

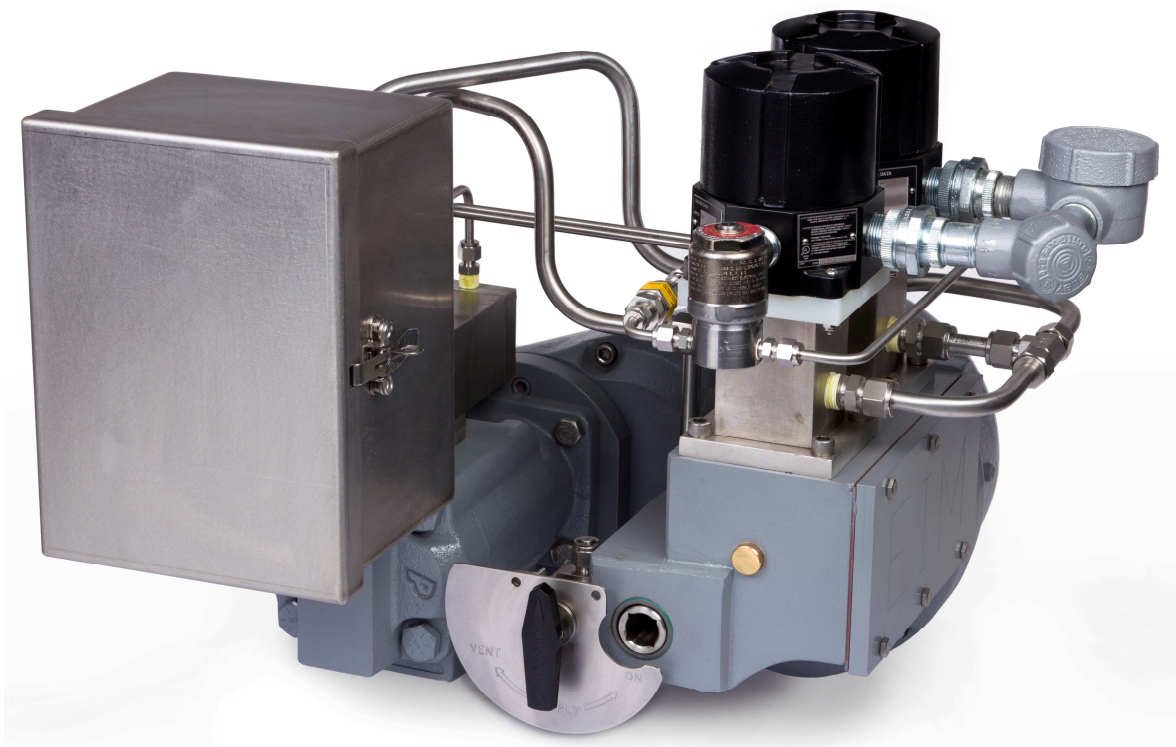
EIM G-Series Gas Motor High Pressure Pneumatic Actuator

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When communicating with EIM for replacement parts or for technical questions, we **MUST** have actuator nameplate information, including Job, Serial, and Model numbers. This allows us to check records of EIM equipment furnished.

When ordering parts, specify repair part by EIM part number and description from drawings furnished with actuator.



INTRODUCTION

This installation and operation manual explains how to install, operate, and maintain the G-Series valve actuator.

Carefully follow the instructions in this manual and make sure you install the actuator correctly and according to your requirements.

Safety notices in this manual detail precautions the user must take to reduce the risk of personal injury and damage to the equipment. The user must read these instructions in their entirety. Failure to observe these safety notices could result in serious bodily injury, damage to the equipment, voiding of the warranty, or create operational difficulty.

Safety notices are presented as follows:

⚠ WARNING: Alerts user of potential danger; failure to follow the warning notice could result in serious personal injury or death.

CAUTION: Identifies precautions the user must take to avoid personal injury or equipment damage.

NOTE: Highlights information critical to the user's understanding of the G-Series Gas Motor valve actuator installation or operation.

⚠ WARNING: Read this manual in its entirety before installing, operating, or performing maintenance on the G-Series actuator.

⚠ WARNING: Use caution when working on, with, or around valves and actuators. High pressures, forces, voltages, and flammable media can be present.

⚠ WARNING: Failure to follow instructions for proper electrical wiring, storage, setup, and maintenance may cause serious injury, damage equipment, or void warranty.

⚠ WARNING: If the actuator is being installed within a hazardous area, take into account that:
Improper installation in hazardous areas can cause an explosion.
Assembly, disassembly and maintenance are only allowed at the actuator when, at the time of the activity, an explosive mixture is not present.

STORAGE INSTRUCTIONS

If your actuator cannot be installed immediately, the following procedures are to be followed. This will ensure optimum performance from your G-Series actuator.

Failure to comply with recommended procedures could lead to actuator malfunction and will void the warranty.

The G-Series actuator is an inherently weatherproof unit when shipped from the factory, providing that all compartment covers and entry plugs remain intact. The actuator should be immediately stored in a clean, dry warehouse, free from vibration and rapid temperature changes, until it can be installed and commissioned.

If the actuator must be stored outside, it should be stored off of the ground, at an elevation sufficient to prevent it from being immersed in water or buried in snow, and covered to prevent damage from site debris.

If not attached to a valve, the preferred orientation is with the motor and control compartment horizontal.

Rain and snow must be kept from entering the exhaust muffler port.

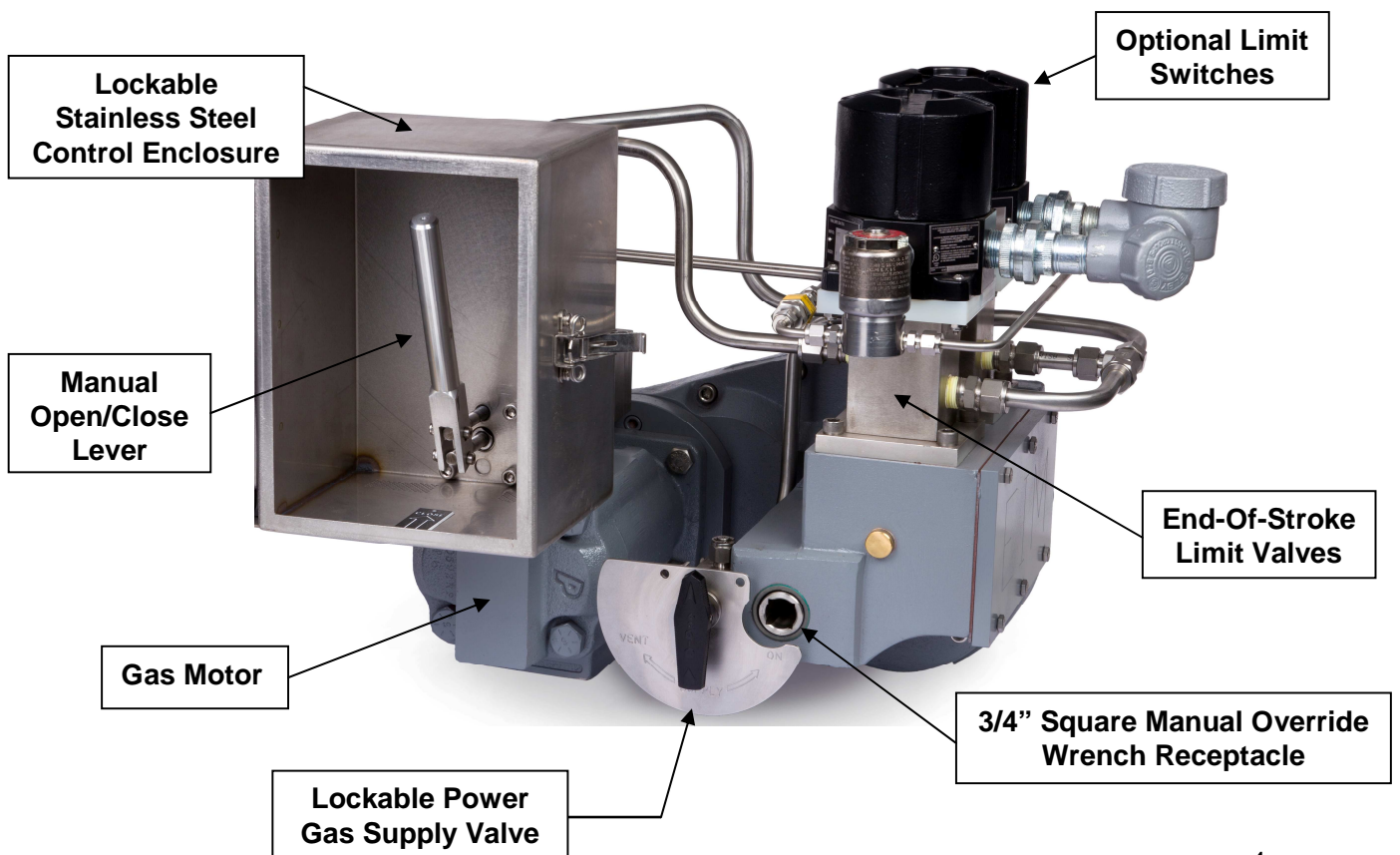
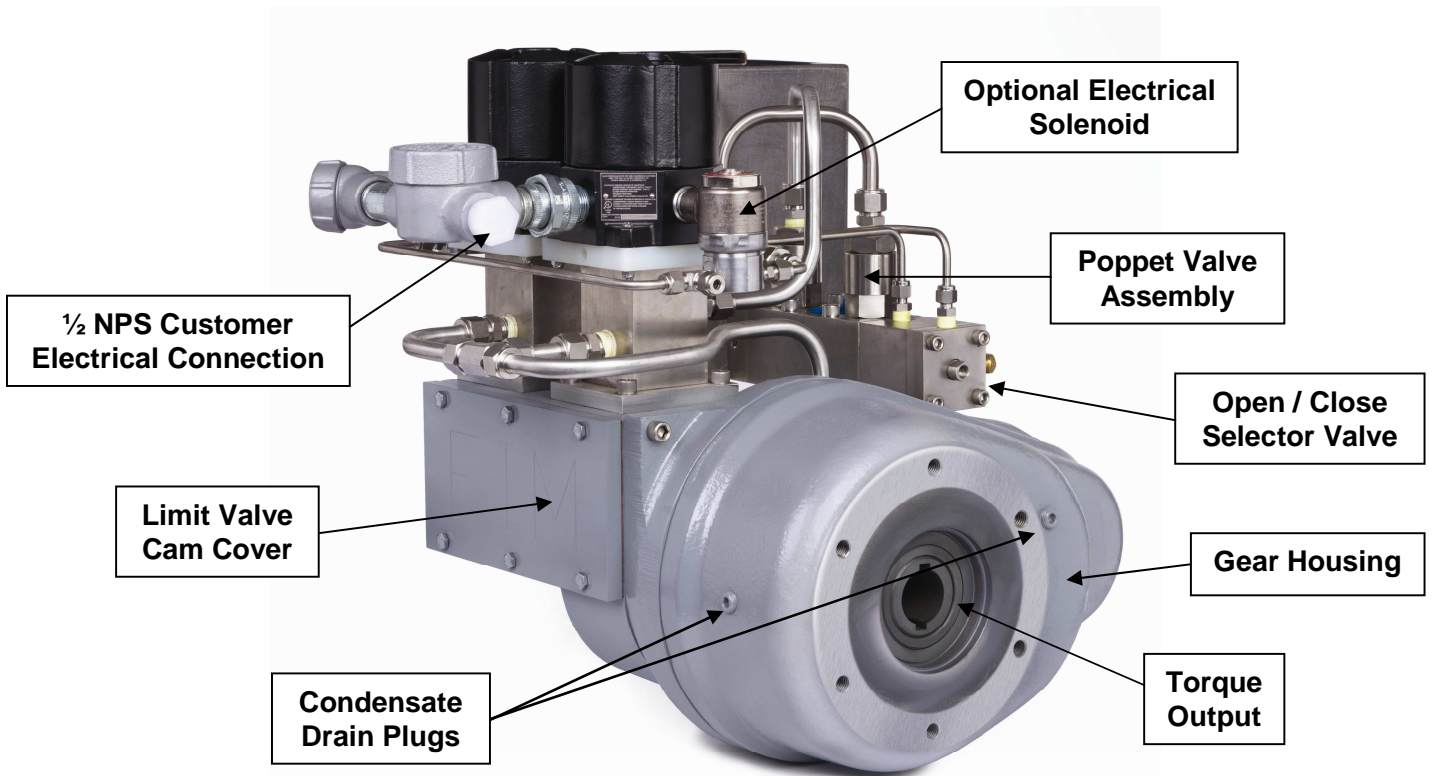
If the actuator is mounted on a valve and the valve stem protrudes from the unit, a suitable stem protector must be installed to prevent drive sleeve corrosion. Stem protectors may be purchased from your local EIM distributor.

CAUTION: Condensation or moisture that enters the actuator can damage internal components, which may ultimately result in failures.

- (1) Ensure integrity of gaskets and O-rings.
 - (2) Seal all conduit openings, and supply gas connections whether used or not.
 - (3) Replace any plastic conduit plugs with pipe plugs appropriate for the application.
 - (4) It is strongly recommended to remove the drain plugs occasionally to remove any possible moisture accumulation. This is a particularly important maintenance practice in the fall of the year before the winter freeze.
-

For storage procedures exceeding one year, contact your local EIM representative for recommendations. Contact information is located on the last page of this manual.

Component Identification



PRODUCT DATA

The EIM G-Series actuator is a high-pressure pneumatic valve actuator powered by either line or stored gas pressures between 400-1480 PSI. (It will run at lower pressures but may not develop adequate torque to complete its job.) It is a compact unit, having cam-operated opening and closing limit valves, a manual control valve, manifold piping and manual override capability. Signal-operated pilot valves, electrical limit switches and numerous accessories are also available.

In the current units, model size changes are accomplished by gear substitution only. All new units have complete compatibility in regard to components and assemblies. All model sizes share the same housing and motor. The only differences between the G-0, G-2, and G-3 sizes are in the number, type, and ratios of the gears.

Service Note: While the basic design and operation of the G-Series units have not changed over the years, there are certain differences between older actuators and the current models. Actuator sizing was previously accommodated by a combination of motor, housing, and gear changes. Consequently, there were a variety of non-compatible parts for older G0, G2, and G3 actuators. Please consult the factory for clarification on specific details when ordering parts.

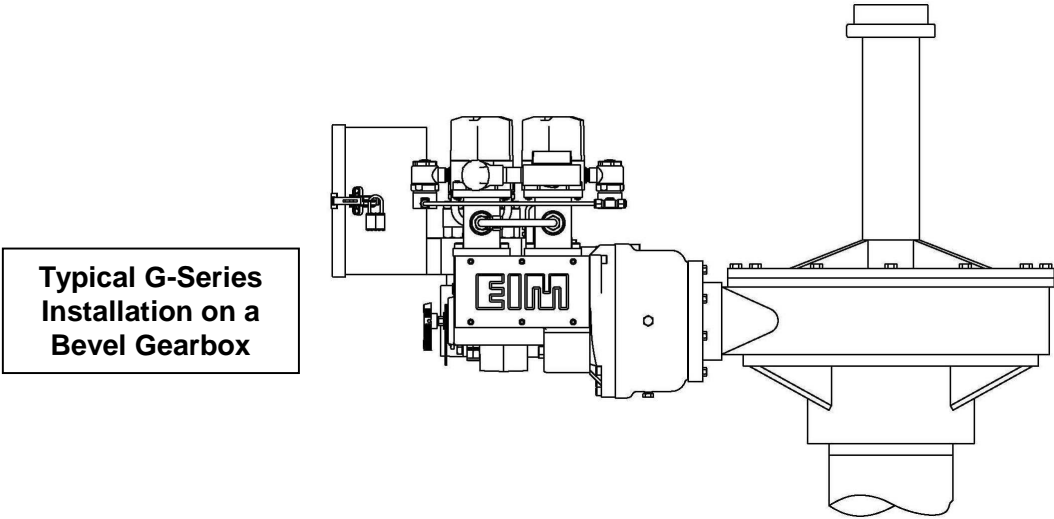
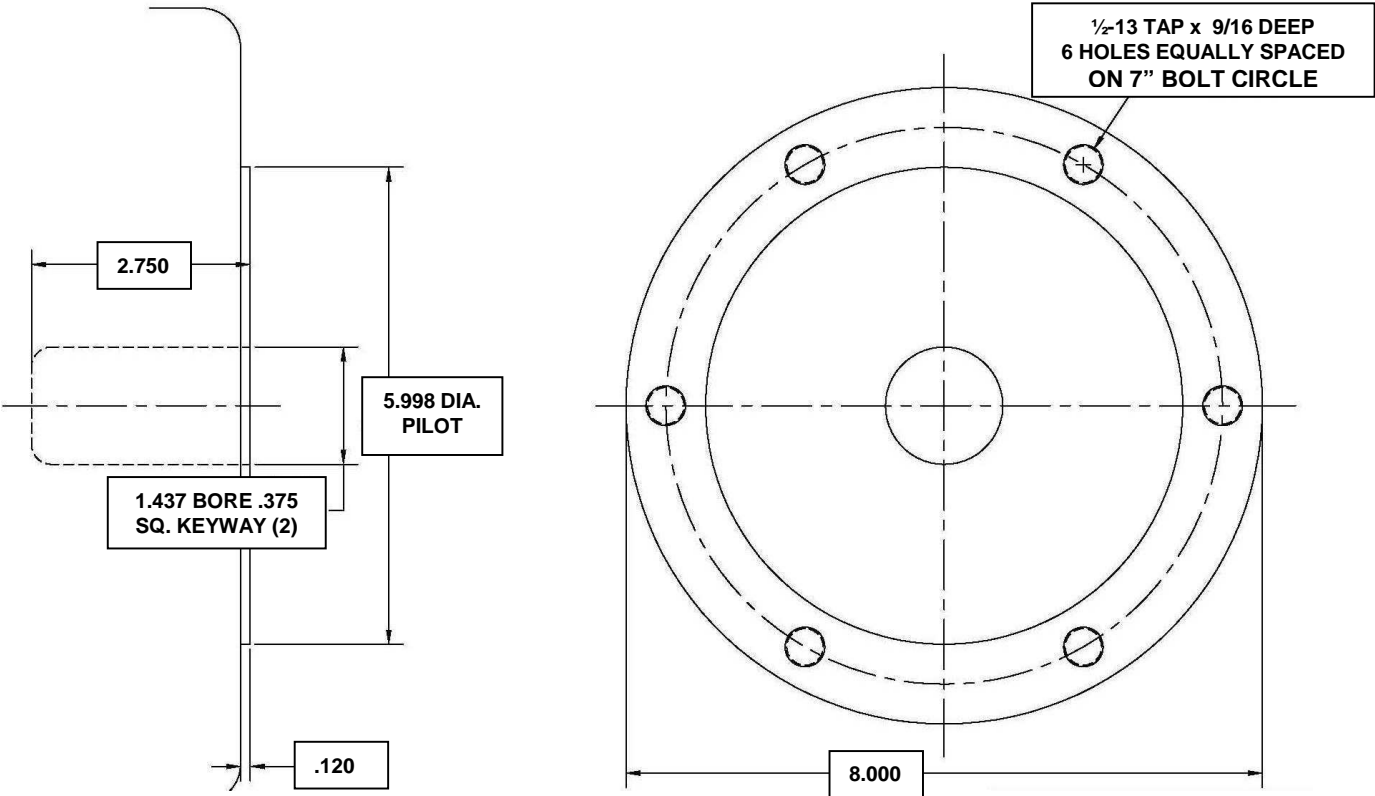
Actuator Identification

There is an alpha-numeric code used to describe basic actuator features for computer assisted order entry and product identification. This number appears on the nameplate affixed to the actuator gear housing.

ASSEMBLY TO VALVE

The EIM G-Series actuator and control mounts directly to the valve gearhead by means of an adaptor, and connects to the existing handwheel shaft. Most valve manufacturers can supply their valves already equipped with an adaptor. If not, adaptors can be designed to weld or bolt on in place of the bearing cap of the valve gearhead. The actuator may be mounted in any position to facilitate inspection and maintenance.

The mounting arrangement shown below is the same for all G0, G2, and G3 model sizes.



PNEUMATIC HOOKUP

1) Upon completion of mounting the actuator to the valve per previous instructions, move the valve position to mid-stroke with the actuator's Handwheel. This will provide sufficient time to stop actuator operation in case of incorrect pneumatic connection(s).

2) Identify a means of removing power from the actuator during hook up and verify functionality.

3) Be sure no erroneous electrical or pneumatic remote signal can be received that would cause the actuator to initiate operation.

4) The basic control system on each pneumatic actuator is sized to deliver a gas volume at the necessary flow rate to achieve design performance for all model sizes. The gas motor is the same for all G-Series models so the supply piping size requirement is the same for all of them.

All supply lines to the actuator should be no smaller than ½" NPT pipe size. Long lengths of supply line piping, greater than 6 ft to the actuator will require 1" NPT to within 6 ft of the actuator.

CAUTION: ALL piping fittings and components used in the gas supply line to the actuator MUST be rated for operation at 1480 psi minimum .

NOTE: Do not hang pipe loads on the actuator. Use external support or flexible connections to the actuator.

5) Installation of a filter in the gas line leading to the pneumatic motor is required. The filter MUST have connections equal or greater than ½ NPT and should be mounted in a horizontal pipe run as near as possible to the actuator.

The filter MUST have a 90-120 micron rating and be capable of flowing the correct volume (SCFM) of gas shown on the chart above.

EIM manufactures filter assy. P/N 100088 designed specifically for this application.



6) A lubricant is required for all internal moving parts of the pneumatic motor and control

valving. This is intended to reduce wear and prevent rust.

Consequently, installation of a lubricator in the gas line leading to the pneumatic motor is required. The lubricator MUST have connections equal or greater than ½ NPT and MUST be mounted in a horizontal pipe run as near as possible to the actuator.

The automatic lubricator MUST be capable of being adjusted to supply one drop of oil for every 20-40 SCFM of gas being used by the actuator.

EIM manufactures lubricator assy P/N 100009 designed specifically for this application.



PNEUMATIC HOOKUP - continued

7) Acceptable for use in the lubricator must be mineral oil base & have an aniline point in the range of 200-220° F. Oils must be thin enough to atomize in the lubricator. This should be in the range of Group DTurbine Light with a viscosity of 32 at 100° F. Listed below is a representative group of suitable light oils that may be considered for use.

CHEVON GTS OIL 32
 EXXON TERESSTIC T-32
 MOBIL LIGHT
 SHELL TURBO 32
 TEXACO REGAL OIL
 Para/Synthetic Lubricant
 Southeast Oil & Grease Co.
 AL-32

NOTE: Do not use penetrating oils or detergent oils as they will damage seals and thicken in cold weater.

Any temperature below 32° F may require the addition of small amounts of pure ethylene glycol into the air system to prevent freezing. Do not reduce the volume of oil normally used.

NOTE: An alcohol injector can be used in extremely cold environments to prevent possible freezing of the moistur in the supply gas. Contact the factory for recommendations.

8) The G-Series actuator includes a current EIM designed muffler / mist extractor to quiet exhaust and capture the lubrication oil from the exhausting gas.



DO NOT reduce the line size smaller than the port in the bottom of the muffler / mist extractor and DO NOT use a standard pipe as an exhaust. A standard pipe will not reduce noise to acceptable levels, capture oil or keep out rain. The muffler / mist extractor should be placed

well above line of sight and above personnel height.

As is common with rapid pressure drop of natural gas, frost will accumulate on the outside of the exhaust system during operation. This is normal and poses no

issue. The same frost will occur on the inside of the muffler and will rapidly melt after the flow of gas ends. The condensate will settle at the bottom of the exhaust muffler and does not cause a problem because of the small amount created. However on the next exhaust event, the drops of water will be blown out. This mist is commonly misrepresented as being a large oil discharge, when in fact, it is water.

CAUTION: Use of the product on any power medium other than compressed air, nitrogen, or natural gas may establish a potential hazard.

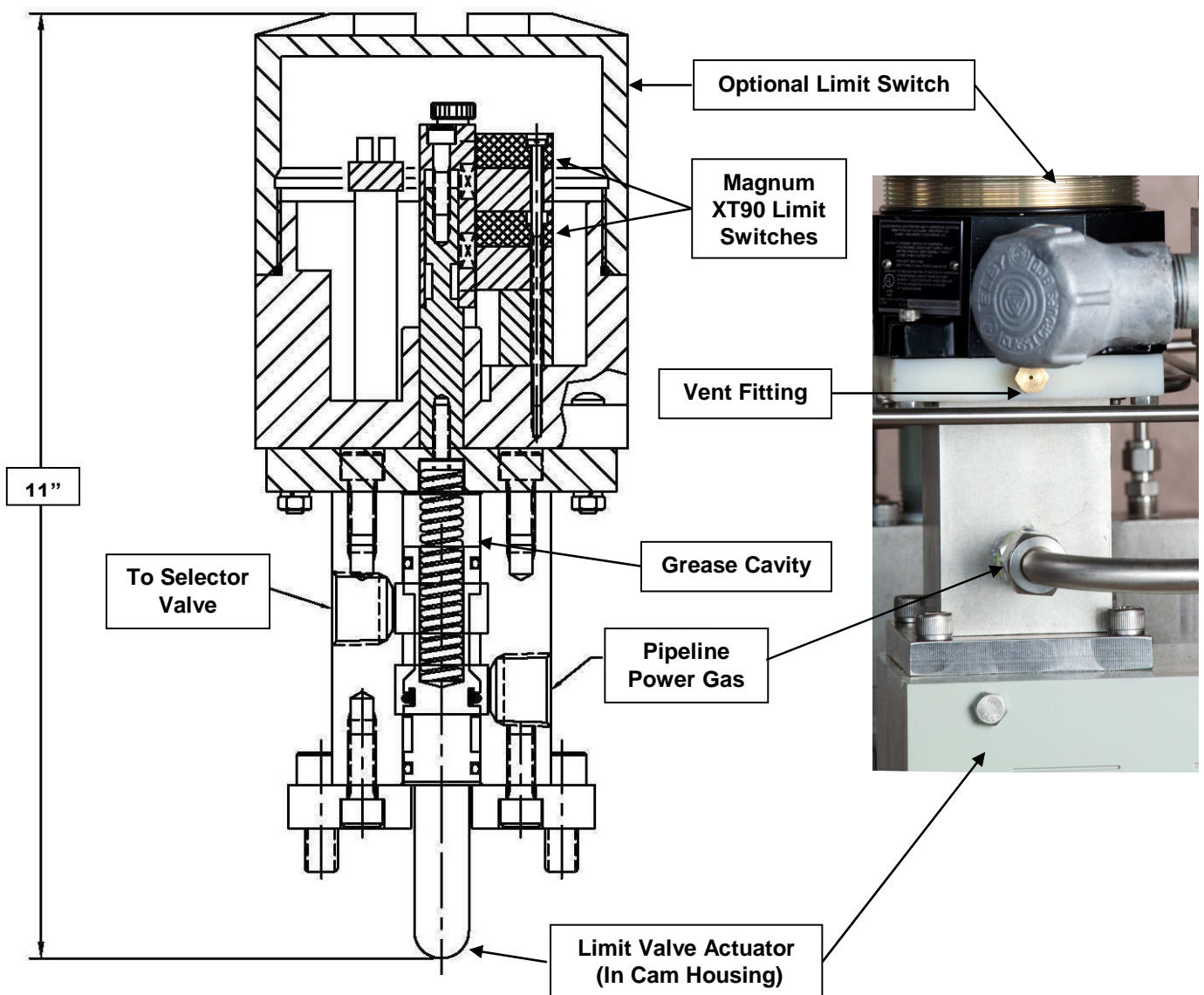
NOTE: This product, as well as similar devices such as cylinders, solenoid valves, ESD valves, compressor, etc. emit to atmosphere in their normal operational mode. Confer with established codes and safety regulations.

Travel Limit Valves

The EIM G-Series actuator is equipped with two limit valves; one controlling the opening direction of travel and the other controlling the closing direction of travel. These limit valves are actuated by a cam mechanism that closes either limit valve when either extreme of travel is reached.

The limit valves have a cavity and a spring on the top. To avoid moisture accumulation in the cavity, the factory suggests filling the cavity with grease and then inserting the spring and installing the cover plate. Some grease will squirt out when the limit valve is actuated, while the remainder will act as a void filler to guard against condensation and corrosion accumulation.

NOTE: Be sure the vent fitting is not plugged with paint or dirt before performing this operation or the Travel Limit Valve may be damaged.



Actuator Travel Limit Cams

In order to avoid excessive loads on the seating surfaces of the valve, travel limit cams must be set according to the following instructions after mounting the actuator to the valve. .

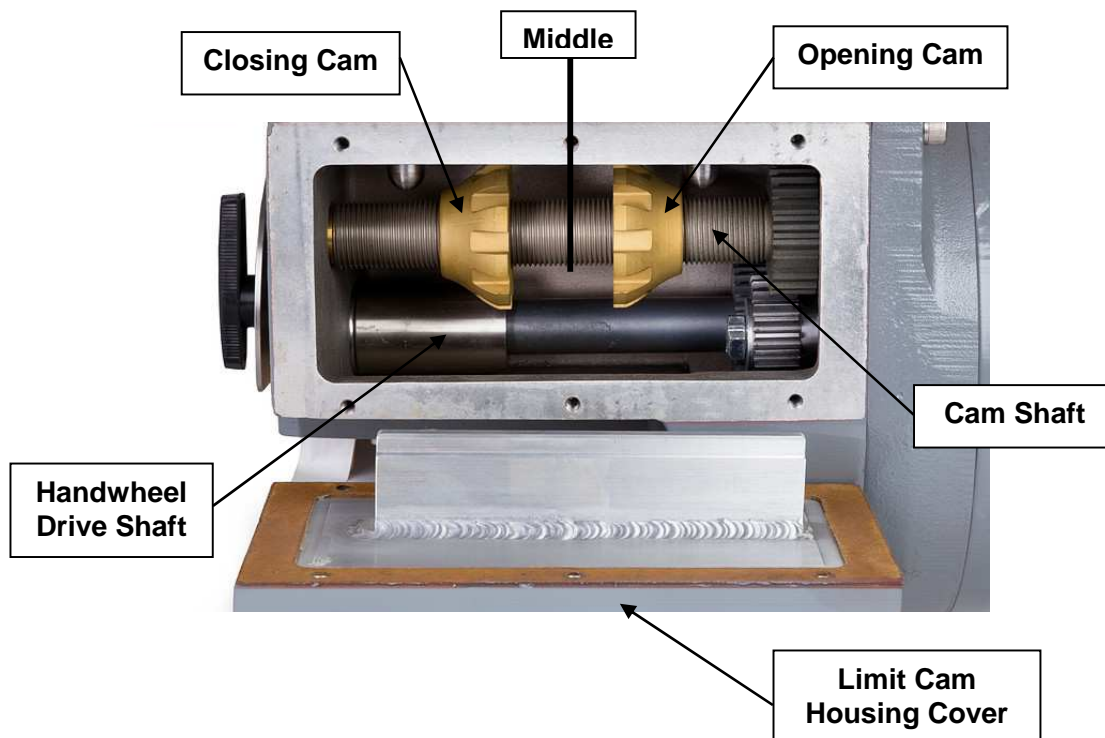
Cam gearing is the mechanical means by which the actuator is allowed to run in one direction without running out of travel. This is related to the number of turns of the *input shaft* of the worm or bevel gear required to perform one complete stroke of the valve. Cam gearing has nothing to do with torque output.

Limit cam travel is determined by the cam gear ratios, which are variable depending on the number of turns required for full valve travel. Five (5) cam ratios are offered on the G-Series, ranging from 1-to-1 to 30-to-1. The ratio represents, in the case of a 30-to-1 ratio, that the handwheel shaft should turn 30 times to one revolution of the camshaft. Visual inspection of the cam gearing will identify the ratio of a specific EIM G-Series actuator as follows: 1-to-1; 3-to-1; 7.5-to-1; 15-to-1 and 30-to-1.

The higher the ratio, the higher the number of actuator drive sleeve turns allowed. This needs to be considered when attempting to mount the actuator to a valve it was not originally sized for. Cam gearing can be changed, but will require a skilled technician. Please contact the factory for more information when moving a G-Series actuator from one valve to another.

Setting Actuator Travel Limit Cams

The EIM Gas Motor valve operator is shipped from the factory with the cam cover plate mounted in reverse to prevent damage to the limit valve assembly if the actuator is inadvertently turned by hand. The limit cam housing cover should be removed and the cams placed back-to-back on the middle of the cam shaft before starting the limit cam setting procedure outlined below.



Setting Actuator Travel Limit Cams - continued

NOTE: Failure to follow proper procedure can cause damage to the valve and/or actuator and void warranties on both.

Be sure the valve limit assemblies have a vented plug installed in the top to avoid hydraulic compression. *Caution: Painting may plug vent ports*

| Task | Description |
|--------------------------------------|--|
| 1) Close Pipeline Valve Manually | Close the pipeline valve manually using the handwheel connection. |
| 2) Adjust Close Limit Cam | Rotate the close side limit valve cam (the Close Side Cam is on the left when facing the cam compartment) until the Limit Valve pinches off the gas flow completely. DO Not Over-Adjust The Cam. |
| 3) Re-install the Cam Cover | Cam cover must be installed to prevent closing cam from rotating. |
| 4) Open Pipeline Valve Manually | Partially open the pipeline valve manually using the handwheel connection. |
| 5) Close Pipeline Valve w/ Power Gas | The pipeline valve should now be closed by power gas. Should the mainline valve not fully close before the Close Limit Valve is actuated by the cam, the bronze cam should be adjusted a third of a revolution at a time until a satisfactory setting is achieved. Test, and if necessary, repeat until the mainline valve closes properly. If the mainline valve closes before the limit valve closes, advance the cam in one-half revolution steps until satisfactory. |
| 6) Open Pipeline Valve Manually | Repeat steps #2 through #5 for the open position cam. |

The specific EIM cam-setting fixture (part No. 100126-1) can be very helpful in the cam setting operation since it permits visual inspection of the cams as they travel along the cam shaft. In the absence of the cam jig, the cam limit housing cover may be used for the same purpose.



OPTIONAL ELECTRIC LIMITS

General Information

Two optional limit switches are available for G-Series pneumatic actuators, one for open position and one for the close position – see illustration A. Both switch assemblies are mounted to the top of, and actuated by, the Travel Limit Valves as shown below. Wiring schematics are shown on the Control Diagrams. The switch assemblies are manufactured by Westlock and are rated for use in Hazardous Locations: NEMA Type 4, 4X, 7 & 9; Class I, Groups B, C, & D; Class II Groups E, F, & G; Div. 1 & 2.

NOTE: Limit switch actuation adjustments **are not** made by means of the travel limit cam. See Limit Switch Setting Instructions below.

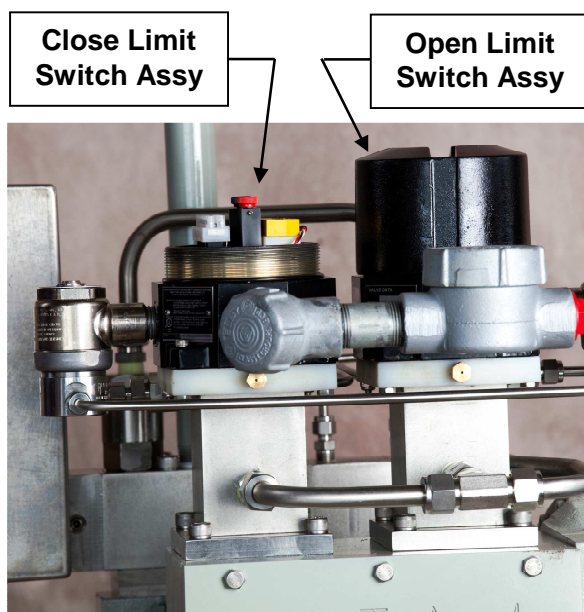
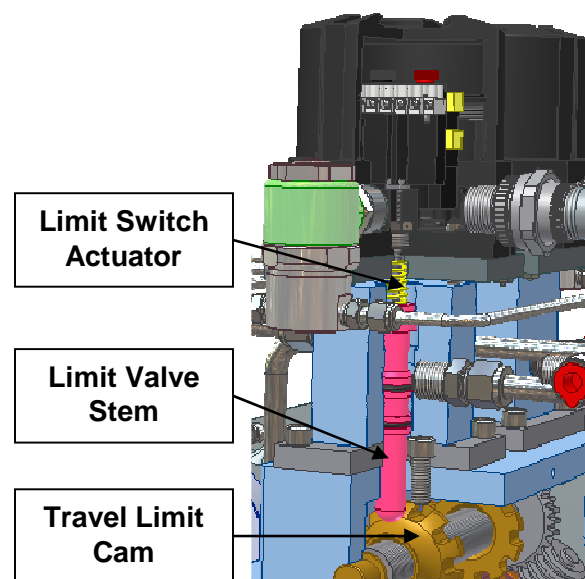
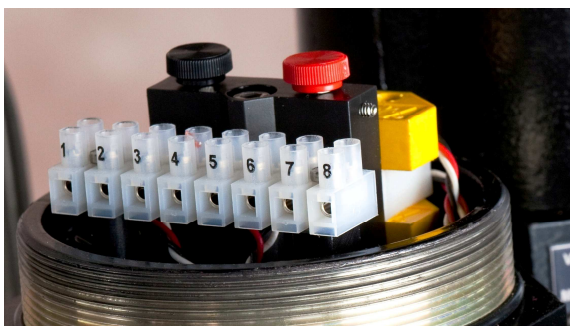


Illustration - A



Limit Switch Setting Instructions



1. Stroke the actuator to the closed position. Turn both the black and red knobs of the triggering system clockwise until the triggers reach the top of the triggering system.

2. Turn the black knob counter-clockwise to set the lower Magnum switch.

3. Stroke the actuator to the open position. Turn the red knob of the triggering system counter-clockwise until the trigger reaches the bottom of the triggering system to eliminate the effect of the magnetic fields interacting. Then turn the red knob clockwise to set the upper Magnum switch.

Note: Operate the actuator from one extreme to the other several times to check switch operation.

4. Once the triggers are set, tighten the setscrews on both sides of the triggering system to lock the triggers in place.

LUBRICATION AND MAINTENANCE

⚠ WARNING: Always turn off and blow down the power gas supply before working on a unit or operating it with a wrench or handwheel.

LUBRICATION

EIM G-Series housings are factory filled with a high quality grease that is carefully selected to ensure proper performance under specified operating conditions. The preferred grease used by the factory is Shell GADUS S2 V100 2 (Formerly known as Shell ALVANIA RL 2). It is high performance multipurpose - "NLGI 2, Lithium Grease, 100 cSt viscosity".

Approximately 3 lbs of grease is manually applied to the gears and housing of each actuator.

Normal operation **may not** require lubricant replacement. It is not necessary to change the housing grease unless known contaminants are introduced into the housing, during rebuilding of the unit, or if the actuator is making excessive noise.

MAINTENANCE

The most important maintenance items on the G-Series actuators are the filter, lubricator, and muffler / mist extractor. It is recommended that an annual winterization maintenance program be initiated in the late summer months. At a minimum, the annual maintenance program should include the following inspection points. A complete annual maintenance checklist is shown on the following page.

Filter - Check the power gas filter annually for dirt accumulation. Most pipeline gas is not truly clean. Debris from miles of pipe can clog the filter and prevent the actuator from performing adequately. The porous bronze filter media should be removed and cleaned with ordinary paint thinner or solvent. It is recommended to keep clean filter elements in stock to simplify the change-out procedure.

It should be noted that, under extreme circumstances, no damage will occur if running the G-Series actuator without a filter element. If your gas is relatively clean, the operator can run for extended periods without any damage less the gas filter element.

Lubricator - The motor and controls of the EIM G-Series are lubricated by use of an inline lubricator. As high pressure gas passes through the lubricator, drops of oil are siphoned from the reservoir and circulated through the selector valve, limit valves, motor and out through the exhaust muffler. The lubricator should be filled as needed depending on valve use. Always keep the oiler full to avoid running the unit without lubrication. The redesigned and much improved controls upgrades require far less oil to adequately lubricate the motor and controls. Consequently it is highly recommended to purchase a current EIM high pressure lubricator which is calibrated to deliver minimal oil.

It should be noted that the G-Series actuator is designed to run for short periods without lubrication. No appreciable damage will occur if this is done infrequently. However, extended use without lubrication will certainly damage the motor beyond functionality.

It is advised to install a drain valve on the bottom side of the oiler to allow for easy removal of accumulated condensation.

LUBRICATION AND MAINTENANCE - continued

Muffler / Mist Extractor - As with all gas powered actuators, gas is discharged either during the stroke or after the stroke. The EIM G-Series gas motor discharges gas during stroke. The exhaust contains trace amounts of lubricant from the oiler that is discharged with the spent gas. The G-Series actuator includes a current EIM designed muffler / mist extractor to quiet exhaust and capture the lubrication oil from the exhausting gas.

The muffler / mist extractor has a drain plug for easy recovery of lubricating fluid and condensates. It is advisable to install a drain valve in the bottom side of the filter to allow for easy removal of accumulated liquids.

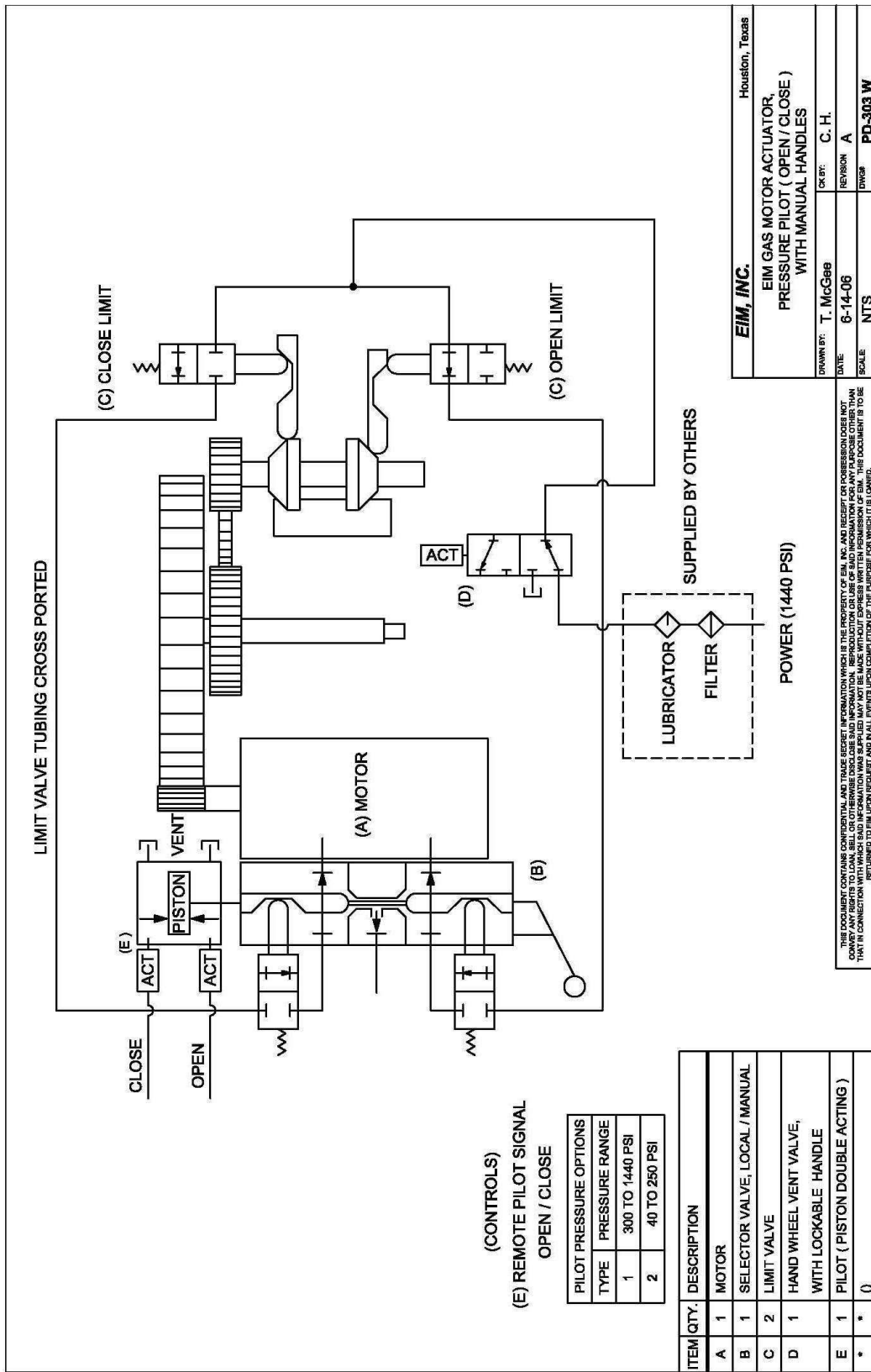
NOTE: Do not allow rain to accumulate in the muffler as it may freeze in winter.

Recommended Annual Maintenance Checklist

- 1) Clean and / or replace filter element.
- 2) Fill the power gas lubricator with oil.
See Pneumatic Hookup section of this manual for fluid recommendations.
- 3) Drain lubricant oil and condensates from the muffler / mist extractor
- 4) Visually inspect for any mechanical damage. Replace worn or damaged components.
- 5) Check for any external leaks and tighten fittings appropriately and/or replace failed components.
- 6) Check for internal component leakage by testing for the presence of air exiting any exhaust or vent port(s) while the actuator is not moving.
Note: 90 Durometer O-rings must be used where they meet a broken edge or port.
70 Durometer o-rings may be used in all other applications.
- 7) Replace any seals that permit oil leakage or water ingress.
- 8) Remove the plug from the lowest drain point in the main housing to allow condensate, if any, to drain.
Note: It is difficult to ensure that you will never pick up small quantities of condensation inside the actuator. However, following the annual maintenance program, the condensation problem will always be minor and never hamper the operation of the G-Series actuator. Do not be alarmed if condensation has contaminated the grease. The gears are large and slow turning with an abundance of grease in the housing. The gears will get adequate lubrication and cooling with water-contaminated grease. The concern should be if grease levels are low and water builds inside the actuator and then freezes, which could lock the actuator or fracture the housing.
- 9) Remove the cam gearing housing cover to inspect for the presence of condensation and wear. The cam gearing is lubricated with grease and should not require service for several years.

TYPICAL CONTROL DIAGRAM

Example One – Double Acting Pneumatic #PD-303 W



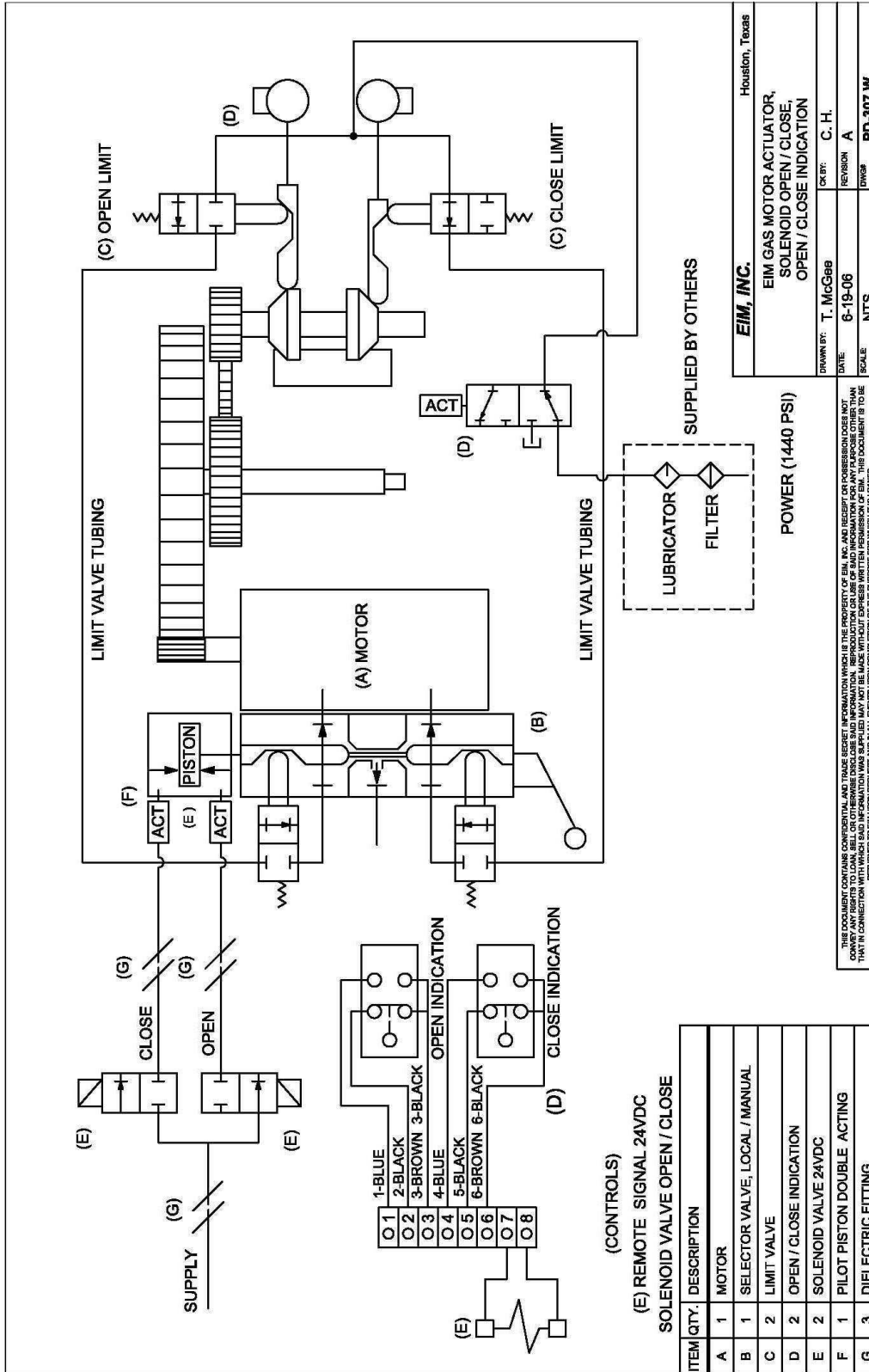
(E) REMOTE PILOT SIGNAL
OPEN / CLOSE

| PILOT PRESSURE OPTIONS | |
|------------------------|-----------------|
| TYPE | PRESSURE RANGE |
| 1 | 300 TO 1440 PSI |
| 2 | 40 TO 250 PSI |

| ITEM QTY. | DESCRIPTION |
|-----------|--|
| A 1 | MOTOR |
| B 1 | SELECTOR VALVE, LOCAL / MANUAL |
| C 2 | LIMIT VALVE |
| D 1 | HAND WHEEL VENT VALVE, WITH LOCKABLE HANDLE |
| E 1 | PILOT (PISTON DOUBLE ACTING) |
| * | * |
| | () |

TYPICAL CONTROL DIAGRAM

Example Two – Remote Electric Control #PD-307 W



PERMCO GAS MOTOR

The gas motor supplied is a precision built rotary gear type. Internal components take up their own wear & will last approximately 5,000 to 15,000 hours of use. This depends on motor speed, method of oiling, operating pressure and preventative maintenance practices.

INSTALLATION

Install a moisture trap and filter in the air line ahead of the actuator's air motor. For efficiency of output and speed control, use gas lines the same size or in the next pipe size larger than the intake port of the motor.

The motors are piped up to work equally well in both directions of operation. The control valve makes reversing possible [refer to typical control diagram].

When coupling or connecting the motor to a driven member, avoid any end or side thrust on the motor shaft. Do not hammer on the shaft itself.

LUBRICATION

Lubrication is necessary for all internal moving parts and rust prevention. An automatic air line lubricator must be installed in the air line just ahead of the air motor. The lubricator should be adjusted to feed one drop of oil for every 50 – 75 SCFM of air going through the motor. Oil specifications can be found in the Pneumatic Hookup section of this manual.

Excessive moisture in the air line can cause rust formation in the motor and might also cause ice to form in the muffler due to expansion of air through the motor.

The moisture problem can be corrected by installing a moisture separator in the line & by installing an aftercooler between the compressor and air receiver.

GENERAL INFORMATION

The air motor is designed to be driven by compressed nitrogen and compressed natural gas. Under no circumstances should it be driven by fluids, particles, solids or any substance mixed with air.



Do not allow corrosive gases or particulate material to enter the motor. Water vapor, oil-based contaminants, or other liquids must be filtered out

SERVICING

If the motor is sluggish or inefficient, try flushing with an approved solvent:

- To flush, disconnect air line and muffler, add several teaspoons or spray solvent directly into the motor
- Rotate the shaft by hand in both directions for a few minutes, reconnect the air line and slowly apply pressure until there is no trace of solvent in exhaust air
- Flush unit in a well ventilated area.
- Re-lubricate the motor with a squirt of oil in the chamber

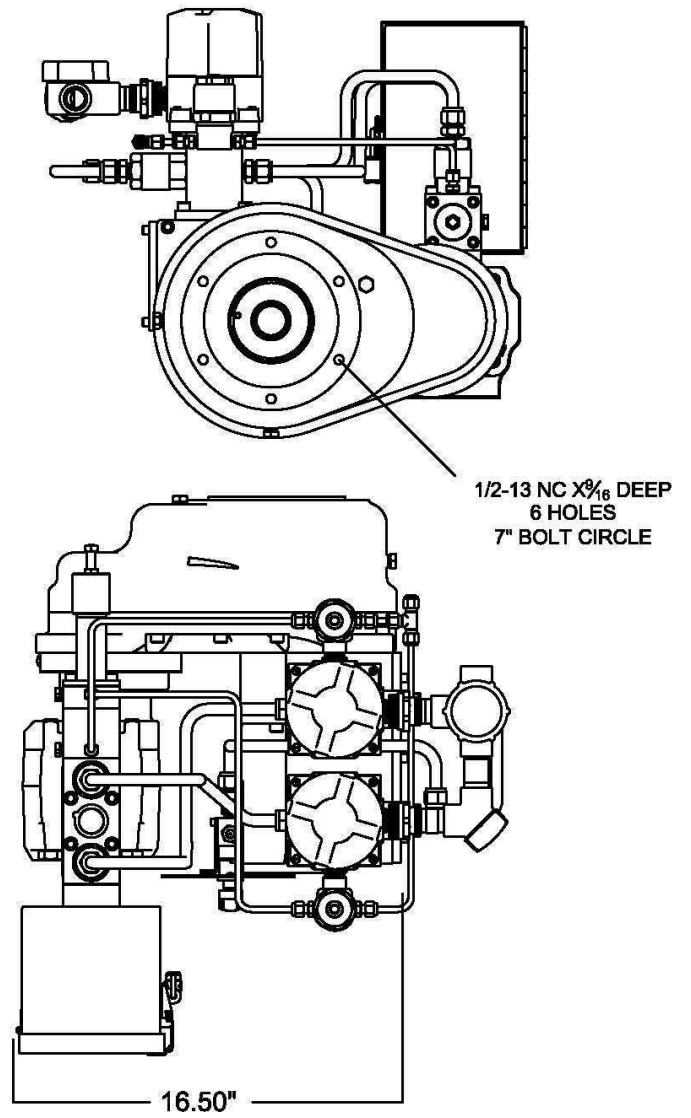
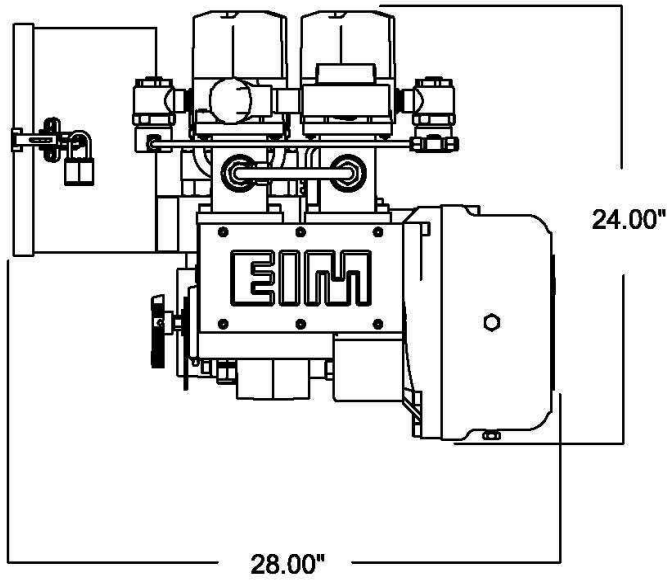
TROUBLESHOOTING

⚠ WARNING: Lock out power gas before using the handwheel. Never use power gas and handwheel together. Handwheel drives directly to the valve gear shaft.

⚠ WARNING: Use caution when working on, with, or around valves and actuators. High pressures, forces, voltages. and flammable media can be present.

| SYMPTOM | PROBABLE CAUSE | CORRECTION |
|--|--|---|
| MOTOR WILL NOT RUN | No power to actuator Low gas motor pressure – filter is clogged in power or control circuit Gears are locked Broken limit spring | Check high pressure gas supply Clean or replace filter Turn hand wheel to verify gear operation Repair or replace |
| MOTOR RUNS SLOW AND LACKS POWER | Clogged filter Exhaust restriction | Clean filter Drain exhaust collector |
| MOTOR ONLY PARTIALLY OPENS OR CLOSES VALVE | Limit improperly Set | Check actuation & reset |
| ACTUATOR CLOSES THE VALVE BUT WIL NOT OPEN THE VALVE | Broken open limit spring Closed limit set too far into the valve seat Reduced gas flow or pressure Damaged valve | Lock out, bleed gas and replace spring Adjust cams and allow for coast Check filter and gas pressure Call valve specialist |
| HANDWHEEL WILL NOT OPERATE VALVE | Motor locked up Cam nuts improperly adusted Broken Handwheel shaft Broken valve stem or stripped stem nut Damaged actuator gearing | Remove motor and turn handwheel Adjust cams Repair or replace Repair or replace Replace as required |
| ACTUATOR RUNS FINE BUT LEAKS GAS AT END OF STROKE | Broken or worn T-ring in limit valve assembly Improper limit cam setting | Replace seal Adjust cams |
| GAS LEAKAGE INTO THE CAM HOUSING OR MAIN HOUSING | Gas motor seal Limit valve leakage | Replace gas motor Replace lower O-ring Examine limit valve port |

Overall Dimensions – All G-Series



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