Use this guide, PL814 (MIV-E), or PL815 (MIV-M) to replace one or more damaged/failed switches in either a Hale Electric (MIV-E) or Manual (MIV-M) Master Intake Valve (MIV). Shown MIV-E (Left) and MIV-M (Right). All referenced documents and plate (PL) drawings are available from the Tech Resource Center on the Hale website (https://www.haleproducts.com).

Refer to 029-0020-28-0, MASTER INTAKE VALVE DESCRIPTION, INSTALLATION AND OPERATION MANUAL for additional or more detailed information.

NOTES: Always remove old thread locking compound from used fastener threads before installation as the presence of old thread locking compound negatively affects torque.

Recommended O-ring Lubricant: Synthetic Multi-Purpose Clear O-ring Lubricant (Synthetic NLGI Grade 2 Heavy-Duty, Multi-Purpose)

Recommended Grease: Super Lube Food Grade NLGI 2 Synthetic PTFE(Provided) (Aerosol 31040 & 31110 Allowed)

Recommended Solvent: Safety Kleen® or Stoddard Solvent (or equivalent)

Table 1. Applicable MIV Kit

Kit Number	Description	Remarks
546-1620-02-0	MIV-E/M Switch Kit	Kit contains replacement micro switches, supporting hardware, and gaskets.

ATTENTION ⚠ CAUTION

INDICATES A POTENTIALLY HAZARDOUS SITUATION, WHICH IF NOT AVOIDED MAY RESULT IN MINOR OR MODERATE INJURY.

IMPORTANT ⚠ NOTICE

ADDRESSES PRACTICES NOT RELATED TO PERSONAL INJURY (EQUIPMENT DAMAGE)

Table 2. Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE	None	Shop Rag(s) (As Required)
5/16-inch Allen key (1/)		O-ring Lubricant (See NOTES, page 1.)
7/16-inch Box End Wrench		Grease (See NOTES, page 1.)
5/8-inch Wrench		Suction Extension (Old or Spare)
9/16 inch socket		7/16–14 x 4 inch Long Screw (Quantity 3)
Ratchet (and Extension)		7/16–inch Thick Fender Washer (Quantity 3)
Small Straight Blade Screwdriver		Loctite 242 (Medium Strength, All-Purpose, Removable, Thixotropic, Blue) (or Equivalent)
9/16 inch Torque Wrench (23 lb-ft)		Safety Kleen® or Stoddard Solvent (or Equivalent) (See NOTES, page 1.)
		Ruler
		Loctite 596 (or Equivalent)

1/ For older MIVs, using cap screws.

ATTENTION ⚠ CAUTION OPERATING THE MIV WITHOUT THE INTAKE STRAINER/SUCTION TUBE IN PLACE POSES A PINCH HAZARD. KEEP HANDS CLEAR OF THE MIV DISC WHEN OPERATED.

IMPORTANT ⚠ NOTICE REMOVING THE EXTENSION SHAFT IN EITHER THE OPEN (HANDWHEEL FULLY CLOCKWISE) OR CLOSED (HANDWHEEL FULLY COUNTERCLOCKWISE) POSITION WILL RESULT IN SWITCH DAMAGE. ONLY REMOVE THE SHAFT WHILE HALF WAY BETWEEN OPEN AND CLOSED TO PREVENT SWITCH DAMAGE.

NOTES: If the apparatus configuration/clearance allows, this repair may be accomplished by removing ONLY the gearbox adapter (including gearmotor assembly).

An old (or spare) suction extension clamped (or screwed) to a workbench along with the screws and washers listed under Consumables (see Table 2) works best to hold the MIV during the procedures provided herein.

Figure 1 identifies the MIV-E/MIV-M components of interest.

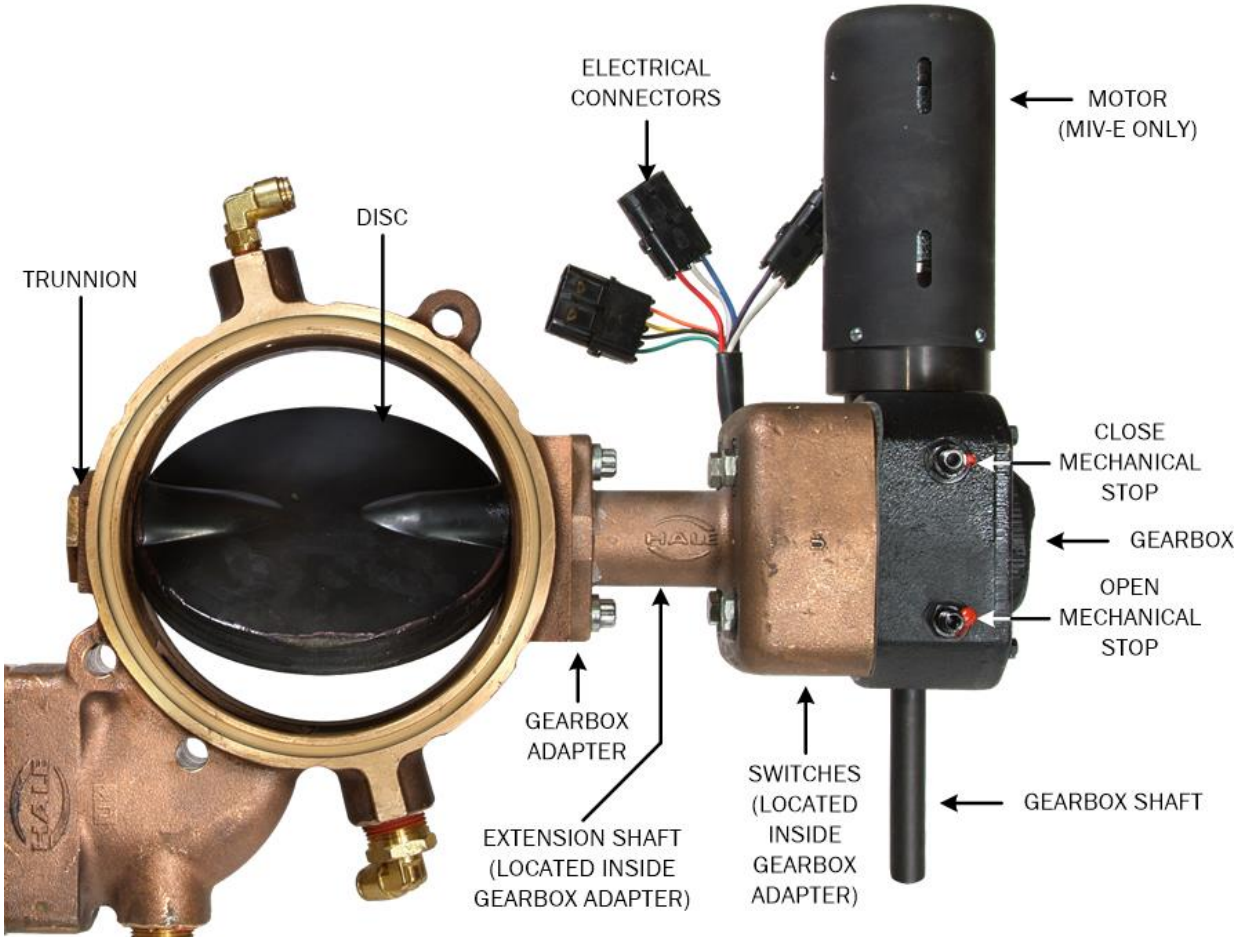


Figure 1.

Perform the following to remove and replace the control and/or positon indicating micro switches (see Table 1) in a Hale MIV. If the apparatus configuration/clearance allows, this repair may be accomplished without removing the MIV from the pump. Procedures located in this guide are intended to be performed as bench procedures.

1. Position MIV disc half way between open and closed.

   a. For a MIV-E, if connected and functional, use panel controls (see Figure 2.) to move MIV disc to a position half way between closed and open. Otherwise, use gearbox shaft to move MIV disc to a position half way between closed and open. (Approximately 5 turns from either the fully open or fully closed position.)

   NOTE: If available, installing a handwheel on the shaft makes moving the MIV disc easier.

   b. For a MIV-M, use handwheel to move MIV disc half way between closed and open position. (Approximately five turns from either the fully open or fully closed position.)

Figure 2.

2. Remove gearbox adapter (including gear motor assembly). See Figure 1.
   a. If MIV removed from pump, secure MIV.

      Option 1 (preferred), secure MIV to an old or spare suction extension using three [3] 7/16–14 x 4 inch long screws and three [3] 7/16–inch thick fender washers; with suction extension that has been clamped (or screwed) to a workbench. Using 5/8-inch wrench, tighten screws.

      Option 2, use a stable work surface and cribbing to elevate the MIV so the disc clears the work surface.

   b. Note/match mark gearbox adapter and valve body. (For reassembly purposes.)
   c. Using 7/16-inch box end wrench (5/16-inch Allen key for older MIVs), loosen two [2] 7/16–14 x 1 inch long 12 point (or cap) screws.
   d. Remove screws.

IMPORTANT ⚠ NOTICE **IF THE EXTENSION SHAFT IS REMOVED (OR ALLOWED TO FALL OUT), WHILE THE SHAFT IS IN THE FULLY OPEN OR FULLY CLOSE POSITION THE SWITCHES (THE ROLLERS/ACTUATION LEVERS RIDE ON THE SHAFT INSIDE THE ADAPTER) MAY BE DAMAGED.**

NOTE: Use care NOT to damage the O-ring, or drop the extension shaft (shaft mates with the disc and the gearbox).

3. Perform **Remove Motor Gearbox (Bench Procedure)** (see Page 6).
4. If MIV-E, perform **Remove And Replace Switches (MIV-E Bench Procedure)** (see Page 7).
5. If MIV-M, perform **Remove And Replace Switches (MIV-M Bench Procedure)** (see Page 8).

Take removed assembly to a clean stable work surface (typically mount the gearbox adapter in a vise). Clean gearbox adapter (including gear motor assembly), all gasket mating surfaces, and bolt threads, thoroughly.

NOTE: Always remove old thread locking compound from used fastener threads before installation as the presence of old thread locking compound negatively affects torque.

Figure 3.

6. Perform **Install Motor Gearbox (Bench Procedure)** (see Page 9).
7. Install gearbox adapter (including gear motor assembly).
   a. Grease bore of valve body and mating surface of adapter. (Prevents O-ring damage and aids assembly.) See Figure 3.
   b. Orient adapter-to-valve body per note/match marks.
   c. Push adapter into valve body ensuring disc stem and extension shaft mate properly.
   d. Apply Loctite 242 (or equivalent) to two [2] 7/16–14 x 1 inch long 12 point (or cap) screws.
   e. Install screws.

f. Using 7/16-inch wrench (or 5/16 inch Allen key or ball hex socket for cap screws), tighten 12 point (or cap) screws.

g. Using 7/16-inch torque wrench (or 5/16 inch hex socket and torque wrench [set CW]), torque 12 point (or cap) screws to 37 lb-ft.

8. Apply grease (see NOTES: on Page 1) to edge of disc and entire disc seat area in bore of valve.

9. Test MIV.

ATTENTION ⚠ CAUTION **OPERATING THE MIV WITHOUT THE INTAKE STRAINER/SUCTION TUBE IN PLACE POSES A PINCH HAZARD. KEEP HANDS CLEAR OF THE MIV DISC WHEN OPERATED.**

a. Bench test MIV as follows.

1) For a MIV-E, use panel controls and indicators to exercise MIV thru multiple close/open/close position transitions. See Figure 2.

i. At apparatus, connect electrical connectors to MIV per tags.

ii. At operator panel, push switch toward CLOSED.

iii. Hold switch in CLOSED until red indicator illuminates.

iv. Release switch.

v. Verify disc position is correct. (B = A ± 1/16-inch [See Figure 11.])

vi. Repeat Steps 2) thru 5) (above) except alternate between OPEN (green indicator) and CLOSED (red indicator) several times to verify MIV function and disc positioning.

vii. If disc position is NOT correct, perform, **MIV Mechanical Stop Adjustment Procedure** (see Page 10).

2) For a MIV-M, install handwheel and exercise MIV thru multiple close/open/close transitions.

i. Using handwheel, close MIV.

ii. Verify disc position is correct. (B = A ± 1/16-inch [See Figure 11.])

iii. At apparatus, connect electrical connectors to MIV per tags.

iv. Repeat Steps 1) and 2) (above) except alternate between OPEN (green indicator) and CLOSED (red indicator) several times to verify MIV function and disc positioning.

v. If disc position is NOT correct, perform, **MIV Mechanical Stop Adjustment Procedure** (see Page 10).

3) Ensure disc is closed as final transition. (Protects disc and aids in assembly.)

4) Remove handwheel if installed.

b. Install MIV on apparatus per 029-0020-28-0, MASTER INTAKE VALVE DESCRIPTION, INSTALLATION AND OPERATION MANUAL, Section 3, Installation.

c. Hydrostatically test MIV per 029-0020-28-0, Section 3. (Factory tested to 250 psi [17 Bar]).

d. Perform vacuum (or dry prime) test per NFPA 1901.

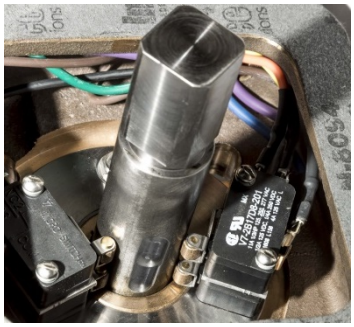
e. Return MIV to service or troubleshoot (see 029-0020-28-0, Section 6) MIV as required.

Remove Motor Gearbox (Bench Procedure)

IMPORTANT ⚠ NOTICE **REMOVING THE EXTENSION SHAFT IN EITHER THE OPEN (FULLY CLOCKWISE) OR CLOSE (FULLY COUNTERCLOCKWISE) POSITION WILL RESULT IN SWITCH DAMAGE. ONLY REMOVE THE SHAFT WHILE HALF WAY BETWEEN OPEN AND CLOSED TO PREVENT SWITCH DAMAGE.**

1. Note/match mark gearbox adapter-to-gearbox orientation.
2. Record (note/photo/match mark) position of sequencing slot in relation to position/control switches. See Figure 4.

MIV-M



MIV-E

Figure 4.

3. Remove four [4] 3/8–16 x 2-1/2 inch long gearbox adapter-to-gearbox bolts.
   a. Using 9/16 inch socket, extension, and ratchet (set CCW), loosen bolts.
   b. Remove four gearbox adapter-to-gearbox bolts (with washers) but DO NOT REMOVE gearbox until instructed.

   NOTE: Avoid pulling the extension shaft out of the gearbox adapter (or letting it fall out). Hold the shaft in place inside the adapter while separating the assembly.

4. Remove gearbox (including gear motor assembly). See Figure 1.
   a. Position assembly with gearbox toward you.
   b. Separate gearbox (including gear motor assembly) from gearbox adapter but DO NOT REMOVE gearbox until instructed.
   c. Hold extension shaft in place and remove gearbox (including gear motor assembly).
   d. Pull extension shaft out of gearbox adapter. See Figure 5.

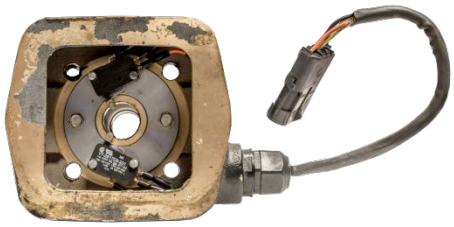


Figure 5.

5. Return to the next step of the calling procedure (see Page 4).

Remove And Replace Switches (MIV-E Bench Procedure)

Using a multimeter, verify all (four) micro switches as functional (or failed) by checking continuity from the common terminal (C) to the normally open terminal (NO) and then activate the switch and check the normally closed terminal (NC) on all four switches. Inspect wiring and push on terminals for faults (broken, loose, frayed, corroded, etc.) then inspect harness connector and the watertight strain relief connector. Replace all failed (or intermittent) switches as follows.

NOTE: This bench procedure replaces all four switches (which is recommended); however, replacement of only the failed switch (or switches) is acceptable.

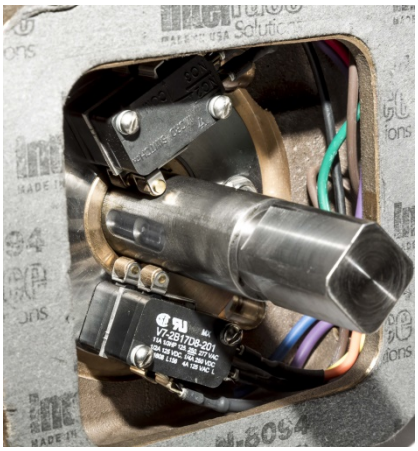


Figure 6.

1. Remove both switch stacks as follows.
   a. Note/photo orientation (including top or bottom of stack, positioning of stack, and labeling on switch showing or not showing) for all four switches See Figure 6.
   b. Using a small straight blade screwdriver, loosen two #4-40 x 1-1/8 inch long machine screws (each screw has two #4 lock washers) securing switch stack.

   NOTE: Expect the spacer (located between the two switches) to fall out when the screws are removed.

   c. Remove screws, doubled up lock washers, and spacer.
   d. Repeat steps for remaining switch stack.
   e. Note/tag and disconnect wiring for all four switches.
2. Discard all bent/damaged/failed/intermittent/worn micro switches and all mounting hardware.
3. Position gearbox adapter with wire harness at top-right of adapter.
4. Install first switch stack as follows. See Figure 7.
   a. Position two new switches with labeling showing.
   b. Connect wiring according to tags/notes for these switches.
   c. Place spacer between switches.
   d. Apply Loctite® 242 (or equivalent) to new #4-40 x 1-1/8 inch long machine screw threads. (Only on first 1/2-inch.)

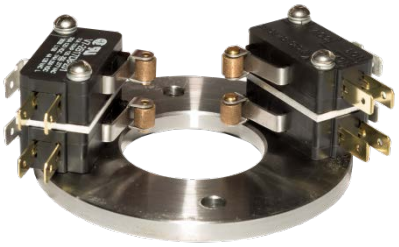


Figure 7.

   e. Insert one new machine screw (with two new #4 lock washers) thru one of the switch mounting holes.
   f. Position switch stack according to noted/photographed orientation for labeling showing switch stack. (Ensure routing prevents wire damage.)
   g. Hand start machine screw. (Insert and start the remaining new screw – with two new lock washers, and Loctite®.)
   h. Tighten both machine screws. (Do NOT overtighten; ONLY tighten machine screws until the lock washers are compressed.)
5. Install second switch stack as above, except position/connect as noted/tagged for labeling NOT showing switch stack.

Return to the next step of the calling procedure (see Page 4).

Remove And Replace Switches (MIV-M Bench Procedure)

Using a multimeter, verify both micro switches as functional (or failed) by checking continuity from the common terminal (C) to the normally open terminal (NO) and then activate the switch and check the normally closed terminal (NC) on both switches. Inspect wiring and push on terminals for faults (broken, loose, frayed, corroded, etc.) then inspect harness connector and the watertight strain relief connector. Replace all failed (or intermittent) switches as follows.

Figure 8.

NOTE: This bench procedure replaces both switches (which is recommended); however, replacement of only a single failed switch is acceptable.

1. Remove both switches as follows.
   a. Note/photo orientation (including positioning, and labeling on switch showing or not showing) for both switches See Figure 8.
   b. Using a small straight blade screwdriver, loosen two #4-40 x 5/8 inch long machine screws (each screw has two #4 lock washers).
   c. Remove screws and doubled up lock washers.
   d. Repeat steps (above) for remaining switch.
   e. Note/tag and disconnect wiring for both switches.
2. Discard all bent/damaged/failed/intermittent/worn micro switches and all mounting hardware.
3. Position gearbox adapter with wire harness at top-right of adapter.
4. Install first switch as follows. See Figure 9.
   a. Position new switch with labeling showing.
   b. Connect switch wiring according to tags/notes.
   c. Apply Loctite® 242 (or equivalent) to two #4-40 x 5/8 inch long machine screw threads. (Only on first 1/2-inch.)

Figure 9.

   d. Insert one new machine screw (with two new #4 lock washers) thru one of the switch mounting holes.
   e. Position switch according to noted/photographed orientation for labeling showing switch. (Ensure routing prevents wire damage.)
   f. Hand start machine screw. (Insert and start the remaining new screw – with two new lock washers, and Loctite®.)
   g. Tighten both machine screws. (Do NOT overtighten; ONLY tighten machine screws until the lock washers are compressed.)
5. Install second switch as above, except position/connect as noted/tagged for labeling NOT showing switch.

Return to the next step of the calling procedure (see Page 4).

Install Motor Gearbox (Bench Procedure)

Figure 10.

1. Install extension shaft. See Figure 10.
   (Left = MIV-M; Right = MIV-E)
   a. Apply a thin coat of grease to new extension shaft.
   b. Orientate sequencing slot to position between switches (as noted) and square end of shaft toward gearbox.
   c. Use shaft to spread switch rollers and then push shaft into bore of gearbox adapter.
2. Apply new gasket to gearbox adapter.
3. Align square bore of gearbox with square end of extension shaft.
4. Push gearbox over extension shaft until gearbox mates with gearbox adapter.
5. Install four 3/8–16 x 2-1/2 inch long gearbox adapter-to-gearbox bolts (with washers).
   a. Apply Loctite® 242 (or equivalent) to threads.
   b. Hand start all four bolts (with washers).
   c. Using 9/16 inch socket, extension, and ratchet (set CW), tighten bolts.
   d. Using 9/16 inch socket, extension, and torque wrench (set CW),using a criss-cross pattern, torque bolts to 23 lb-ft.

Return to the next step of the calling procedure (see Page 4).

MIV Mechanical Stop Adjustment Procedure
(Only Perform If MIV Fails Testing)

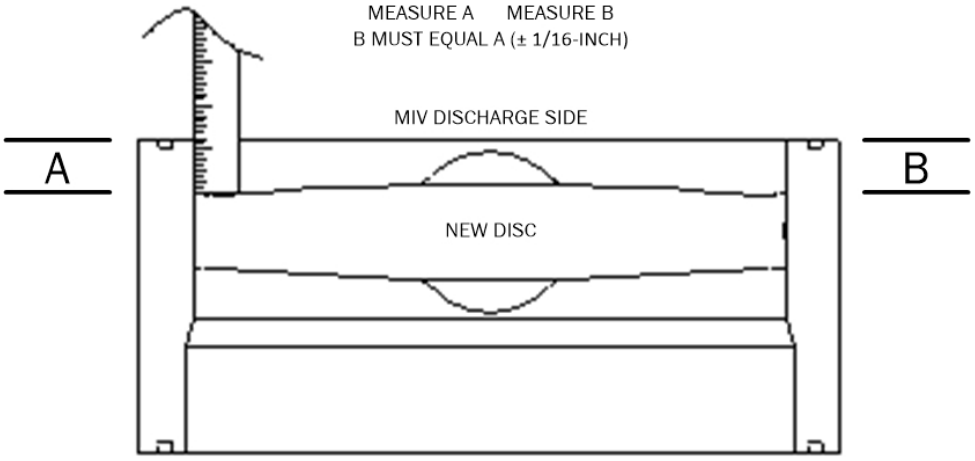


Figure 11.

1. Check display operation and disc stop position.
   a. Operate valve to open position.
   b. Close vale as follows.
      1) If MIV-M, manually operate valve to closed position. (Stop when the red lamp is lit.)
      2) If MIV-E, use panel controls (gear motor) to operate valve to closed position. (Allow the switch to stop the disc rotation. Verify lamps sequence from amber to red then the motor stops.)
   c. Measure difference in disc positions A and B. (See Figure 11.) The disc edges should measure an equal distance (or within ±1/16-inch).
      1) If measurements are within specifications, no adjustment is required. Return the valve to service.
      2) If measurements are outside of specifications, continue.

   EXAMPLE: A measures 5/8-inch, then B must measure between 9/16 and 11/16-inch otherwise adjustment is required.

2. Center gearbox adapter as follows.
   a. With valve in closed position, loosen gearbox adapter mounting 12 point (or cap) screws (see Figure 1).
   b. Turn gearbox shaft (by hand) 1/8 turn (45°) in open direction.
   c. Tighten mounting bolts.
   d. Repeat Step 1.
   e. If measurement is worse than before, loosen gearbox adapter mounting bolts and turn gearbox shaft 1/4 turn in opposite direction then tighten mounting bolts.
   f. Repeat Steps d. and e. until no adjust is required.

3. Adjust closed mechanical stop. See Figure 12.
   a. If MIV-M, tighten stop screw until it contacts segment gear. **(NOTE: Do NOT over tighten.)**
      1) Operate valve in both directions. Check lamp operation and disc stop position, if necessary back out screw a small amount until lamp and stop sequence properly.
      2) Tighten jam nut.
      3) If applicable, replace rubber plug.
   b. If MIV-E, tighten stop screw until it contacts segment gear then back out 1/2 to 3/4 turn.
      1) Operate valve in both directions. Check lamp operation and disc stop position, verify motor stops electrically and not by mechanical stop. (NOTE: When the motor stops operating, the gearbox shaft should be able to rotate about 3/4 turn before hitting the mechanical stop.)
      2) If Step 1) fails, back out stop screw another 1/4 turn and repeat Step 1) until no adjustment is required.
      3) If applicable, replace rubber plug. Otherwise, apply tamper proof sealant (Loctite 596 or equivalent) to jam nuts at stop screw.

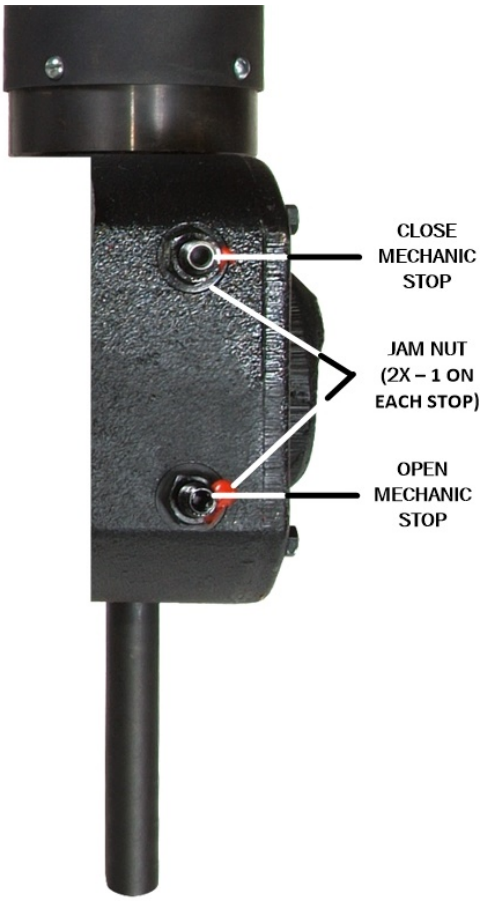


Figure 12.

4. Adjust open mechanical stop. See Figure 12.
   a. Operate valve to open position.
   b. If MIV-M, tighten stop screw until it contacts segment gear. **(NOTE: Do NOT over tighten.)**
   c. Operate valve in both directions. Check lamp operation and disc open position, if necessary back out screw a small amount until lamp and stop sequence properly.
      1) Tighten jam nut.
      2) If applicable, replace rubber plug.
   d. If MIV-E, tighten stop screw until it contacts segment gear then back out 1/2 to 3/4 turn.
      1) Electrically operate valve in both directions. Check lamp operation and disc stop position, verify motor stops electrically and not by mechanical stop. (NOTE: When the motor stops operating, the gearbox shaft should be able to rotate about 3/4 turn before hitting the mechanical stop.)
      2) If Step 1) fails, back out stop screw another 1/4 turn and repeat Step 1) until no adjustment is required.
      3) Tighten jam nut.
      4) If applicable, replace rubber plug. Otherwise, apply tamper proof sealant (Loctite 596 or equivalent) to jam nuts at stop screw. See Figure 12.