounting instructions in the following order:

1. Base plate (subassembly #11). (See **Section 4.9.2**.)
2. Worm shaft (subassembly #3). (See **Section 4.10.2**.)
3. Handwheel declutch (subassembly #5). (See **Section 4.2.2**.)
4. Clutch and clutch ring (subassembly #16). (See **Section 4.15.2**.)
5. Handwheel adapter (subassembly #12). (See **Section 4.14.2**.)
6. Top-mounted handwheel (subassembly #1-8) or side-mounted handwheel (subassembly #13). (See **Section 4.3.2 or 4.4.2**.)
7. Motor (subassembly #4). (See **Section 4.1.2**.)
8. Thrust base (subassembly #10) - if fitted. (See **Section 4.8.2**.)

4.13 Handwheel Adapter (MX-05)

Table 4.19 – Handwheel Adapter Parts List (MX-05)

Part Number	Description	Qty.
12-1	Handwheel Adapter	1
12-2	Needle Bearing	1
12-3	Quad Ring	1
12-4	O-Ring	1

Figure 4.21 – Handwheel Adapter (MX-05)

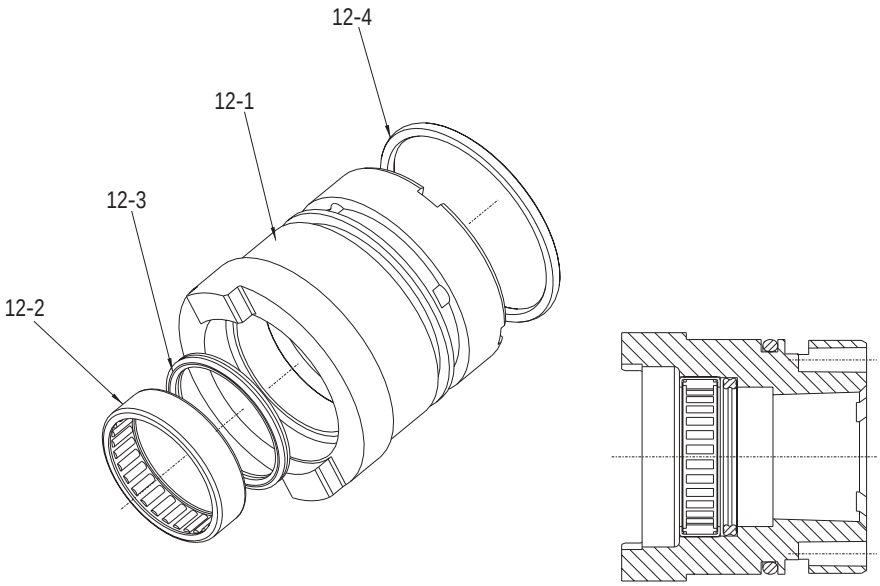
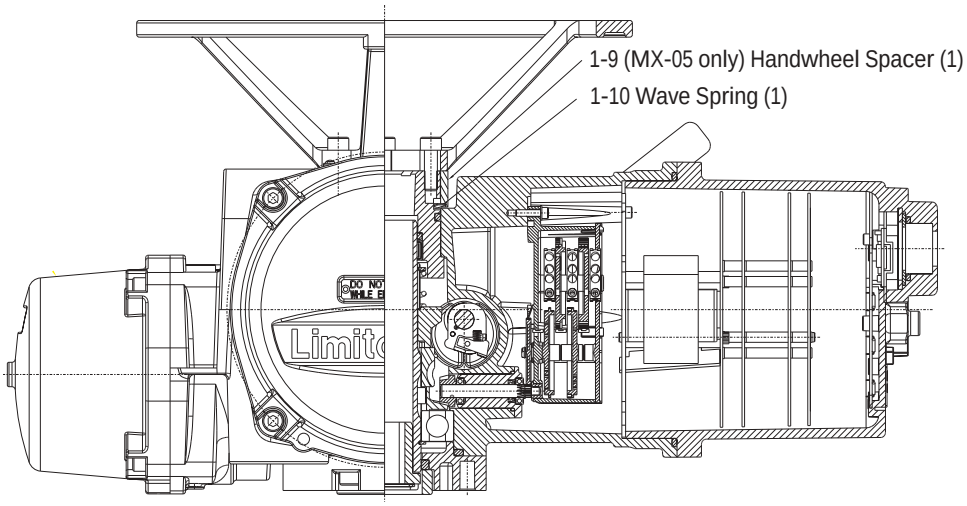


Figure 4.22 – Handwheel (MX-05)



4.13.1 Removal

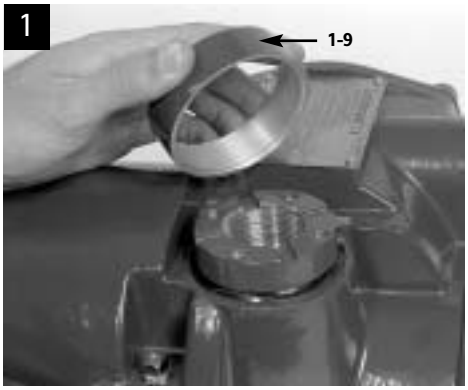
FIRST REMOVE

1. Remove actuator from mounting adapter.
2. Drain oil.
3. Remove top-mounted handwheel (#1-8). (See **Section 4.3.1**.)
4. Remove motor (subassembly #4). (See **Section 4.1.1**.)
5. Remove worm shaft (subassembly #3). (See **Section 4.10.1**.)
6. Remove base plate (subassembly #11). (See **Section 4.9.1**.)
7. Remove drive sleeve (subassembly #2). (See **Section 4.11.1**.)

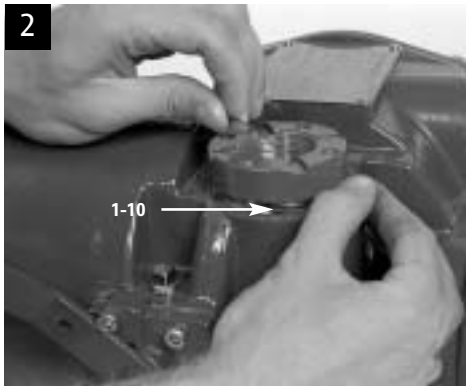
STEP 1

⚠ **WARNING Potential to operate while dangerous mechanical parts are exposed during subassembly removal. To prevent injury, turn off all power sources to actuator before removing handwheel adapter assembly. Power sources may include: main power or control power.**

Remove handwheel spacer (#1-9).

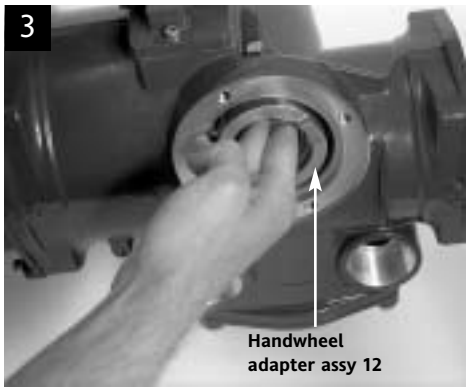


STEP 2
Unwind wave spring (#1-10) and remove.



STEP 3
NOTE: The handwheel adapter for the MX-05 is removed and introduced from the base of the actuator housing.

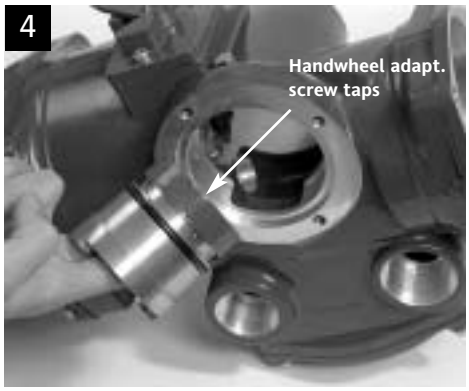
Push adapter assembly (#12) from the top of the actuator out through the bottom of the actuator housing.



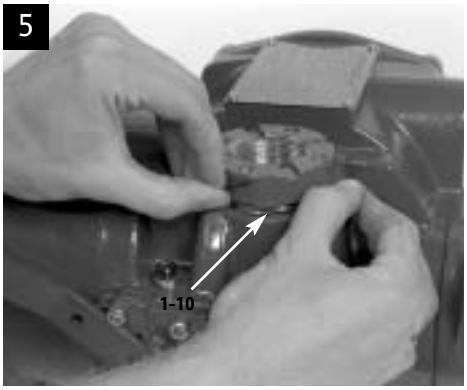
4.13.2 Remounting

STEP 4
NOTE: Lightly lubricate quad rings/o-rings before remounting subassemblies.

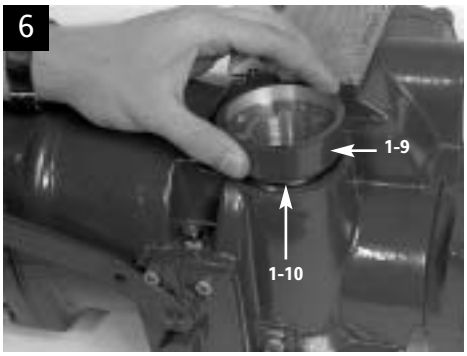
With handwheel screw taps facing toward the nameplate side of the actuator, slide handwheel adapter assembly (#12) into the actuator housing's drive sleeve bore. Use hammer handle or similar device to push handwheel adapter assembly against shoulder inside actuator housing.



STEP 5
Once handwheel adapter assembly is installed in actuator housing, wind wave spring (#1-10) into groove on the handwheel adapter.



STEP 6
Slide handwheel spacer (#1-9) over handwheel adapter assembly, ensuring wave spring (#1-10) is seated in groove of the handwheel spacer.



STEP 7
Remount all removed subassemblies according to the remounting instructions in the following order:
1. Drive sleeve (subassembly #2). (See **Section 4.11.2**.)
2. Base plate (subassembly. #11). (See **Section 4.9.2**.)
3. Worm shaft (subassembly. #3). (See **Section 4.10.2**.)
4. Motor (subassembly #4). (See **Section 4.1.2**.)
5. Top-mounted handwheel (#1-8). (See **Section 4.3.2**.)

NOTE: After completing handwheel assembly procedure, turn handwheel enough to ensure wave spring is not pinched between actuator housing and handwheel spacer. If it is pinched, remove handwheel (#1-8) and handwheel spacer (#1-9) to reseat the wave spring (#1-10) into the grove on the handwheel spacer. Install handwheel.

6. Add oil.

4.14 Handwheel Adapter (MX-10, 20 & 40)/ Handwheel Worm Gear (MX-10, 20, 40, 85 & 140)

Table 4.20 – Handwheel Adapter Assembly Parts List

Part Number	Description	Qty.
12-1	Handwheel Adapter	1
12-2	Ball Bearing	1
12-3	Quad Ring	1
12-4	O-Ring	1

Figure 4.23 – Handwheel Adapter Assembly

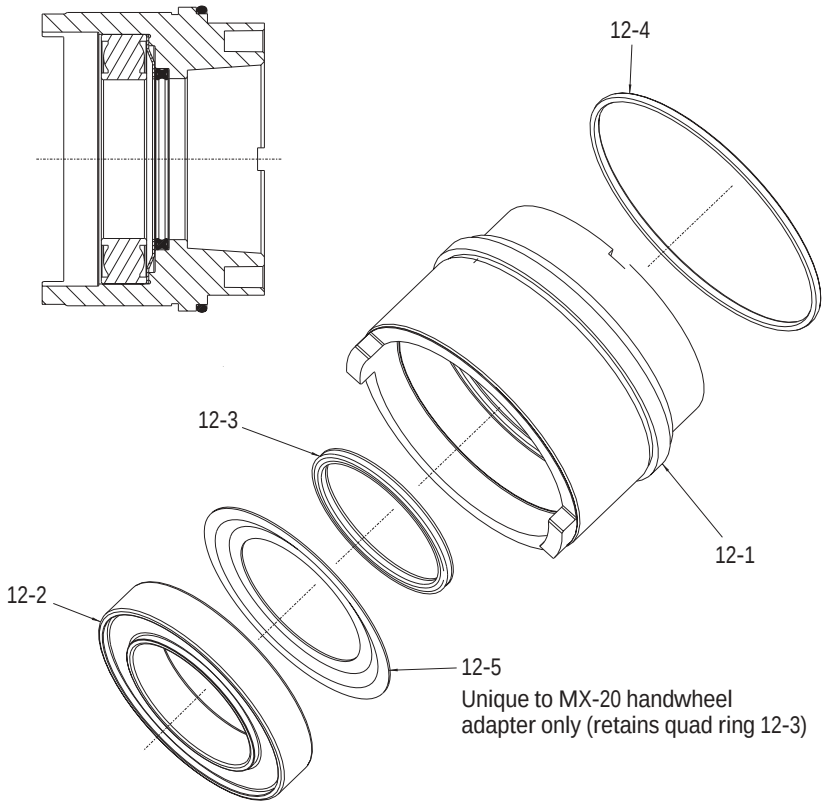
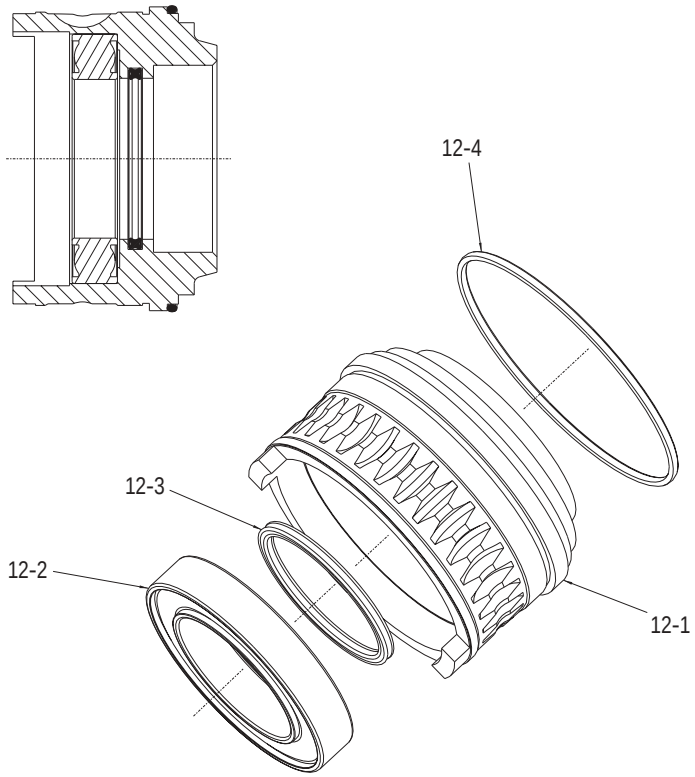


Table 4.21 – Handwheel Worm Gear Assembly Parts List

Part Number	Description	Qty.
12-1	Handwheel Worm Gear	1
12-2	Ball Bearing	1
12-3	Quad Ring	1
12-4	O-Ring	1

Figure 4.24 – Handwheel Worm Gear Assembly



4.14.1 Removal

FIRST REMOVE

1. Top-mounted handwheel (#1-8) or side-mounted handwheel (subassembly #13).
   (See **Section 4.3.1 or 4.4.1**.)

NOTE: Before removing handwheel and handwheel adapter assembly, turn handwheel approximately 45˚ to permit declutch lever to fully engage therefore making handwheel assembly easy to remove.


Handwheel Worm Gear Adapt. (12-1)

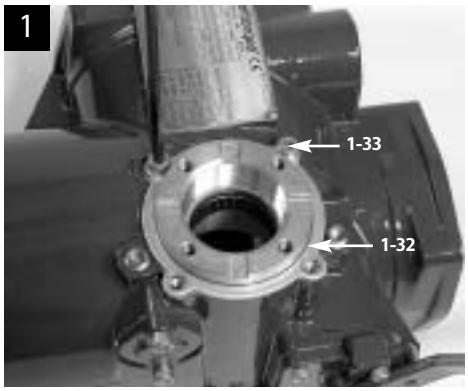

Handwheel Adapter (12-1)

The **Handwheel Adapter Assembly** and the **Handwheel Worm Gear Assembly** procedures are interchangeable. The parts within the assembly are the same with exception to the Handwheel Adapter (#12-1) and the Handwheel Worm Gear Adapter (#12-1). The Handwheel Adapter Assembly is used when the handwheel is top-mounted. The Handwheel Worm Gear Assembly is used when the handwheel is side-mounted.

STEP 1

⚠ **WARNING Potential to operate while dangerous mechanical parts are exposed during subassembly removal. To prevent injury, turn off all power sources to actuator before removing handwheel adapter assembly. Power sources may include: main power or control power.**

Remove the four screws (#1-33) from the retainer plate (#1-32).

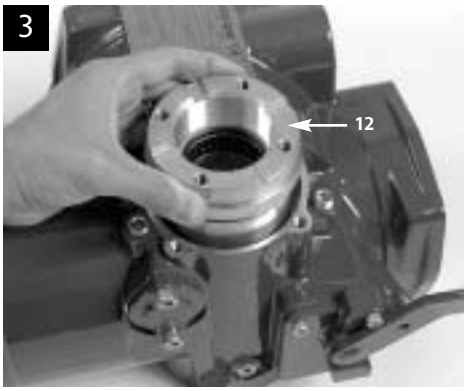


STEP 2

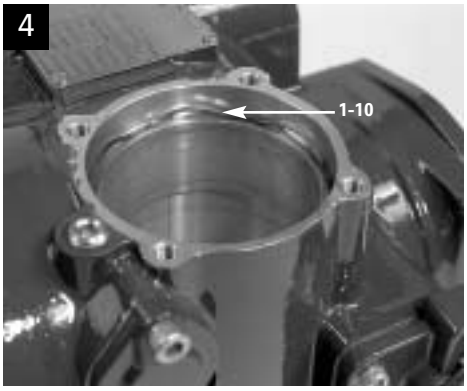
Lift off the retainer plate (#1-32).



STEP 3
Pull the handwheel adapter assembly (#12) out of the actuator housing.

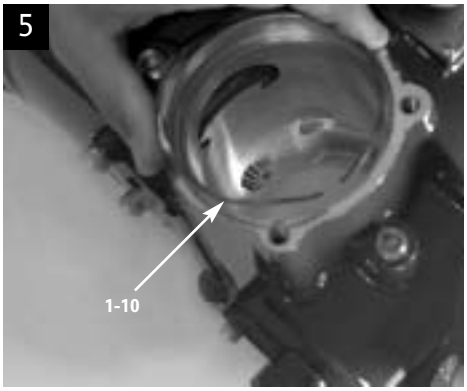


STEP 4 (MX-10 ONLY)
Lift out wave spring (#1-10) from actuator housing.



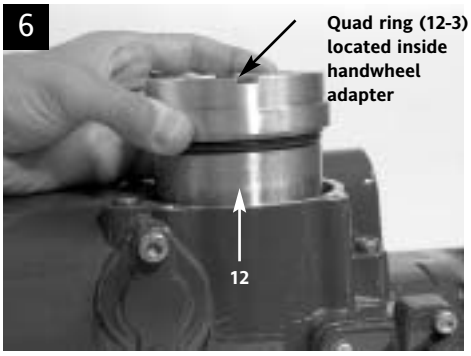
4.14.2 Remounting

STEP 5 (MX-10 ONLY)
Insert the wave spring (#1-10) onto the shoulder of the actuator housing.

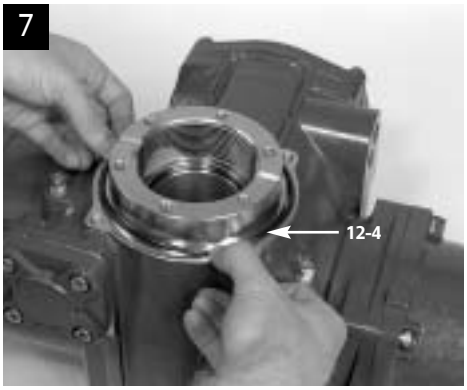


STEP 6
NOTE: Lightly lubricate quad rings/o-rings before remounting subassemblies.

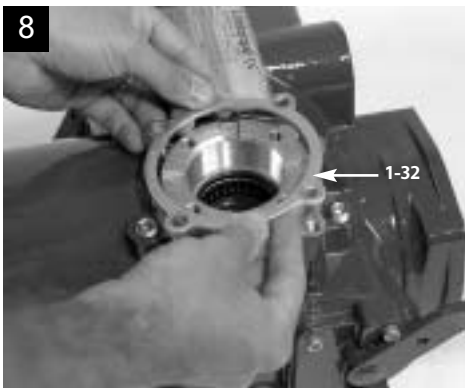
Fit the handwheel adapter assembly (#12) into the top of the actuator housing. Slowly rotate the assembly as it approaches its lower position in the actuator; this will allow the quad ring (#12-3) to ease over the end of the drive sleeve avoiding damage to the quad ring.



STEP 7 (MX-20 & 40 ONLY)
Place o-ring (#12-4) around handwheel adapter; pressing the o-ring into the slot between the handwheel adapter assembly (#12) and the actuator housing (approximately every 15˚ to 30˚ until o-ring seats into slot).



STEP 8
NOTE: Retainer plate (#1-32) may sit slightly above actuator housing until screws are retightened.



⚠ WARNING: PRECAUTION NOTE
The MX-10 through MX-140 requires precaution to prevent damage to the declutch latch. This applies while installing the handwheel adapter/gear assembly (#1-35), retainer plate (#1-32) and screws (#1-33). If the unit is in the clutched position (handwheel operation) during assembly, a lug-to-lug condition can result between the clutch and the handwheel adapter/gear. In this situation the latch will be compressed and damaged when the plate screws are tightened.

Assure the clutch lugs are fully engaged to the bronze gear lugs before installing the handwheel adapter/gear assembly. The latch must be rotated down and not holding the clutch off the bronze worm gear. When installing the handwheel adapter/gear, ensure these lugs fall between the clutch lugs. This position will allow the handwheel adapter/gear lugs to be fully engaged to the clutch lugs. The final step is to install the retaining plate and socket head cap screws.

Place the retainer plate (#1-32) on the top of the actuator housing. Align the mounting taps, and secure with screws (#1-33).

STEP 9 (MX-10, 20 & 40)
Install handwheel (#1-8) onto handwheel adapter assembly (#12), align the handwheel with screw holes and tighten the 4 socket head cap screws (#1-11).
or
Install side-mounted handwheel (subassembly #13) according to remounting instructions detailed in **Section 4.4.2**.



4.15 Clutch & Clutch Ring Components (MX-20, 40, 85 & 140)

Table 4.22 – Clutch & Clutch Ring Components Parts List

Part Number	Description	Qty.
1-38	Clutch	1
1-37	Clutch Ring	1
1-39	Clutch Spring	1
1-40	Spring Spacer	1

Figure 4.25 – MX-20 & 40
Clutch & Clutch Ring Components

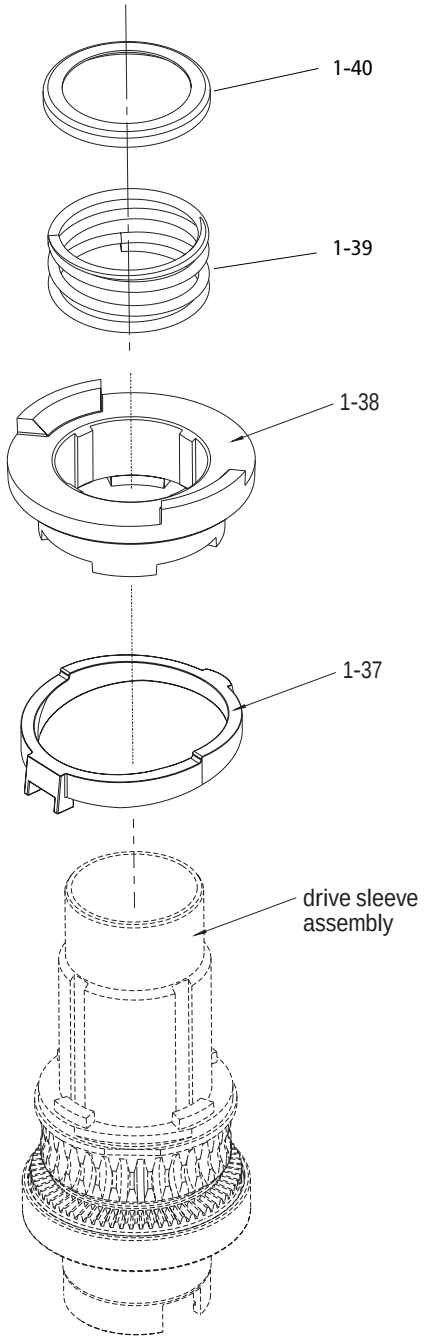
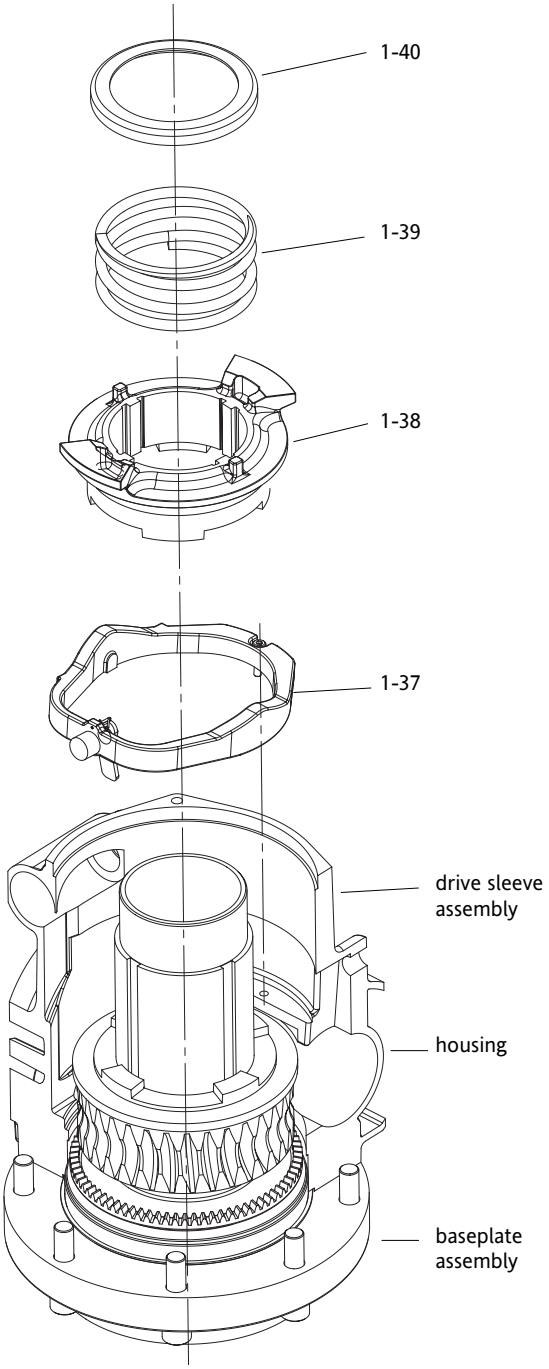


Figure 4.26 – MX-85 & 140
Clutch & Clutch Ring Components



4.15.1 Removal

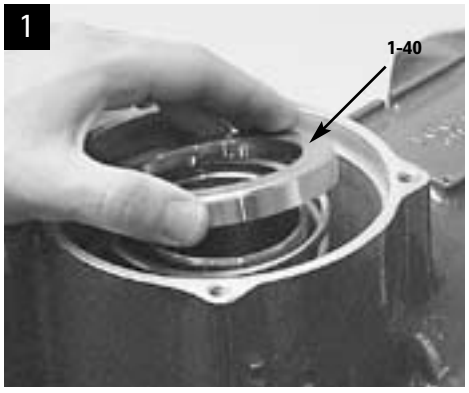
FIRST REMOVE

1. Drain oil.
2. Remove top-mounted handwheel (#1-8) or side-mounted handwheel (subassembly #13). (See **Section 4.3.1**, **Section 4.4.1, or Section 4.5.1**.)
3. Remove handwheel adapter (subassembly #12). (See **Section 4.14.1**.)

STEP 1

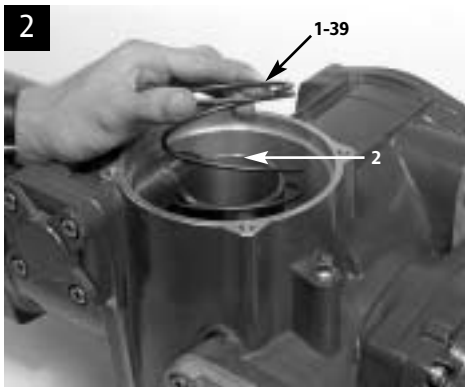
⚠ **WARNING Potential to operate while dangerous mechanical parts are exposed during subassembly removal. To prevent injury, turn off all power sources to actuator before removing clutch and clutch ring components. Power sources may include: main power or control power.**

Remove spring spacer (#1-40).



STEP 2

Remove clutch spring (#1-39) that is positioned over the drive sleeve assembly (#2).

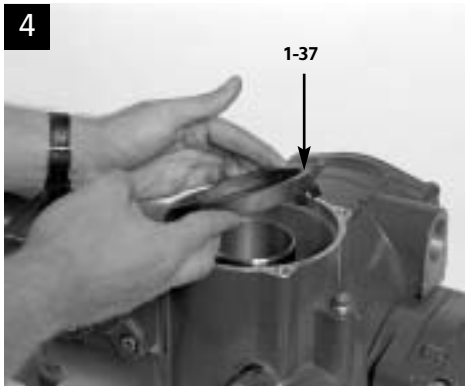


STEP 3

Remove clutch (#1-38).



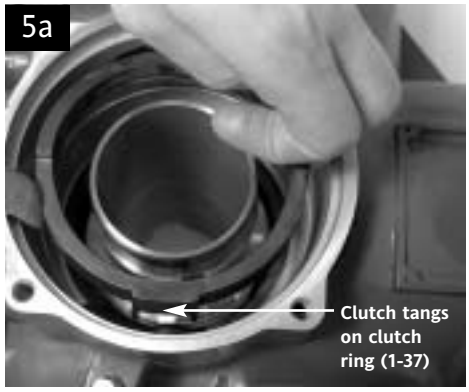
STEP 4
Remove clutch ring (#1-37).
MX-85 & 140 (removing clutch ring assembly)
While pulling up on clutch ring end with socket head cap screw (#15-9), rotate latch 90˚ and slide clutch ring over drive sleeve and out of housing.

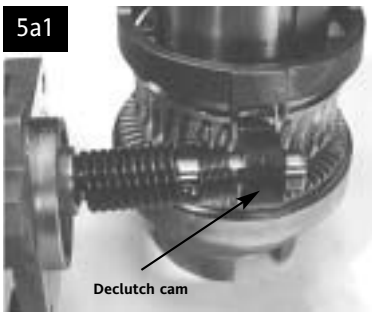


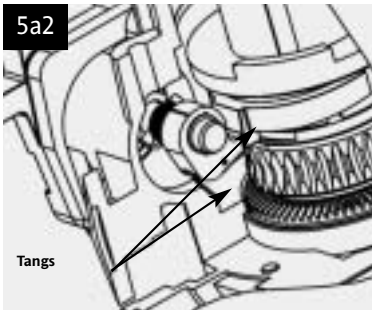
4.15.2 Remounting

⚠ **WARNING Potential to operate while dangerous mechanical parts are exposed during subassembly removal. To prevent injury, turn off all power sources to actuator before removing clutch and clutch ring components. Power sources may include: main power or control power.**

STEP 5a (MX-20 & 40 only)
Remounting clutch ring
Fit the clutch ring (#1-37) over the drive sleeve with the tangs (forked protrusion) facing down. Seat tangs over declutch cam (see **Figures 5a and 5a1** at right). See warning note in **Section 4.14.2, Step 8**.





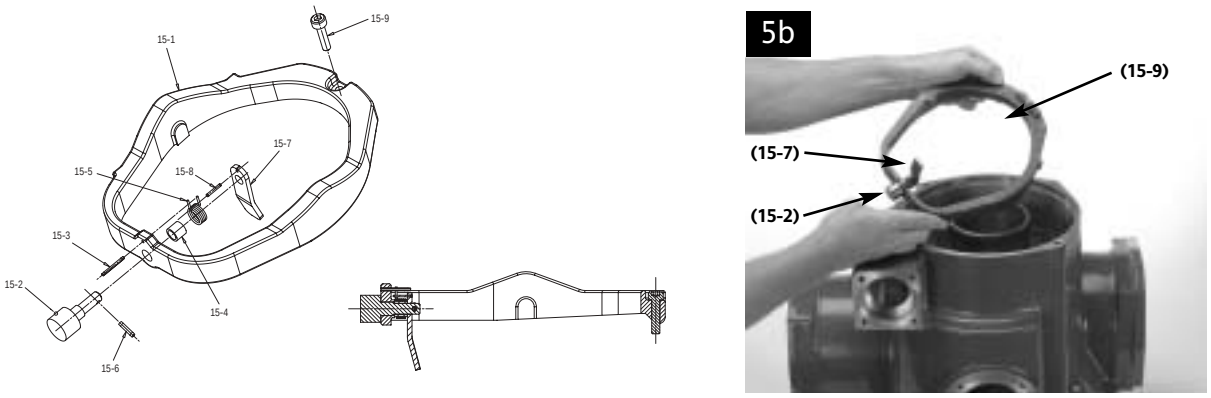


STEP 5b (MX-85 & 140 only)

Table 4.23 – Clutch Ring Assembly Parts List

Part Number	Description	Qty.
15-1	Clutch Ring	1
15-2	Roller	1
15-3	Roll Pin	1
15-4	Spacer	1
15-5	Latch Spring	1
15-6	Roll Pin	1
15-7	Latch	1
15-8	Roll Pin	1
15-9	Socket Head Cap Screw	1

Figure 4.27 – MX-85 & 140 Clutch Ring



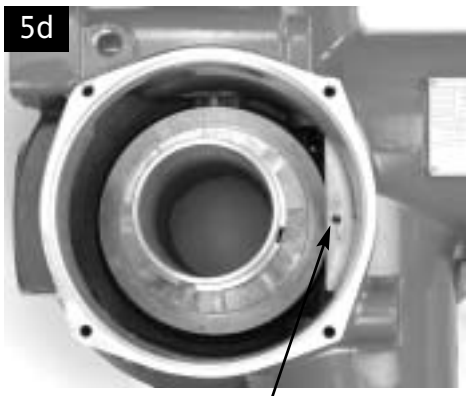
STEP 5b, c, d (MX-85 & 140) continued
Fit the clutch ring (#1-37) over the drive sleeve. With the roller (#15-2) down and holding the latch (#15-7) 90˚ from free position. See **5c**.

5c



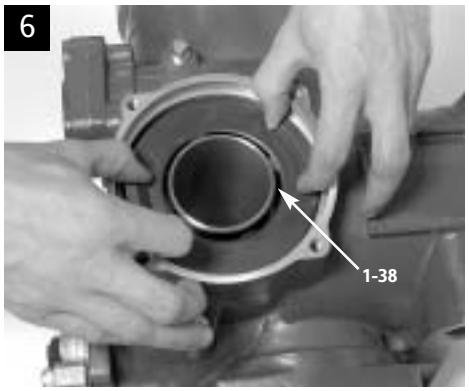
NOTE: The clutch ring socket head cap screw (#15-9) must fit into hole in housing to keep ring from rotating. See **5d**.
See **Warning Note in Section 4.14.2, Step 8**.

5d



Housing hole for clutch ring screw for anti-rotation of clutch ring assembly

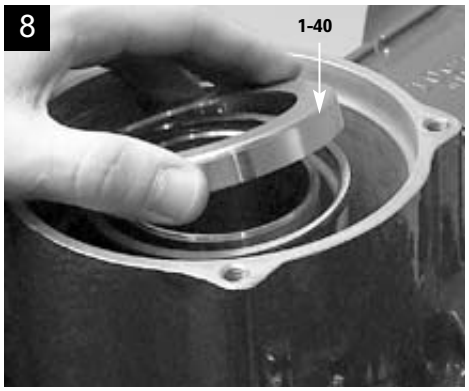
STEP 6
Slide clutch (#1-38) over drive sleeve assembly.



STEP 7
Slide spring (#1-39) over drive sleeve assembly.



STEP 8
Slide spring spacer (#1-40) over drive sleeve assembly.



STEP 9
Remount removed subassemblies according to their remounting instructions in the following order:
1. Handwheel adapter assembly (subassembly #12). (See **Section 4.14.2**.)
2. Top-mounted handwheel (#1-8) or side-mounted handwheel (subassembly #13). (See **Section 4.3.2** or **Section 4.4.2 [MX-20], or Section 4.5.2 [MX-40]**.

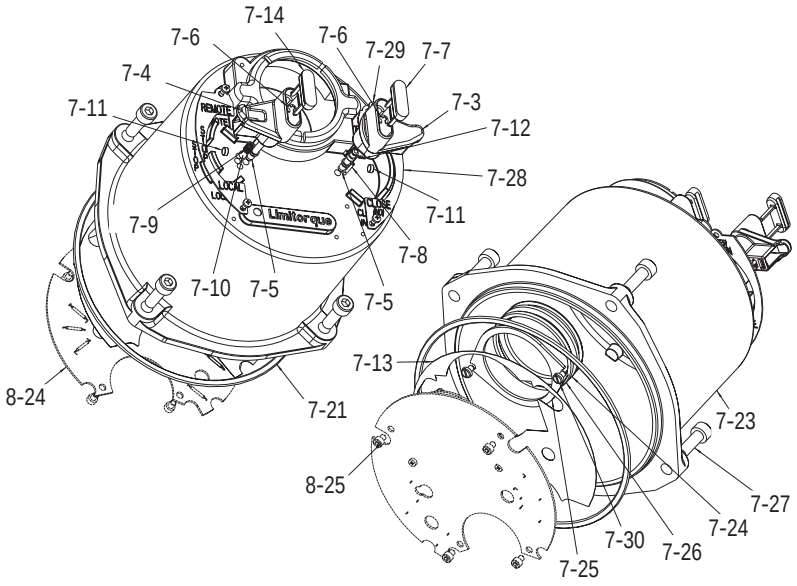
5 Electronic Assemblies

5.1 Accutronix Control Panel (ACP) (MX-05, 10, 20, 40, 85 & 140)

Table 5.1 – Accutronix Control Panel Parts List

Part Number	Description	Qty.
7-3	OPEN/CLOSE Knob	1
7-4	LOCAL/STOP/REMOTE Knob	1
7-5	Knob Pin	2
7-6	Screw	2
7-7	Black Knob Cap	1
7-8	Roll Pin	1
7-9	Spring	1
7-10	Ball	1
7-11	LCS Neodymium Magnet	2
7-12	LCS Torsion Spring	1
7-13	PC Board Shield	1
7-14	Red Knob Cap	1
7-21	O-Ring	1
7-23	Controls Cover	1
7-24	Window	1
7-25	Window Retainer	1
7-26	O-Ring	1
7-27	Socket Head Cap Screw	4
7-28	LCS Nameplate	2
7-29	Self-Tapping Screw (M3x5)	4
7-30	Pan Head Machine Screw (M4x6)	2

Figure 5.1 – Accutronix Control Panel



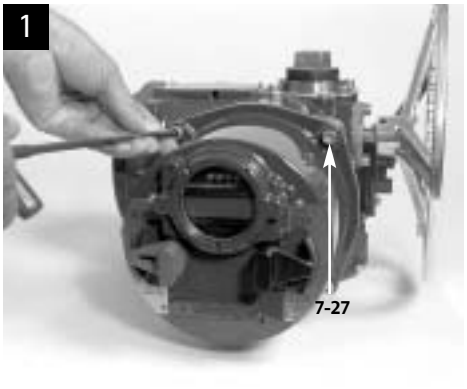
5.1.1 Removal

STEP 1

⚠ WARNING Hazardous Voltage! Turn off all power sources to actuator before removing ACP assembly.
Power sources may include main power or control power.

CAUTION Potential to cause electrostatic damage to electronic components. Before handling electronic components, ensure that you are discharged of static electricity by briefly touching a grounded metal object.

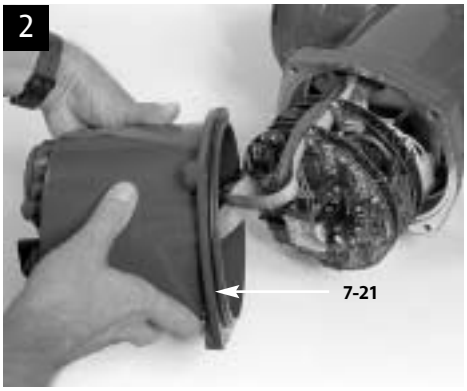
Remove the four M8 screws (#7-27) using a 6mm hex key.



STEP 2

CAUTION Be careful not to drop cover. Weatherproof (WP) covers have a short spigot/pilot. Be careful when removing screws not to let cover drop off the actuator.

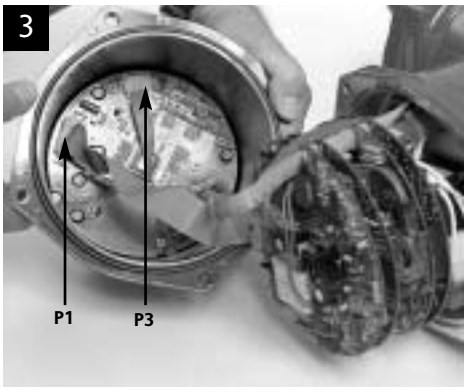
Withdraw the ACP cover until the ribbon cables are accessible. Notice the o-ring (#7-21) on the ACP cover spigot/pilot. Replace at remounting.



STEP 3

CAUTION Careful not to jam cover. Explosionproof covers have a long spigot/pilot. Remove with caution; careful not to tilt when removing from actuator housing. Tilting cover too far to one side or the other could cause it to bind in the actuator housing.

Disconnect the 2 ribbon cables inside the ACP cover (#7-23) from the connectors P1 and P3 on the ACP board.

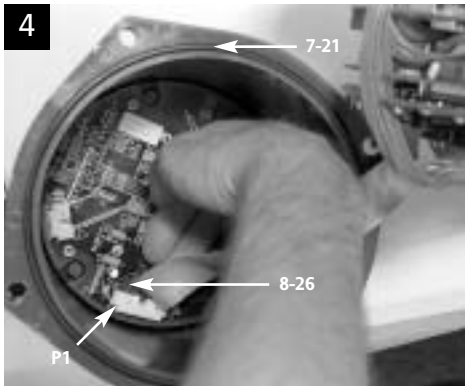


5.1.2 Remounting

STEP 4

⚠ WARNING Hazardous Voltage! Turn off all power sources to actuator before remounting ACP assembly.
Power sources may include main power or control power.

Ensure o-ring (#7-21) is intact on the ACP spigot/pilot. Hold the ACP in front of the control module assembly and connect 20-pin ribbon connector plug (#8-26) to connector P1 on the ACP board. This ribbon cable is always connected to the main processor board and also the I/O option board, if included in package.

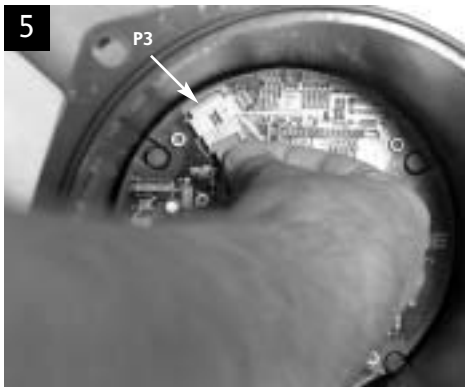


STEP 5

CAUTION Potential to pinch ribbon cables. When remounting ACP cover, take special care not to pinch ribbon cables.

NOTE: To ensure 10-pin ribbon cable is properly secured and out of the way of the cover, run cable along semicircular slots on electronic boards.

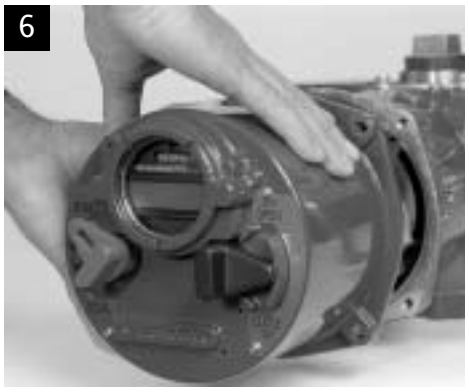
Connect the 10-pin ribbon connector plug to connector P3 on the ACP board (the 10-pin connector is connected to the encoder subassembly #6).



STEP 6

NOTE: The face of the ACP may be installed in any one of four 90˚ incremental positions. When changing ACP position, avoid over-twisting the ribbon cable.

Rotate the ACP until the display orientation of the front face is correct for normal viewing, then slide the ACP assembly into the actuator housing.



STEP 7
Secure the ACP with the four M8 screws (#7-27) using a 6mm hex key.

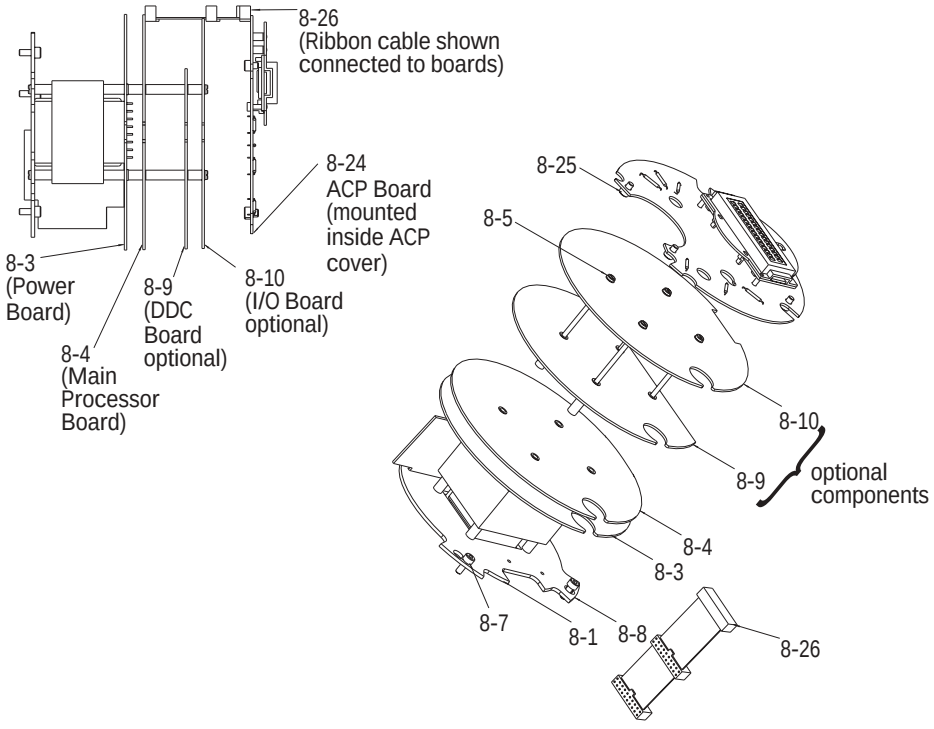


5.2 Control Module (MX-05, 10, 20, 40, 85 & 140)

Table 5.2 – Control Module Parts List

Part Number	Description	Qty.
8-1	Controls Chassis Plate	1
8-3	Power Board	1
8-4	Main Processor Board	1
8-5	Phillips Pan Head Mach	4
8-7	Socket Head Cap Screw (M4x10)	3
8-8	Chassis Assembly	1
8-9	DDC Board (Network Board) - Optional	1
8-10	PC Board, (I/O Board) - Optional	1
8-24	PC Board, Local Control Station	1
8-25	Socket Head Cap Screw (M4x6)	4
8-26	Ribbon Cable Assembly	1

Figure 5.2 – Control Module



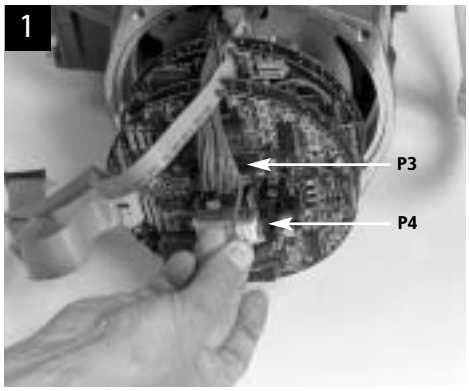
5.2.1 Removal

STEP 1

⚠ WARNING Hazardous Voltage! Turn off all power sources to actuator before removing control module assembly. Power sources may include main power or control power.

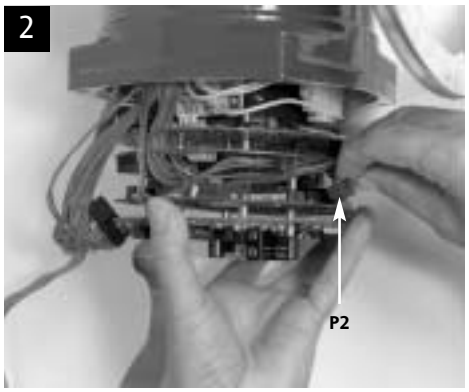
CAUTION Potential to cause electrostatic damage to electronic components. Before handling electronic components, ensure that you are discharged of static electricity by briefly touching a grounded metal object.

If the I/O option board is installed, disconnect wire harness plug P3 and P4.



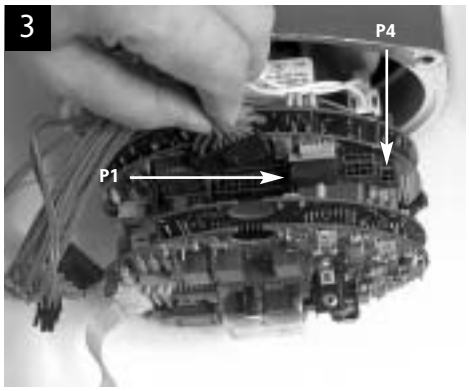
STEP 2

If DDC board is installed, disconnect wire harness plug P2.

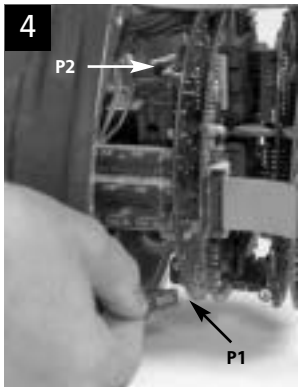


STEP 3

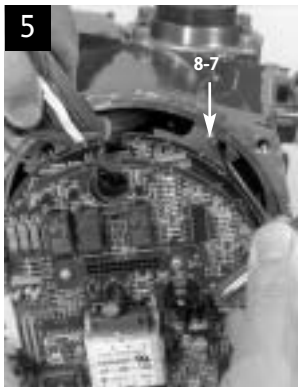
Disconnect wire harness plug P1 and P4 from the main processor board.



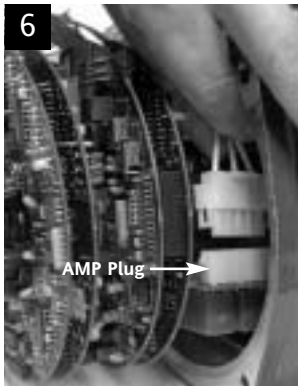
STEP 4
Disconnect wire harness plugs P1 and P2 from the main power board.



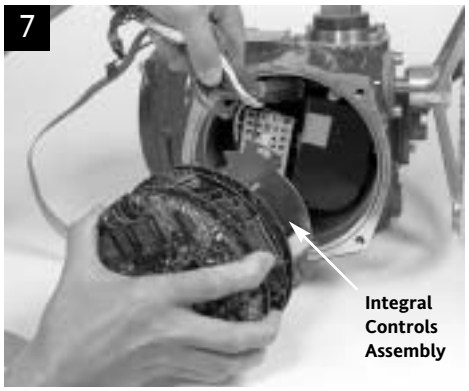
STEP 5
Using a 3 mm hex key, loosen the three M4 mounting plate screws (#8-7) located at the back of the controls compartment. Slightly rotate the complete control module assembly in a counterclockwise (CCW) direction, until the keyhole slots in the baseplate (#8-1) allow the heads of the screws to pass through.



STEP 6
Disconnect the AMP® power connector from the fuse section of the main power board.

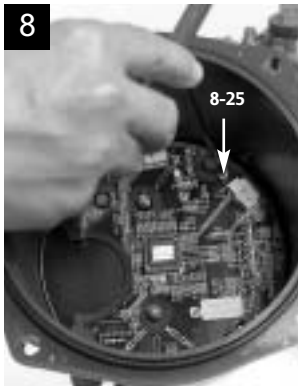


STEP 7
Remove the control module assembly from actuator housing (leave 20-pin ribbon cable connected to control module boards). Take control module assembly to work area to perform maintenance as required.



If control module assembly return is required for repair/replacement, remove the ACP board from inside the ACP cover as follows:

STEP 8
Using a 3 mm hex key, remove the four M4 screws (#8-25) that retain the ACP board inside the ACP cover.



STEP 9
Lift the ACP board out of the ACP cover.



(See **Section 5.2.3** for fuse replacement.)
(See **Section 5.2.4** for control module return options.)
(See **Section 5.2.5** for EPROM care and replacement.)

5.2.2 Remounting

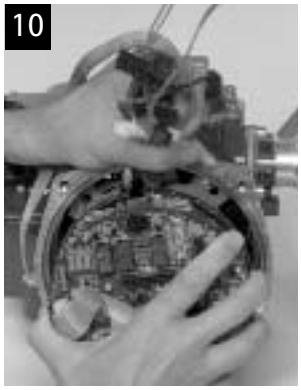
If the standard board set was separated from the DDC and/or I/O option boards, reassemble boards back together as a complete unit before remounting the control module back into the actuator.

STEP 10

CAUTION Ensure the voltage jumper on power board (see Figure 5.3) is located in the proper slot for the nameplate and motor voltage!

⚠ WARNING Hazardous Voltage! Turn off all power sources to actuator before remounting ACP assembly. Power sources may include main power or control power.

CAUTION Potential to cause electrostatic damage to electronic components. Before handling electronic components, ensure that you are discharged of static electricity by briefly touching a grounded metal object.



Position control module subassembly over the three mounting screw heads (#8-7). Rotate the subassembly in clockwise (CW) direction until all three screws are seated in the key slots. (The keyhole slots in the mounting plate [#8-1] are spaced in such a way that the control module assembly will mount in only one position).

STEP 11

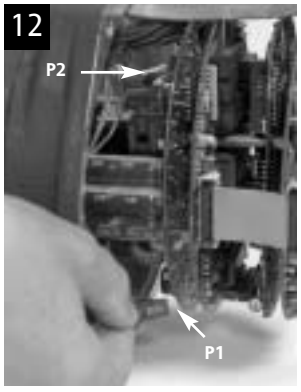
Tighten the three screws (#8-7) with a 3 mm hex key.



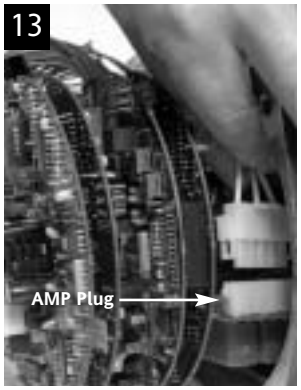
STEP 12

NOTE: Ensure wiring harness bundle routes through the semicircular slots on the printed circuit boards.

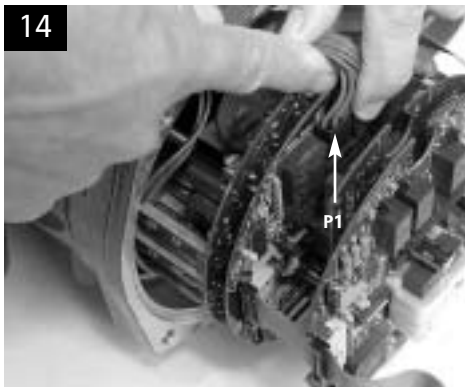
Connect the 6-pin Molex® wire harness to plug P1 and 14-pin Molex® harness to plug P2 on main power board.



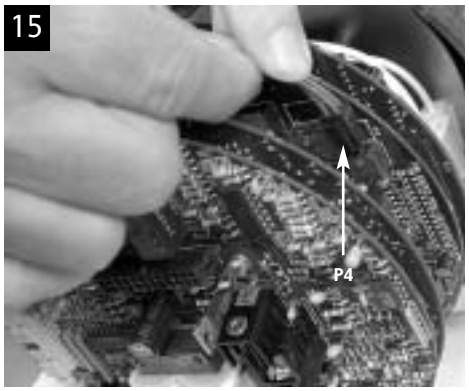
STEP 13
Connect the AMP® power connector to the fuse section on the main power board.



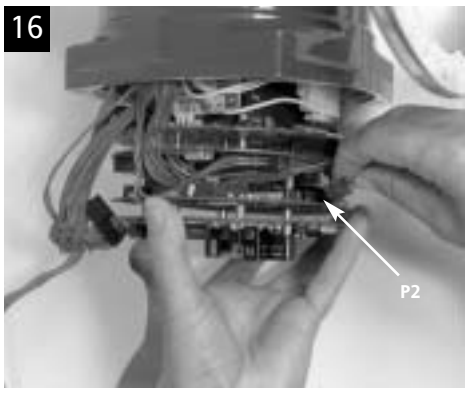
STEP 14
Connect the 20-pin Molex® harness to plug P1 on the main processor board.



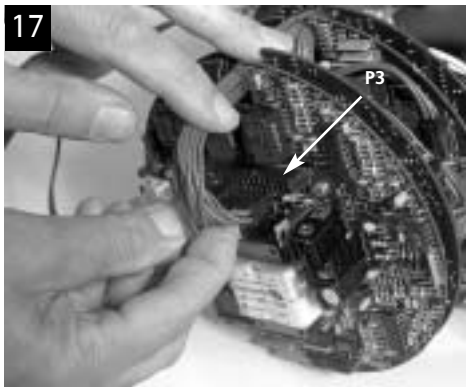
STEP 15
Connect the 4-pin Molex® harness to plug P4 on the main processor board.



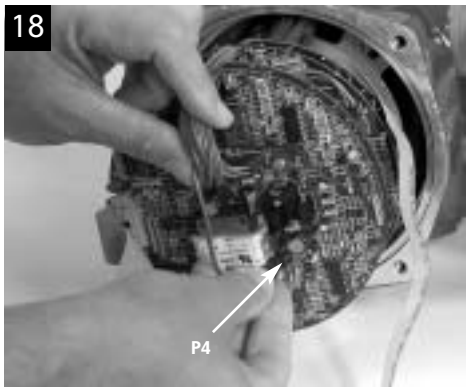
STEP 16
If DDC board is installed, connect 10-pin Molex® harness to plug P2 on DDC board (network processor board).



STEP 17
If I/O option board is installed, connect 24-pin Molex® harness to plug P3,

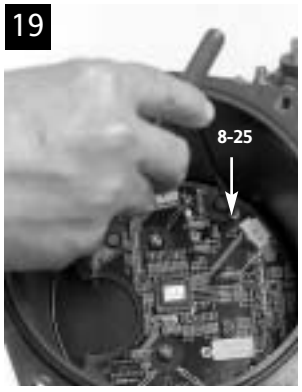


STEP 18
and connect 2-pin Molex® harness to plug P4 on I/O option board.

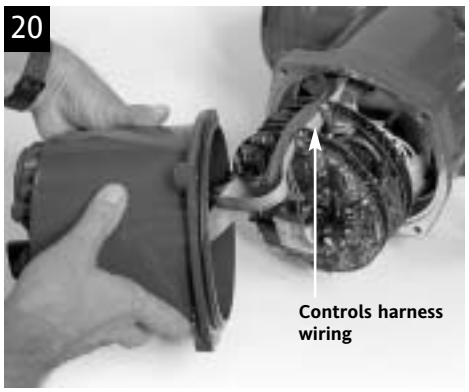


If control module assembly return was required for repair/replacement, remount the ACP board back inside the ACP cover as follows:

STEP 19
Using a 3 mm hex key, install the four M4 screws (#8-25) to retain the ACP board inside the ACP cover.



STEP 20
Ensure control harness wiring bundle is routed through the control module mounting plate notch and along electronic board semicircular slot. This will help prevent pinching the wiring when ACP cover is installed.

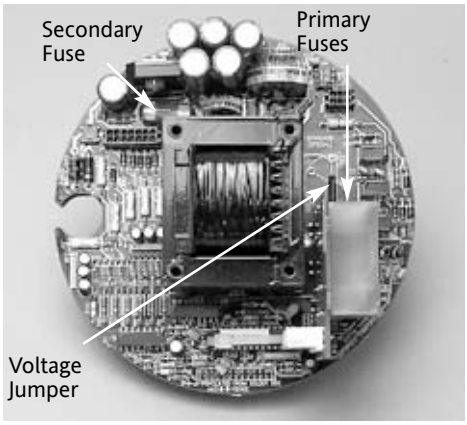


STEP 21
Reference ACP (subassembly #7) to reconnect plugs and install ACP cover.

5.2.3 Fuse Replacement

NOTE: If fuses need to be replaced, they can be found on the power board (#8-3). There are two primary fuses (1 Amp, 600 V) on the part of the power board that is perpendicular to the main processor board. There is also one secondary fuse (0.1 Amp, 250 V) on the part of the power board that is parallel to the main processor board. Remove plastic covers to replace the fuses. Removal of the steel chassis assembly (#8-8) may be necessary to access the secondary fuse. The view to the right shows the control module with the chassis assembly removed.

Figure 5.3 – Location of fuses and voltage jumper



5.2.4 Control Module Return Options

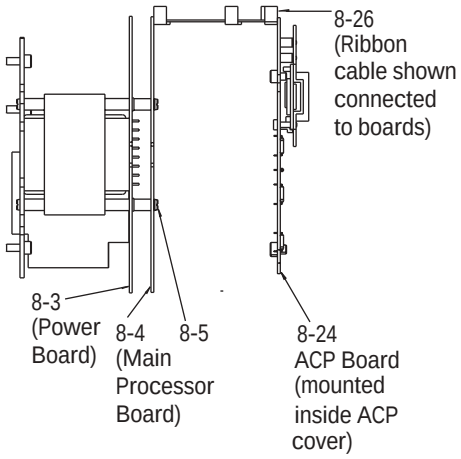
There are four options to consider when returning control module components for repair/replacement. When returning, use the **Return Material Authorization (RMA)** outlined in Section 2.6.2. Use the following guidelines to determine your return process based on your existing control module configuration.

If your actuator is configured with:

A. Standard board set

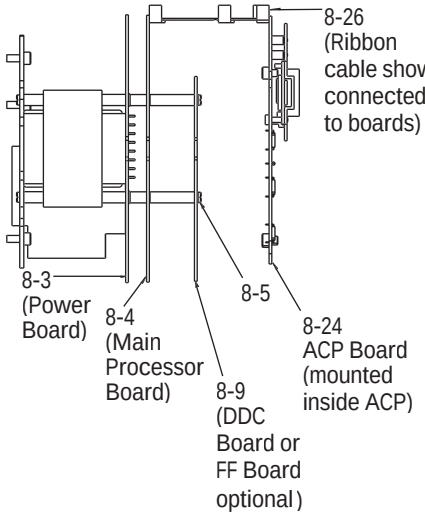
The standard board set control module includes the Power board (#8-3), Main Processor board (#8-4), and Accutronix Control Panel board (ACP board) (#8-24). If your MX is configured with the standard board set control module, return the complete control module using the RMA procedure in **Section 2.6.2.**

Figure 5.4 – Standard Board Set



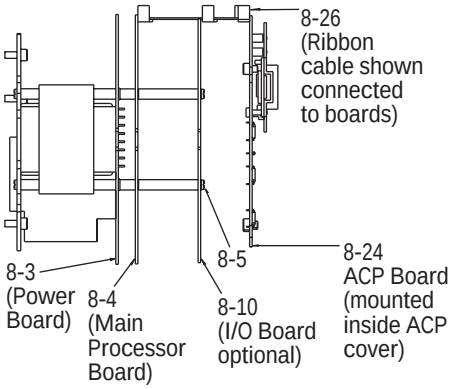
B. Standard board set + DDC option or FF option
This control module includes the standard board set and the DDC board (#8-9). If your MX is configured with standard board set + DDC board and you have isolated a problem with the DDC board only, remove screw (#8-5) to remove the DDC board (#8-9). Return the DDC board using RMA procedure. If you have not isolated the problem to the DDC board only, then return the standard board set with the DDC board left intact on the control module. Return the complete control module using the RMA procedure in **Section 2.6.2**.

Figure 5.5 – Standard Board Set with DDC Option



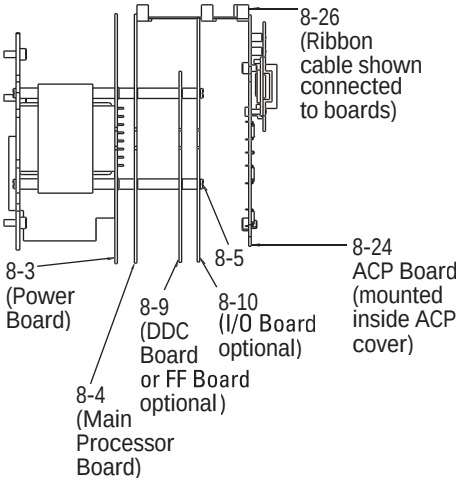
C. Standard board set + I/O option
This set includes the standard board set and the I/O board (#8-10). If your MX is configured with standard board set + I/O board, return the complete control module using the RMA procedure in **Section 2.6.2**.

Figure 5.6 – Standard Board Set with I/O Option



D. Standard board set + DDC & I/O option
This set includes the standard board set with DDC board (#8-9) & I/O option board (#8-10). If your MX is configured with standard board set + DDC board & I/O board and you have isolated a problem with the DDC board only, remove screw (#8-5) to remove the DDC board (#8-9). Return the DDC board using RMA procedure. If you have not isolated the problem to the DDC board only, then return the standard board set with the DDC board & I/O board left intact on the control module. Return the complete control module using the RMA procedure in **Section 2.6.2**.

Figure 5.7 –Standard Board Set with DDC or FF and I/O Option



5.2.5 EPROM Care & Replacement

There are four EPROMs in the MX Control Module. These are located on the LCS board, on the main processor board, on the Power Board, and on the DDC option board. Under normal circumstances, these EPROMs should nor require replacement. Kits including the EPROMs for the DDC, Main, and LCD board are available for unit upgrades.
NOTE: DDC firmware and Mainboard firmware must be the same revision level.

The location of the LCS EPROM is shown in **Figure 5.8**.

Figure 5.8 – LCS Board

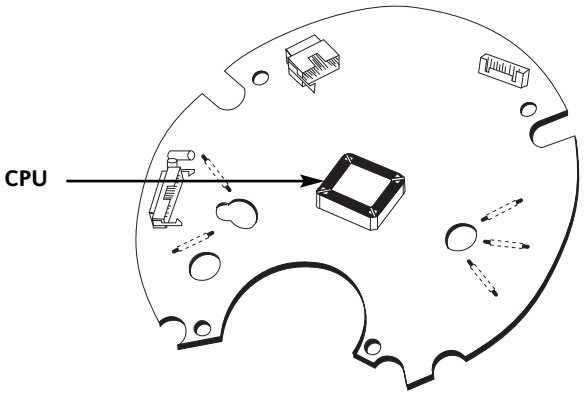


Figure 5.9 shows the location of the Main CPU Board EPROMs.

NOTE: Remove and replace tie wrap.

Figure 5.9 – Main CPU Board

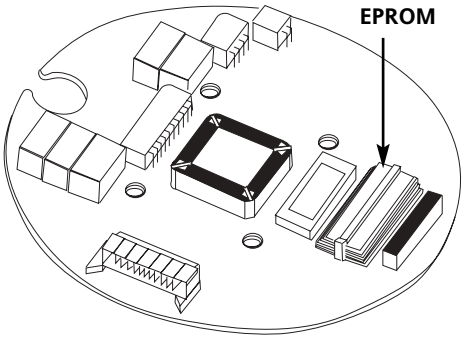


Figure 5.10 shows the location of the EPROM on the Power Board.

NOTE: Power board EPROM is not included in replacement kit. This EPROM should not be replaced in field.

Figure 5.10 – Power Board

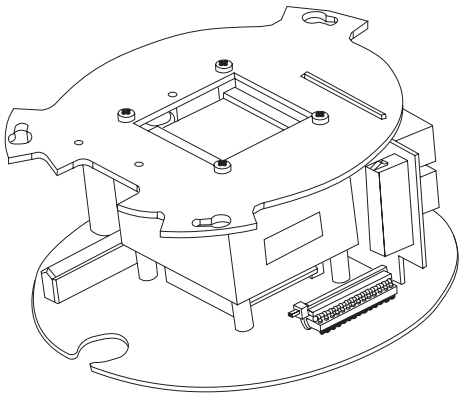
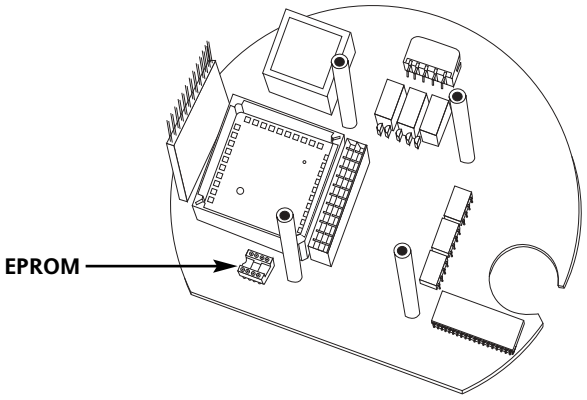


Figure 5.11 shows the location of the DDC EPROM on the DDC Option Board.

Figure 5.11 – DDC Board



5.2.5.1 EPROM Storage & Handling

MX control modules contain EPROMs that are fragile and static-sensitive integrated circuits. Care should be taken in the storage and handling of the EPROMs.

Do not ship or store EPROMs near strong electrostatic, electromagnetic, magnetic, or radioactive fields.

Do not remove labels from EPROMs.

Store EPROMs in static-free containers with care to prevent breakage from shock or damage to pins.

Always use an ESD (ElectroStatic Discharge) wristwrap and proper grounding techniques when removing or installing EPROMs. Limitorque provides a kit which contains an ESD wristwrap with proper grounding instructions; P/N 102424. Please contact Limitorque service at (434) 528-4400 for purchase.

5.2.5.2 EPROM Removal

It is recommended that an IC (Integrated Circuit) insertion/extraction tool be used to remove EPROMs from the socket. Limitorque provides a kit which contains an EPROM removal tool; P/N 102424.

5.2.5.3 EPROM Installation

It is recommended that an IC insertion/extraction tool be used to hold the EPROM for installation. Limitorque provides a kit which contains an EPROM removal tool; P/N 102424. To insert a replacement EPROM, use the following procedure:

The notch at one end of the EPROM must be lined up with the notch at one end of the socket. If the EPROM notch is not matched to the socket notch, the EPROM will be damaged when the unit is powered. Gently place the pins of one side of the EPROM into the socket holes in the correct side of the socket.

Roll the EPROM over until the pins on the other side are each lined up with the socket holes. You may have to use slight pressure to line up the pins. When you are sure all pins are in line with the socket holes, firmly push down on top of the EPROM until the pins are well seated in the socket.

NOTE: A problem that can frequently occur when inserting ICs into sockets is if one or more pins are misaligned, missing the intended socket hole. In this case, the affected pins do not make contact. The problem is difficult to see because the pins can appear to be in the socket hole. After installing the EPROM or other IC, always examine both rows of pins very carefully to ensure that the pins are aligned correctly with the IC.

5.2.5.4 Adding Electronic Option to Your Accutronix MX Actuator

Listed below are the options available for the Accutronix MX.

1. **Modutronic option**; does not require any hardware, however, a "keycode" from the factory is required.

2. **2-speed timer**; does not require any hardware, however a "keycode" from the factory is required.

3. **APT option**; Analog Position Transmitter, non-contracting 4-20 mA position transmitter requiring the addition of the I/O (input/output) option board.

4. **ATT option**; Analog Torque Transmitter, non-contacting 4-20 mA torque transmitter requiring the addition of the I/O (input/output) option board.

5. **AR option**; Alarm Relays, (3) non-latching relays requiring the addition of the I/O (input/output) board. Non-latching relays change state when power is removed from the actuator, e.g. if the relay is CLOSED & power is removed, the relay will OPEN.

6. **DDC option**; network communication field board that is required for 2-wire twisted pair, MODBUS communication.

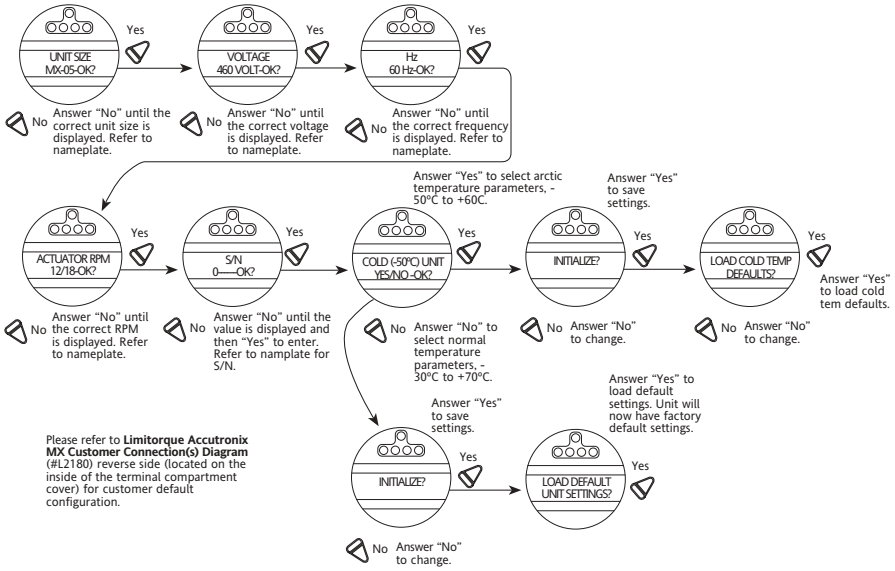
7. **FF option**; network communications board required for Foundation Fieldbus communication.

The procedure for adding electronic options to your MX actuator is as follows:

- For adding the **Modutronic** and **2-speed** timer options, the actuator QA Stamp ID must be supplied in order to acquire the necessary keycode.
  - Each MX actuator is supplied a unique "QA Stamp ID". This number is assigned during the END-OF-LINE test sequence for each unit.
  - This serial number is located on the second screen after the "RESTRICTED SETTINGS" screen. It is an eight (8) digit number after the letters "S/N". Please refer to the I&O manual, 130-11000, supplied with your actuator for the Menu sequence.
    - User must supply this number. Example: 12345678
    - Also record the Order Number & Serial Number of the actuator. These numbers can be found on the unit nameplate.
- Once you have acquired the QA Stamp, O/N & S/N, please contact your assigned Service Coordinators for the keycodes required to turn-on the desired options @ (434) 528-4400.
- The "keycode" is then entered into the desired option menu found in "RESTRICTED SETTINGS" using the black knob on the ACP. A "NO" answer will change the value form 0-9 and A-E. A "YES" answer will truncate to the next space.
- After enabling the **Modutronic** option, please change the remote control wiring scheme to "3-wire maintained."
- For adding the APT, ATT, and AR options, the I/) option board is required. When the I/O board is received and installed into the actuator, it will already have the option(s) enabled. The unit will recognize the board and turn on the required software menu feature. Please refer to the I&) manual, 130-11000, supplied with your actuator for the Menu sequence. The user will need to enable the menu options. Please contact your assigned Service Coordinators for purchase of these desired options @ (434) 528-4400.
- For adding the **DDC** or FF option, the DDC or FF option board is required. When the DDC option board is received and installed into the actuator, it will recognize the board and turn on the required software menu feature. Please refer to the I&O manual, 130-11000, supplied with your actuator for the Menu sequence. The user will need to enable the menu options. Please contact your assigned Service Coordinators for purchase of the DDC option @ (434) 528-4400.

5.3 Restoring Power to Actuator with New Control Module

Figure 5.12 – Restoring Power to Actuator with New Control Module

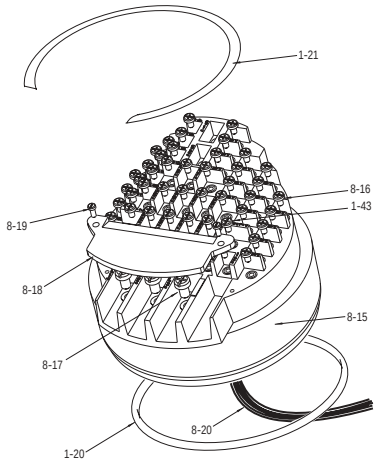


5.4 Terminal Block (MX-05, 10, 20, 40, 85 & 140)

Table 5.3 – Terminal Block Parts List

Part Number	Description	Qty.
1-20	O-Ring	1
1-21	Retaining Ring	1
1-43	Pan Head (M3x4) Plastic Screw	2
8-15	Terminal Block	1
8-16	Self-Lock Combo Head Screw (M3x5)	48
8-17	Self-Lock Combo Head Screw (M5x8)	3
8-18	Cover Plate	1
8-19	Pan Head Self-Tapping Screw	2
8-20	Control Wiring Harness	1

Figure 5.13 – Terminal Block



5.4.1 Removal

CAUTION: Potential to cause electrostatic damage to electronic components. Before handling electronic components, ensure that you are discharged of static electricity by briefly touching a grounded metal object.

FIRST REMOVE

1. Accutronix control panel (subassembly #7).
(See **Section 5.1.1**.)
2. Control module (subassembly #8). (See **Section 5.2.1**.)

STEP 1

⚠ WARNING Hazardous Voltage! Turn off all power sources to actuator before removing terminal block assembly. Power sources may include main power or control power.

Using an M6 hex key, remove the four M8 screws (#8-14) that mount the terminal compartment cover to the actuator.



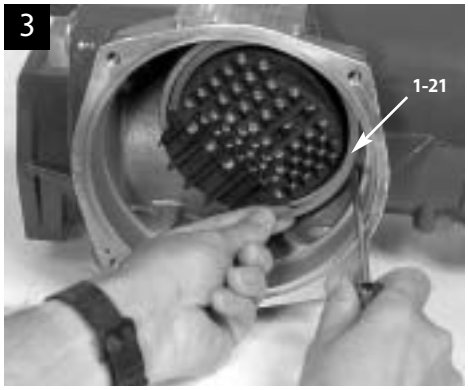
STEP 2

If actuator is already in service, disconnect incoming power leads L1, L2, and L3 (and control wiring from the terminal block if terminal block replacement is required).

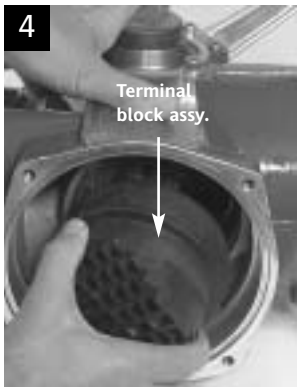


STEP 3

Using a flat head screwdriver, insert the screwdriver blade underneath the edge of the snap ring (#1-21) and work the blade around the back of the snap ring to remove it from the groove, thus allowing terminal block removal.



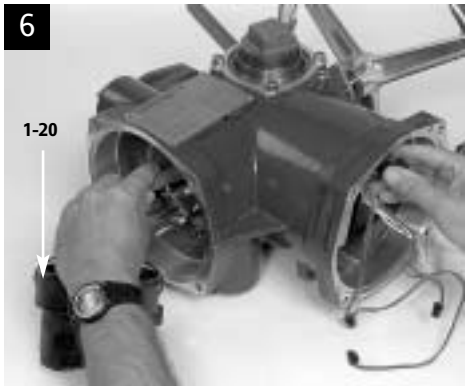
STEP 4
Remove terminal block assembly.



STEP 5
Disconnect leads L1, L2, and L3 from back of terminal block.



STEP 6
Feed the terminal block harness plugs over the contactor assembly (in the control module compartment) while removing the terminal block from the terminal block compartment. Notice an o-ring (#1-20) is included with the terminal block assembly. Ensure you retain or replace the o-ring at remounting.

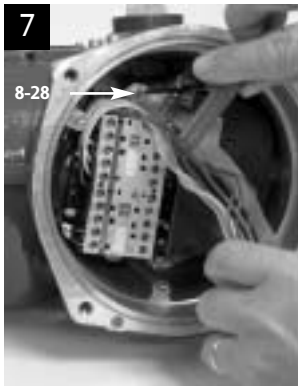


5.4.2 Remounting

STEP 7

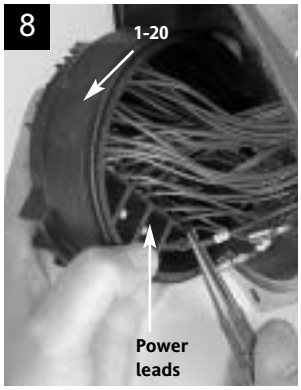
⚠ WARNING Hazardous Voltage! Turn off all power sources to actuator before remounting terminal block assembly. Power sources may include main power or control power.

If necessary, to allow terminal block wiring bundle to pass across the end of the contactor and into the controls compartment, use a M3 hex key to loosen the two 4 mm contactor screws (#8-28). Pull contactor assembly off the screws and lower assembly to create extra space for the wire harness to pass over the contactor and into the controls compartment.



STEP 8

Plug power leads L1, L2, and L3 from contactor assembly into terminal connectors L1, L2, and L3 on back of terminal block. Verify that o-ring (#1-20) is installed on back of terminal block. Lightly lubricate o-ring before installing terminal block.



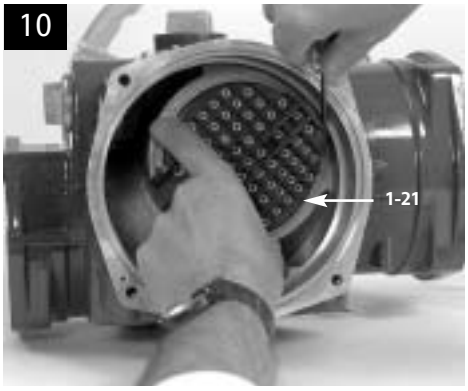
STEP 9

Insert terminal block into terminal block mounting cavity.



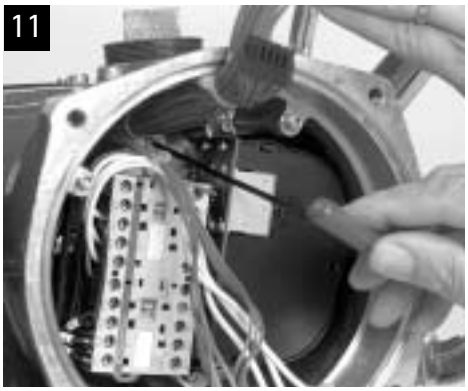
STEP 10

Insert retaining ring (#1-21) into retaining ring groove – snap retaining ring into groove by working a flat blade screwdriver around the edge of the retaining ring until it seats into groove.



STEP 11

If contactor assembly was loosened in Step 7, then remount contactor on screws (#8-28). Retighten with M3 hex key.



STEP 12 & 13

Connect incoming power leads and control wiring according to application wiring diagram if terminal block has been replaced.

Install the terminal compartment cover and secure with four M8 screws using a 6 mm hex key.

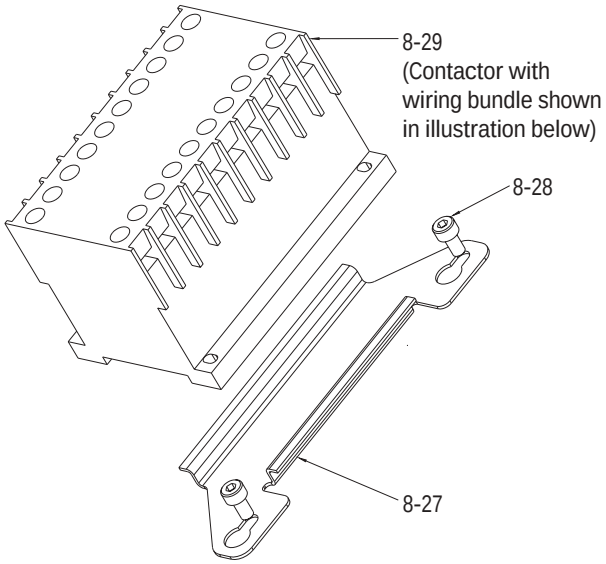


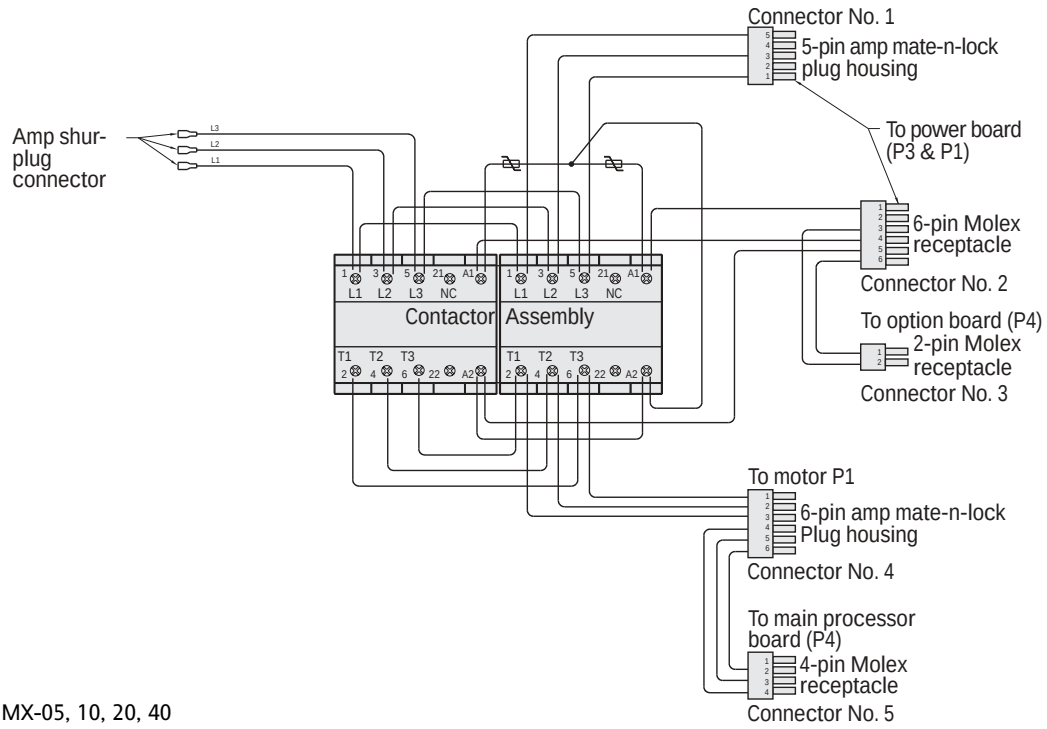
5.5 Control Module—Contractor Assembly (MX-05, 10, 20, 40, 85, & 140)

Table 5.4 – Control Module—Contractor Assembly Parts List

Part Number	Description	Qty.
8-27	Contractor Bracket	1
8-28	Socket Head Cap Screw (M4x8)	1
8-29	Contractor Assembly	1

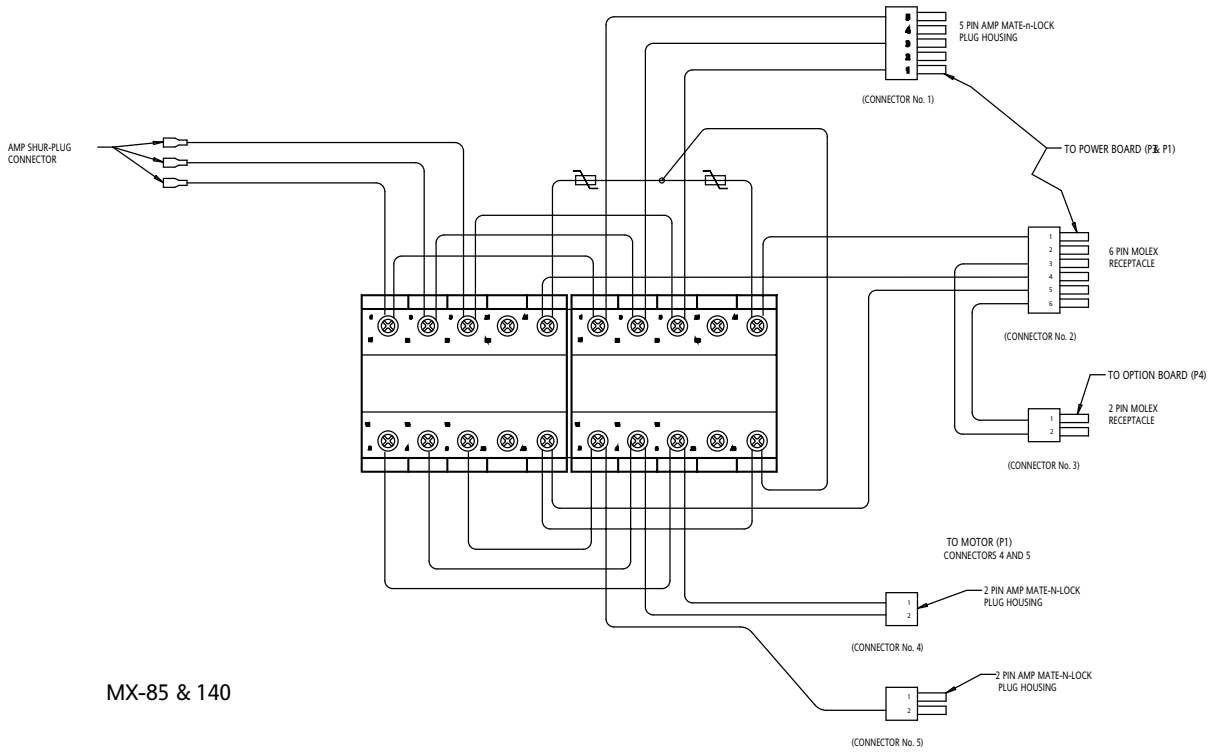
Figure 5.14 – Control Module – Contactor Assembly





MX-05, 10, 20, 40

Figure 5.14 – Control Module – Contactor Assembly (continued)



MX-85 & 140

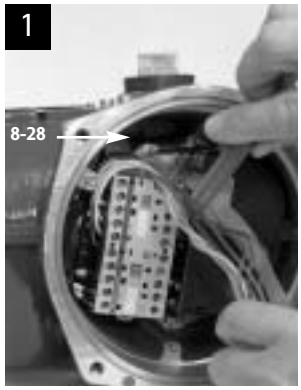
5.5.1 Removal

FIRST REMOVE

1. Remove motor (subassembly #4). (See **Section 4.1.1**.)
2. Remove Accutronix control panel (subassembly #7). (See **Section 5.1.1**.)
3. Remove control module (subassembly #8). (See **Section 5.2.1**.)
4. Remove terminal block (subassembly #15). (See **Section 5.4.1**.)

STEP 1

Using an M3 hex key, loosen the two 4 mm screws (#8-28) that mount the contactor assembly to the actuator.



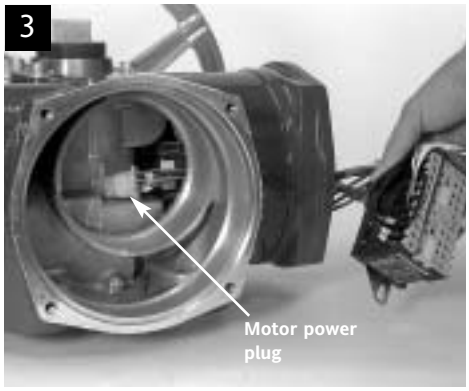
STEP 2
Lift contactor assembly until the keyhole slots in the contactor mounting plate allow the heads of the M4 screws to pass through.



STEP 3
Remove the contactor assembly while threading the motor power socket out of the motor compartment.

NOTE: Only the MX-05, 10, 20 & 40 have the long motor power socket lead.

MX-85 & 140
Disconnect connectors 4 & 5 to motor lead harness.



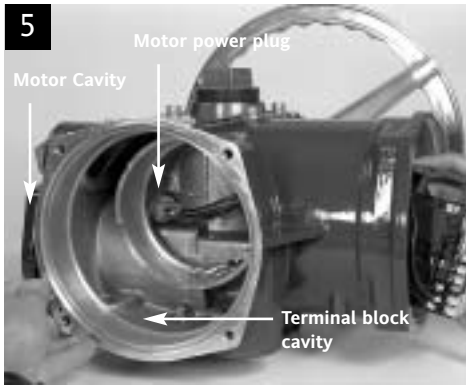
5.5.2 Remounting

STEP 4
Insert contactor assembly into control module cavity.

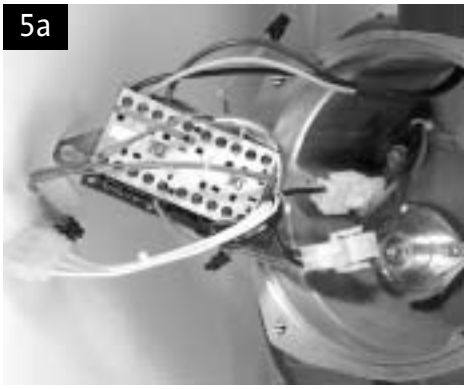


STEP 5
(MX-05, 10, 20, 40, 85 & 140)
Route leads L1, L2, and L3 (input power) to the terminal block cavity.

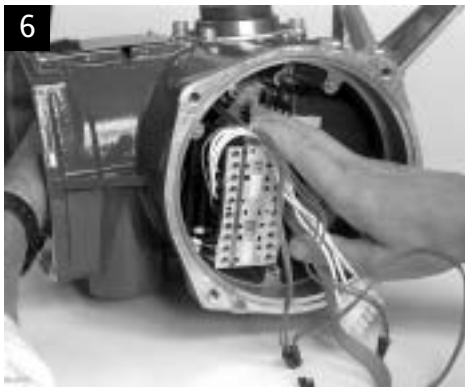
MX-05, 10, 20 & 40 only
Feed the motor power plug through the housing to the motor cavity.



MX-85 & 140 only
Reconnect connectors 4 & 5 to motor lead harness.

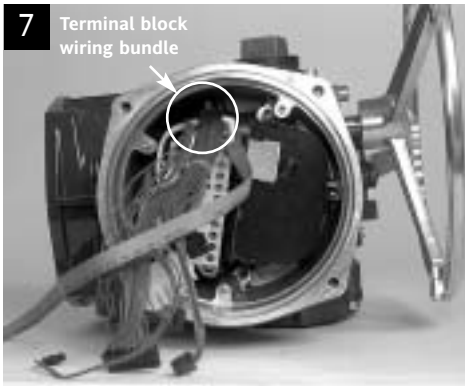


STEP 6
Leave contactor assembly unmounted in control module compartment to allow space for terminal block harness plug bundle to be threaded over the top of the contactor assembly and pulled into the control module cavity.

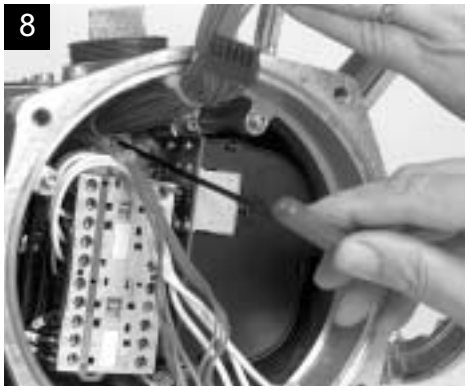


STEP 7
Reference Terminal Block Assembly procedures to remount terminal block assembly into actuator. (See **Section 5.4.2**.)

Before mounting the contactor assembly, ensure the terminal block wiring harness bundle is positioned across the end of the contactor.



STEP 8
Position the contactor assembly so that the keyhole slots in the contactor mounting plate allow the M4 screw heads to pass through; shift the contactor assembly until the screw heads seat in the key slots. Tighten screws using 3 mm hex key to secure assembly.



STEP 9

Remount all removed subassemblies according to the remounting instructions in the following order:

1. Terminal block (subassembly #15). (See **Section 5.4.2**.)
2. Control module (subassembly #8). (See **Section 5.2.2**.)
3. Accutronix control panel (subassembly #7). (See **Section 5.1.2**.)
4. Motor (subassembly #4). (See **Section 4.1.2**.) If the motor voltage has changed, please see **Section 5.2.3., Step 10** to ensure the voltage jumper on the power board is located in the proper slot.

5.6 Encoder (MX-05, 10, 20, 40, 85 & 140)

Table 5.5 – Encoder Parts List

Part Number	Description	Qty.
1-6	Encoder Assembly	1
1-36	Socket Head Cap Screw (M4x16)	3
6-11	Input Gear, 78-tooth (I.D. 3 through 8)	1
6-24	Input Gear, 69-tooth (I.D. 1 or 2)	1

Figure 5.15 – Encoder

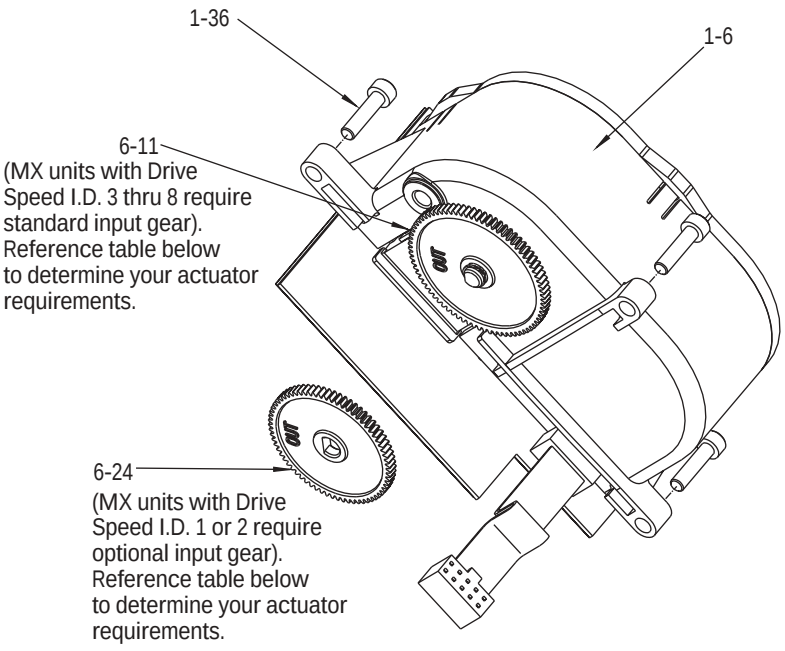


Table 5.6 – Encoder Drive Sleeve Speed

Drive Sleeve Speed I.D.	1	2	3	4	5	6	7	8
50 Hz. RPM	15[2]	22	33	43	65	84/110[1]	127/143[1]	165[2]
60 Hz. RPM	18[2]	26	40	52	77	100/131[1]	155/170[1]	200[2]

NOTE: MX units with Drive Speed I.D. 1 or 2 require an optional input gear. Reference the Output RPM block located on the MX nameplate and cross-reference in table above to determine the unit Drive Speed I.D.

NOTE 1: MX-85 & 140 only.

NOTE 2: N/A MX-85 & 140.

5.6.1 Removal

FIRST REMOVE

CAUTION: Potential to cause electrostatic damage to electronic components. Before handling electronic components, ensure that you are discharged of static electricity by briefly touching a grounded metal object.

1. Remove Accutronix control panel (subassembly #7). (See **Section 5.1.1**.)
2. Remove control module (subassembly #8). (See **Section 5.2.1**.)

NOTE: The encoder is a sealed assembly of high-precision components and not suitable for repair. Should the encoder fail, it will be necessary to install a factory replacement.

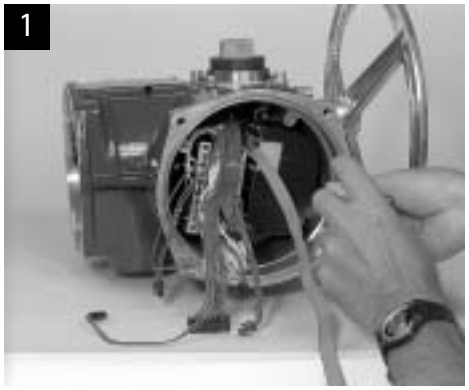
STEP 1

⚠ **WARNING: Hazardous Voltage! Turn off all power sources to actuator before removing encoder assembly. Power sources may include main power or control power.**

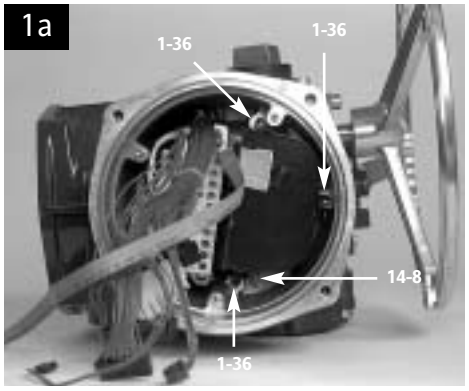
CAUTION: To avoid accidental oil leakage when removing encoder screws (#1-36), be careful not to remove the encoder cartridge mounting screw (#14-8). The encoder cartridge screw is located near one of the encoder mounting screws. Accidentally removing the encoder cartridge mounting screw could cause oil leakage into the control compartment. (See Picture 1a.)

Remove the encoder by locating and removing the three M4 screws (#1-36) that mount the encoder to the actuator housing. Use a 3 mm hex key to remove the screws. (Reference Picture 1a to locate screws (#1-36); **note important cautionary statement discussed with Step 1 and 1a**).

1

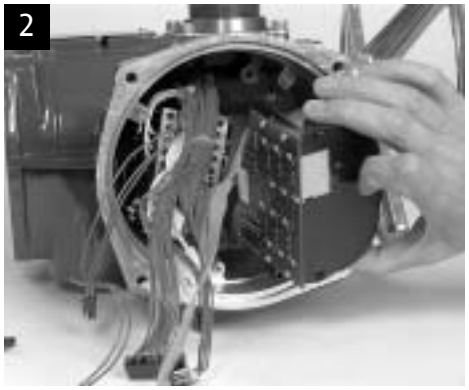


1a



STEP 2

Pull the complete encoder straight out of the mounting holes to disengage the gear drive from the encoder drive cartridge pinion.



5.6.2 Remounting

STEP 3

⚠ **WARNING: Hazardous Voltage! Turn off all power sources to actuator before remounting encoder assembly. Power sources may include main power.**



If actuator uses drive sleeve speed I.D. 1 or 2, ensure optional encoder input gear (#6-24) is installed on encoder (**see NOTE on page 5-24 for details**). Align the three encoder mounting holes with the matching holes in the actuator housing and push the encoder straight on to the mounting boss, carefully positioning the encoder to ensure correct meshing with the encoder drive cartridge pinion. If needed to align gearing, declutch actuator and turn handwheel until encoder gear engages with drive cartridge pinion). Fit the three M4 screws (#1-36) and tighten using a 3 mm hex key. Do not overtighten.

5.7 Encoder Drive Cartridge (MX-05, 10, 20, 40, 85 & 140)

Table 5.7 – Encoder Drive Cartridge Parts List

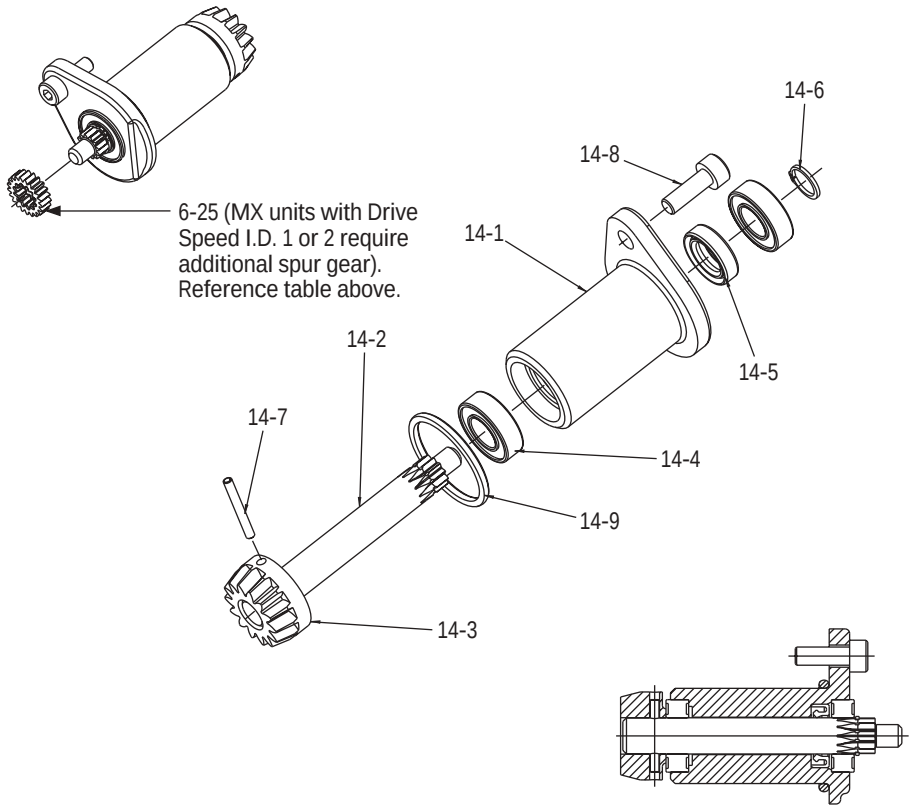
Part Number	Description	Qty.
14-1	Encoder Drive Cartridge	1
14-2	Encoder Drive Shaft	1
14-3	Encoder Pinion	1
14-4	Ball Bearing	2
14-5	Oil Seal	1
14-6	Retaining Ring	1
14-7	Roll Pin	1
14-8	Socket Head Cap Screw	1
14-9	O-Ring	1
6-25	Input Gear, 19-tooth	1

Table 5.8 – Encoder Drive Cartridge Drive Sleeve Speed

Drive Sleeve Speed I.D.	1	2	3	4	5	6	7	8
50 Hz. RPM	15[2]	22	33	43	65	84/110[1]	127/143[1]	165[2]
60 Hz. RPM	18[2]	26	40	52	77	100/131[1]	155/170[1]	200[2]

NOTE: Reference the Output RPM block located on the MX nameplate and cross-reference in table above to determine the unit Drive Speed I.D.
NOTE 1: MX-85 & 140 only.
NOTE 2: N/A MX-85 & 140.

Figure 5.16 – Encoder Drive Cartridge



5.7.1 Removal

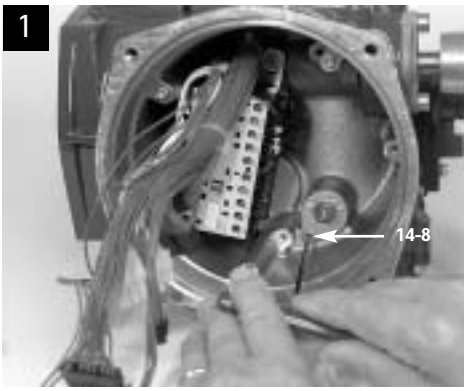
FIRST REMOVE

1. Drain oil.
2. Remove ACP cover (subassembly #7). (See **Section 5.1.1**.)
3. Remove control module (subassembly #8). (See **Section 5.2.1**.)
4. Remove encoder (subassembly #6). (See **Section 5.6.1**.)

STEP 1

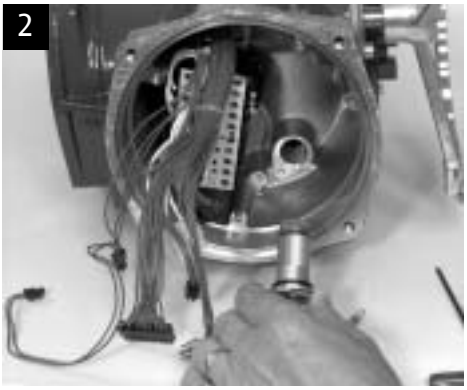
⚠ **WARNING: Hazardous Voltage! Turn off all power sources to actuator before removing encoder drive cartridge. Power sources may include main power or control power.**

Remove the M4 screw (#14-8) using a 3 mm hex key.



STEP 2

Withdraw the complete encoder drive cartridge from the actuator housing.



5.7.2 Remounting

STEP 3

If actuator uses drive sleeve speed I.D. 1 or 2, ensure input gear (#6-25) is installed on encoder (**see NOTE on page 5-28 for details**). Fit the encoder drive cartridge into the actuator housing.



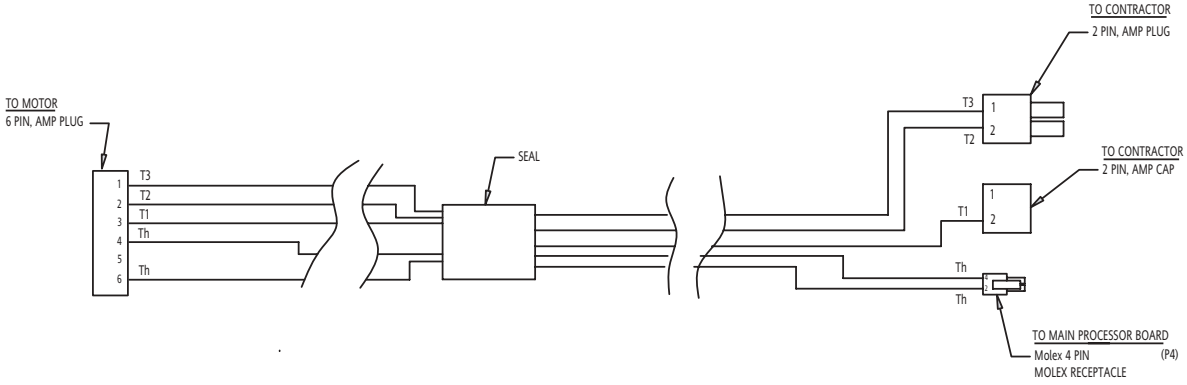
STEP 4

Using a 3 mm hex key, fit the M4 screw (#14-8) into the actuator housing to secure the encoder cartridge.



5.8 Motor Lead Harness (MX-85 & 140 Only)

Figure 5.17 – Motor Lead Assembly



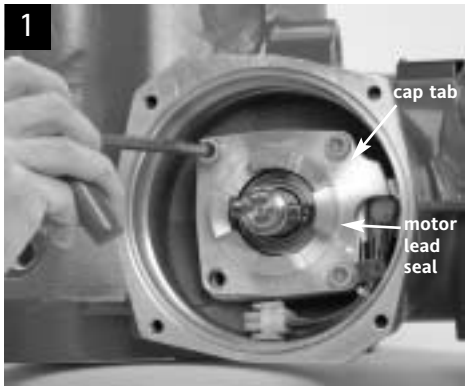
5.8.1 Removal

FIRST REMOVE

1. Remove motor (subassembly #4). (See **Section 4.1.1**)
2. Remove Accutronix control panel (subassembly #7). (See **Section 5.1.1**)
3. Remove control module (subassembly #15). (See **Section 5.4.1**)
4. Remove contractor assembly (subassembly #8). (See **Section 5.5.1**)

STEP 1

If worm shaft assembly (subassembly #3) is still mounted in unit, remove the four screws (#3-9) and rotate cap (CCW) to rotate cap tab away from motor lead seal.



STEP 2

Remove motor lead harness by threading the harness back through housing and out motor end. Work the three connectors out through the hole/slot in the housing one at a time.

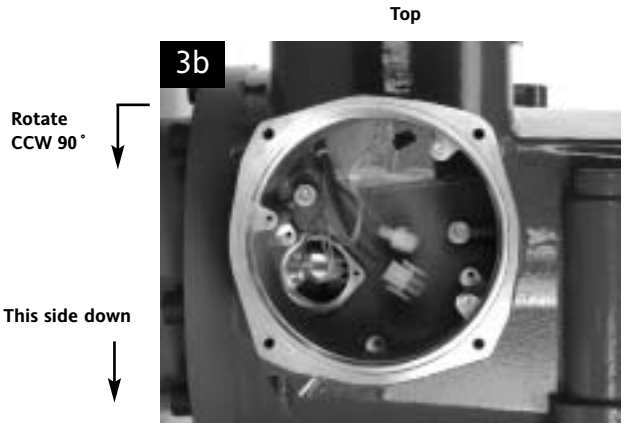


5.8.2 Remounting

STEP 3

Work the three connectors through the hole/slot in the housing. (Hole/slot is located in the motor cavity next to the worm shaft bore.) Thread the three connectors through the housing into the controls compartment cavity until the lead seal fits completely into the hole/slot in the housing.







STEP 4

Remount all removed subassemblies according to the remounting instructions in the following order.

1. Contactor assembly (subassembly #8). (See **Section 5.5.1**)
2. Control module (subassembly #15). (See **Section 5.4.1**)
3. Accutronix control panel (subassembly #7). (See **Section 5.1.1**)
4. Motor (subassembly #4). (See **Section 4.1.1**)

6 Spare & Replacement Parts

6.1 Guidelines for Recommended Spare Parts

Since every Limitorque actuator is designed to meet a specific application, the recommended spare parts needed to support the actuator will vary for every project. The following guidelines are provided to assist in determining the specific spare parts requirements for your Limitorque MX actuators.

6.1.1 Wear Components

The following components will eventually wear under normal use and should therefore be planned as spares. The expected lifetime of these parts will vary from application to application. They are listed in order of most frequent to least frequent replacement. Limitorque recommends stock levels of between 5% and 10% of the total population of each part with a minimum of 1 of each in order to support the product for life.

1. Stem Nut
2. Worm Shaft subassembly
3. Drive Sleeve subassembly

6.1.2 Bearings, O-Rings, & Seals

All bearings should be replaced any time an actuator is refurbished. Therefore, all bearings should be planned for stock for any scheduled refurbishment. In addition, any o-ring or seals should be replaced anytime an actuator is disassembled. Complete actuator seal kits are available for the MX-05/10, the MX-20/40 & the MX-85/140. Limitorque recommends stock levels for seal kits of 10% of the total population of each actuator model and size. Also, an adequate supply of Limitorque approved oil (Chevron SHC-632) should be maintained in stock to support any necessary maintenance or refurbishment.

6.1.3 Critical Components

The following parts are not subject to wear but are still recommended for stock due to their critical nature. Limitorque recommends stock levels of between 5% and 10% of the total population of each part with a minimum of 1 of each in order to support the product for life.

1. Motor
2. Encoder
3. Control Module

6.2 Recommended Spare Parts for MX Actuators

6.2.1 Commissioning & Startup

No additional spare parts are required. All necessary spares are included in the end-user bag.

6.2.2 Short-Term Duty

This is defined as up to 3000 seats or up to 1 million drive sleeve turns, whichever occurs sooner. There are no spare parts required for the actuator during short-term duty.

6.2.3 Long-Term Duty

This is defined as service beyond short-term duty but less than 6000 seats and less than 1.5 million drive sleeve turns. The spares suggested for long-term duty are as follows:

- Quad rings at the top and bottom of the drive sleeve
- Drive sleeve assembly which includes the Worm Gear
- Wormshaft assembly
- Encoder Cartridge assembly
- Motor assembly
- Fuse (Controls, quantity 1)
- Fuses (Power, quantity 2)
- Encoder assembly
- Reversing Starter/Contactor with harness
- Control Module (includes PCB-power, main, ACP, and optional DDC and I/O boards)
- Bronze drive sleeve for thrust base
- Quad rings in thrust base (MX-10, 20, 40, 85 & 140)
- Quad rings in B1 base

NOTE: Oil should be changed every 6000 seats or sooner if the oil has been contaminated with water or other foreign material.

6.2.4 Severe Duty

This is defined as open/close service when run loads exceed 30% of the unit rating. This also includes all modulating applications.

NOTE: Oil should be changed every 3000 seats for open close service, or sooner if the oil has been contaminated.

The spares suggested for severe duty are identical to the long-term duty spares.

6.3 Other Concerns

There are other unique application requirements that may result in additional parts being added to the list of recommended spares. Some additional issues or requirements that should be considered when determining required spare parts include (but are not limited to):

1. Maintenance Program
2. Frequency of operation
3. Modulating duty
4. Frequent operation by handwheel
5. Regular testing
6. Stall/overload condition

Limitorque strongly recommends using OEM parts to support and maintain your Limitorque actuator. Installing parts other than genuine Limitorque parts could cause premature failure of your Limitorque actuator and voids any remaining warranty.

The above guidelines are provided to assist you in determining your unique spare parts needs. Please contact your local Limitorque Sales Office or local Authorized Stocking Distributor for additional help in evaluating your needs.

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7 Regulatory Information

Declaration of Conformity

Application of Council Directive(s)
89/336/EEC; EMC Directive
98/37/EEC; Machinery Directive

Standard(s) to which Conformity is Declared
Machinery; EN 60204 EMC
- Emissions; EN 50081-1&2, EN 55011, CFR 47
- Immunity; EN 50082-1&2, IEC 801-3 & IEC 801-6 ESD; IEC 801-2
- EFT/Bursts; IEC 801-4
- Surge Immunity; IEC 801-5, ANSI/IEEE C62.41 Mains (power)
- Harmonics; MIL-STD-462, Method CSO1 & CSO2

Manufacturer's Name
Limitorque

Manufacturer's Address
5114 Woodall Road
Lynchburg, VA 24502

Importer's Name
Limitorque

Importer's Address
Abex Road
Newbury
Berkshire, RG14 5EY
England

Type & Description of Equipment
Valve Actuators

Model Number
MX Series

Note
Tested with Limitorque products only

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s). List as follows:



(Signature)

Barry Morse
(Full Name)

Internal Sales Manager
(Title)

Newbury, England
Place

November 1, 1999
Date

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NQA
ISO9001
REGISTERED COMPANY
NATIONAL ACCREDITATION OF CERTIFICATION BODIES

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130-12000 Rev. B 11/02 Printed in USA