Masoneilan*
78400/18400 Series
LincolnLog* High Pressure Anti-Cavitation Control Valve

Instruction Manual (Rev. D)
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THESE INSTRUCTIONS ASSUME THAT OPERATORS ALREADY HAVE A GENERAL UNDERSTANDING OF THE REQUIREMENTS FOR SAFE OPERATION OF MECHANICAL AND ELECTRICAL EQUIPMENT IN POTENTIALLY HAZARDOUS ENVIRONMENTS. THEREFORE, THESE INSTRUCTIONS SHOULD BE INTERPRETED AND APPLIED IN CONJUNCTION WITH THE SAFETY RULES AND REGULATIONS APPLICABLE AT THE SITE AND THE PARTICULAR REQUIREMENTS FOR OPERATION OF OTHER EQUIPMENT AT THE SITE.

THESE INSTRUCTIONS DO NOT PURPORT TO COVER ALL DETAILS OR VARIATIONS IN EQUIPMENT NOR TO PROVIDE FOR EVERY POSSIBLE CONTINGENCY TO BE MET IN CONNECTION WITH INSTALLATION, OPERATION OR MAINTENANCE. SHOULD FURTHER INFORMATION BE DESIRED OR SHOULD PARTICULAR PROBLEMS ARISE WHICH ARE NOT COVERED SUFFICIENTLY FOR THE CUSTOMER/OPERATOR'S PURPOSES THE MATTER SHOULD BE REFERRED TO BHGE.

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Safety Information

Important - Please Read Before Installation

These instructions contain DANGER, WARNING, and CAUTION labels, where necessary, to alert you to safety related or other important information. Read the instructions carefully before installing and maintaining your control valve. DANGER and WARNING hazards are related to personal injury. CAUTION hazards involve equipment or property damage. Operation of damaged equipment can, under certain operational conditions, result in degraded process system performance that can lead to injury or death. Total compliance with all DANGER, WARNING, and CAUTION notices is required for safe operation.

This is the safety alert symbol. It alerts you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

Indicates a potentially hazardous situation which, if not avoided, could result in serious injury.

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

Useful Life

The current estimated useful life period for the Masoneilan 78400/18400 Series control valve is 25+ years. To maximize the useful life of the product it is essential to conduct annual inspections, routine maintenance and ensure proper installation to avoid any unintended stresses on the product. The specific operating conditions will also impact the useful life of the product. Consult the factory for guidance on specific applications if required prior to installation.

Warranty

Items sold by BHGE are warranted to be free from defects in materials and workmanship for a period of one year from the date of shipment provided said items are used according to BHGE recommended usages. BHGE reserves the right to discontinue manufacture of any product or change product materials, design or specifications without notice.

This instruction manual applies to the Masoneilan 78400/18400 LincolnLog control valves, and do not apply to other valves outside of this product line.

About this Manual

- The information in this manual is subject to change without prior notice.
- The information contained in this manual, in whole or part, shall not be transcribed or copied without BHGE’s written permission.
- Please report any errors or questions about the information in this manual to your local supplier.
- These instructions are written specifically for the 78400/18400 LincolnLog control valves, and do not apply to other valves outside of this product line.

Note: Indicates important facts and conditions.

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Introduction

Scope
The following instructions are designed to guide the user through the installation and maintenance of the Masoneilan 78400/18400 Series control valves.

The Masoneilan 78400/18400 Series control valve is part of Masoneilan’s Engineered Product portfolio, and is custom designed to fit our customer’s most difficult applications. This document provides detailed installation and maintenance instructions for all sizes, ratings and trim types used in the LincolnLog product line.

Serial Plate
The serial plate is usually fixed to the side of the actuator yoke. It indicates information about the valve including size and type, pressure class rating, body/bonnet material, and serial number.

Numbering System

<table>
<thead>
<tr>
<th>Actuator Type</th>
<th>Body Series</th>
<th>Trimm Type</th>
<th>No. of Stages</th>
<th>Optional Configuration</th>
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</thead>
<tbody>
<tr>
<td>87 Spring-Diaphragm</td>
<td>1 Globe</td>
<td>4</td>
<td>3 Optional Trim</td>
<td>F Forged Body Design</td>
</tr>
<tr>
<td>88 Spring-Diaphragm</td>
<td>2 Angle</td>
<td>4</td>
<td>3 Three Trim</td>
<td>F Forged Body Design</td>
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<tr>
<td>53 Cylinder</td>
<td>3 High Resistance</td>
<td>4</td>
<td>4 Four Trim</td>
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<tr>
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<td>4 Balanced</td>
<td>4</td>
<td>6 Six Trim</td>
<td>F Forged Body Design</td>
</tr>
<tr>
<td>20 Top Mounted</td>
<td>5 Level</td>
<td>4</td>
<td>8 Eight Trim</td>
<td>F Forged Body Design</td>
</tr>
</tbody>
</table>

* Additional stages are available to meet specific operating conditions. Please consult BHGE.

After Sales Service
BHGE offers After Sales Service comprised of highly qualified technicians to support the installation operation, maintenance and repair of its Masoneilan equipment. For support contact the local BHGE representative or Masoneilan factory located closest to you.

Spare Parts
Only Masoneilan replacement parts should be used when carrying out maintenance operations. Obtain replacement parts through local BHGE representatives or Masoneilan Parts Department.

When ordering spare parts, the model and serial numbers indicated on the manufacturer’s serial plate must be given.

Actuator and Accessories
Actuators and other valve accessories have their own instruction manuals, that provide information and details on the assembly and installation. Refer to the appropriate instruction manual for each unique accessory.

Installation

CAUTION

The 78400/18400 Series valve must always be installed with the flow tending to open the valve plug. For applications where insolation of the valve body is required, do not insulate the valve bonnet.

Recommended Installation
It is recommended to install the 78400/18400 Series valves in the vertical position with the actuator extended up whenever possible. This orientation eliminates the need for additional pipe support, reduces the side load friction on the actuator, and provides ease of removal of the trim during maintenance for weld-end construction designs.

Piping Cleanliness
Before installing the valve in the line, clean piping and valve of all foreign material such as welding chips, scale, oil, grease or dirt. Gasket mating surfaces must be thoroughly cleaned to ensure leak-free joints. Sacrificial flush trim should be installed in the operational trim during the installation and line flushing phases.

WARNING

If major system or piping modifications or repairs are performed, thorough flushing and blowdown of the system will be required prior to reinstalling the LincolnLog trim. Sacrificial flushing trim should be installed in the valve to protect the integrity of the flow passages. Failure to follow this warning will violate the valve warranty agreement and could result in control instability, excessive noise levels, and valve leakage.

Isolation Bypass Valve
To allow for in-line inspection, maintenance and removal of the valve without service interruption, provide a manually operated shutoff valve on each side of the control valve and a manually operated throttling valve in the bypass line.

Heat Insulation
In case of a heat-insulated installation, do not insulate the valve bonnet and take protective measures relative to personal safety.

Hydrostatic Testing and Line Cleaning
During this operation, the control valve must not be used as an isolating valve. This means that the valve must always be open before carrying out pressure tests in the process line, cleaning of pipes, etc. Otherwise equipment damage or failure of the seal rings could result. If the valve is to remain installed during line cleaning, flushing trim MUST be installed to prevent damage to trim components.

Flow Direction
The valve must be installed so that the process fluid will flow through the valve in the direction indicated by the flow arrow located on the body.

Welded Connections

CAUTION

Carefully review the information in this section prior to welding any valves inline. Refer any additional questions to the local BHGE Sales Office or Service Center.

Pre-Weld Preparation
Carefully follow the installation steps defined in the sections noted above prior to performing weld procedures.

Welding Process
Perform welding process in accordance with the standard requirements for the materials and weld construction of the specific valve. Apply post weld heat treatment if required.

Internal valve components should be removed prior to performing welding or pre/post weld heat treatment in order to prevent damaging any soft goods (such as PTFE seals). If unable to remove the elastomeric components, then other methods must be employed to prevent the local temperature around the seals from exceeding the maximum material limits (typically 450°F / 232°C for PTFE-based materials).

Post Weld Cleaning & Assembly
Inspect the body, bonnet, and trim components for cleanliness and surface condition. Remove any foreign materials, such as weld chips, slag or scale. Make sure there are no nicks, scratches, burrs or sharp corners on sealing and sliding surfaces. Clean all gasket interface surfaces and reassemble using new gaskets to ensure sealing integrity.
Actuator Assembly
Assemble the actuator onto the control valve using the appropriate instructions for the specific actuator model and type. Connect air pressure lines to the actuator ports to meet intended operating mode (i.e., air-to-extend, air-to-retract, or double-acting).

Disassembly

CAUTION
Prior to performing any maintenance on the valve, isolate the valve and vent the process pressure.

Valve Actuation
Access to the internal components of the valve should be accomplished with the actuator removed. Follow the detailed instructions below and refer to the appropriate actuator instruction manuals.

WARNING
Actuator may be pre-loaded with tension from air pressure or springs. Prior to disconnecting instrumentation read all instructions for the specific actuator.

Disconnect Instrumentation
Disconnect all mechanical connections between the positioner and the other instruments. Disassemble the valve stem and actuator stem coupling as described in the following sections.

Air-to-Extend Actuators
For this actuator configuration, the valve plug is already in the fully retracted position without any air pressure applied. Disconnect the plug stem and actuator stem as described in the threaded connection and stem connector sections above depending on the connection type.

Actuator Removal
Disconnect all electrical and air connections to and from the actuator. Disassemble yoke nut or yoke attachment screws, and lift the actuator off of the valve being careful not to damage the bonnet threads.

Valve Disassembly
The valve must always be reassembled with new packing set and gaskets. Before disassembly, make sure the recommended spare parts are available for reassembly.

1. Disconnect the piping to the leak detector connection on the bonnet (if applicable).
2. Remove the body stud nuts (7).
   Note: For valve sizes 1” through 2”, the bonnet (23) is a one-piece construction. Valve sizes 3” and larger have a bonnet (23) with a separate bonnet flange (24). These larger sizes also use a metal seal (10) and multiple seat ring gaskets (11) at various locations.

3. For valve sizes 1” through 2” follow disassembly instructions 3-10:
   3. Disassemble the bonnet (23) and plug (20) / stem (21) subassembly from the valve body as a single unit.
   4. Remove the packing flange nuts (2), packing flange (3), and the packing follower (4).
   5. Remove the plug (20) and stem (21) subassembly from the valve bonnet (23).

Air-to-Retract Actuators
Apply sufficient air pressure to the actuator to retract the stem completely. Disconnect the plug stem from the actuator stem depending on the connection type as described below.

Threaded Connection
Unscrew the plug stem from the actuator stem, making sure the plug never contacts the seating area liner or seat ring at any time during disassembly.

Stem Connector
Remove the screws and disassemble the stem connector from the valve and actuator stems.

CAUTION
Be careful not to damage the plug (20) or liner (18) while removing the plug/stem subassembly.

6. Remove the old packing set (22) and lantern ring (17).
   Note: Applicable only for units with the optional leak detector bonnet option.

7. Remove the body gasket (10), liner (18), and seat ring (19) from the body.
   Note: Valve sizes 1” and 1.5” have integral seat rings in the liners.

8. Remove the retainer (8), seal ring, and back-up rings (9) from the liner.
   Note: The retainer, seal ring and back-up rings are only used in the balanced valve assemblies.

9. Remove the seat ring gasket (11).
   Note: 2” size valves have multiple seat ring gaskets.

10. Inspect the bonnet (23), plug (20) and stem (21) assembly, liner (18), seat ring (19), and body (25) for any visual defects or damage. Carefully inspect the dynamic sliding surfaces and the seal interface areas.

11. For valve sizes 3” and larger follow disassembly instructions 11-19:
   11. Disassemble the bonnet flange (24) and metal seal (10) from the valve.
      Note: The metal seal (10) will require some force to remove from the valve. Using a common tool, such as an open-end wrench, lever the seal up at various points to lift out evenly.

12. Remove the bonnet (23) and plug (20) / stem (21) subassembly from the valve body as a single unit.

13. Remove the packing flange nuts (21), packing flange (3), and the packing follower (4).

14. Remove the plug (20) and stem (21) subassembly from the valve bonnet (23).

15. Remove the old packing set (22) and lantern ring (17).

   Note: Applicable only for units with the optional leak detector bonnet option.

16. Remove the liner (18) and seat ring (19) from the body.

17. Remove the retainer (8), seal ring, and back-up rings (9) from the liner.

   Note: The retainer, seal ring and back-up rings are only used in the balanced valve assemblies.

18. Remove the seat ring (19) and seat ring gaskets (11).

   Note: There is also a seat ring gasket between the liner and bonnet.

19. Inspect the bonnet (23), plug (20) and stem (21) assembly, liner (18), seat ring (19), and body (25) for any visual defects or damage. Carefully inspect the dynamic sliding surfaces and the seal interface areas.

Packing Box
Packing box maintenance is one of the principal tasks during routine servicing. Tightness of the packing (22) is maintained by proper compression. Compression is achieved by evenly tightening the packing flange nuts (2) against the packing flange (3). Periodic re-tightening of the packing flange nuts may be required to maintain proper sealing.

Care must be taken not to over tighten, as this could create unnecessary friction preventing smooth valve operation. If packing leakage persists after applying maximum compression, then the packing needs to be replaced.

CAUTION
The valve must be isolated and the process pressure vented prior to performing any packing box maintenance.

Pack Replacemen
Disassembly of the valve bonnet from the body is recommended before replacing the standard PTFE V-Ring packing. Other packing types can be replaced without removal of the bonnet. Use the following procedures to replace existing packing.

1. Loosen and remove the packing flange nuts (2).

2. Remove the packing flange (3) and packing follower (4).

3. Remove the old packing set (22) and lantern ring (17).

   Note: Applicable only for units with the optional leak detector bonnet option.

4. Replace packing (22) referring to Figures 8, 9, or 10 for correct number of packing rings.

   Note: For PTFE packing, assemble new packing with the cuts in the rings located 120° apart from the adjacent ring. Press rings into the packing box one at a time.

5. Reassemble the packing follower (4) and the packing flange (3).

6. Tighten the packing flange nuts (2) without over compressing the packing rings.

7. For graphite packing, open and close the valve several times to re-tighten the packing as required.

8. Place the valve back into service and check for leakage. Tighten packing flange nuts (2) as required.

Maintenance & Repair
The purpose of this section is to provide recommended maintenance and repair procedures. These procedures assume the availability of standard shop tools and equipment.

CAUTION
Be careful not to damage the plug (20) or liner (18) while removing the plug/stem subassembly.
Parts Repair
Carefully examine parts for any scratches, unusual wear, or other visual damage prior to re-assembly.

Guiding Surfaces
Guiding surfaces shown in Figure 1, including the liner (18), valve plug (20), and plug stem (21) must be checked. If there is only slight wear indications, then use a light abrasive to smooth out the specific guiding surface areas. Parts with greater damage or wear on the guide surfaces must be replaced.

Figure 1: Plug, Liner, and Stem Guiding Surface

Seating Surfaces
The seat ring (19) (or liner (18) with integral seat), and valve plug (20) seating surfaces must be completely free of dents, scratches, wear, or other visual damage. Any seating surfaces showing signs of minor deterioration may be refurbished in accordance with the following guidelines.

Figure 2: Plug and Seat Ring Seating Surfaces

Seating Surfaces
1. Clean body gasket surface areas.
2. Place seat ring (19) onto a flat surface, noting the seating angle is up.
3. If lapping procedure is done outside of the valve body, proceed to step 4. Otherwise if lapping procedure is done inside of valve body, install a new seat ring gasket (11).

Note: Seat ring gasket (11) is temporarily placed to hold the seat ring during lapping.

It is imperative to use a new gasket or a test part having the same geometrical characteristics in order to insure the correct position of the seat ring during lapping.

This gasket (or similar part) can be kept after lapping for future-lapping use.

The gasket used for lapping must not be reused for the body reassembly.
4. Spread a fine layer of high quality lapping compound (600-grit) on the seating surface.

5. Assemble the liner (18) on top of the seat ring.

6. Place an appropriate tool on the valve stem (21) thread to allow for manual rotation. Options for creating a manual resurfacing tool include using a T-handle secured with a locknut, or using a flat piece of steel with a drilled hole and several locknuts to fasten to the valve stem (21).

7. Insert the plug (20) and stem (21) assembly into the liner (18) until the plug contacts the seat ring.

8. Lap the seat ring (19) by rotating the plug (20) in short oscillating strokes. After 8 to 10 strokes, lift the plug (20) and repeat the operation three more times at increments of 90°, 180°, and 270° from the original position.

Note: Performing the operation at various increments is critical in maintaining concentricity between the parts during lapping.

5. Drive out the plug pin (12) using a punch or by drilling it out. If drilling is required, use a drill bit that is smaller than the plug pin size. Unscrew the plug (20) from the stem (21) following complete removal of the plug pin.

Valve Plug and Stem
If the valve stem needs to be replaced, then the plug must also be changed in order to guarantee correct pinning of the assembly. However, an undamaged valve stem can be reused even if the valve plug needs to be replaced.

CAUTION
Be careful not to damage the plug guiding or seating surfaces while performing the following operations.

Plug Removal

CAUTION

In case of 440C stainless steel or other hardened materials, plug and stem assembly cannot be machined or drilled. If either the plug or stem is damaged, the parts must be purchased as a complete assembly.

Valve Reassembly
After completing the recommended maintenance and repair actions noted above, reassemble the valve using the following procedures.

Plug Stem Assembly
Reassemble the plug and stem subassembly using new replacement parts as required. Thread the valve plug (20) into the stem (21), making sure that the assembly is tight and secure. Apply torque to stem per Tables 1A and 1B.

Figure 3: Soft Seat Option

Gaskets
Gasket seating surfaces must be free of dents, scratches, corrosion, or other types of damage. Clean mating surfaces as required and replace any non-conforming parts. Spiral wound gaskets (Items 10 & 11) must always be replaced after disassembly.

Metal Seal
For valves 3” and larger:

Prior to reassembly, the metal seal (10) should be inspected for cracks or signs of wear on the coating. The metal seal can be reused if it is free from scratches, erosion, corrosion, or any other type of damage.

If the coating is not intact or slight wear exists, a new layer of coating should be re-applied to the original condition by a Masoneilan Authorized Repair Center (MARC®). Prior to reassembly of the valve, inspect the inside of the valve body around the area where the metal seal seats. It is common to find slight ridges or depressions from where the seal was previously seated. During initial assembly, these depressions aid in the sealing of the valve, however these areas can become leak paths during reassembly if the surface is not restored to its original finish.

To prevent this potential leakage, machine the seating angle of the bonnet at 40 degrees by approximately 0.1 inches (2.5 mm) deep, thus causing the seal ring to seat further inside the valve body (n a new undeformed surface). Refer to Figure 4 for details.

9. Lapping can be repeated, but should be limited as much as possible so that the seat remains sufficiently narrow to guarantee tightness.

10. After lapping, disassemble the parts to clean them and thenreassemble, making sure the seating angles are within tolerance. See Figure 2.

Soft Seat Repair
The soft seat assemblies include swaged retainers and can not be repaired in the field. These should be returned to the local Masoneilan service center for replacement or maintenance of the PTFE “reservoir”.

Figure 4: Bonnet Seating Angle Details (see page 16)

Metal Sliding Collar
Filled PTFE “Reservoir”
Seat Ring
Metal Sliding Collar

Note: Performing the operation at various increments is critical in maintaining concentricity between the parts during lapping.
Valve Reassembly
Make sure the valve body and all gasket surfaces are clean and free of any damage.

**CAUTION**

Make sure any recommended lubricants or sealing compounds are compatible with the process fluid. Use acceptable substitutes as required.

**Valve Sizes 1” and 1-1/2”**

1. Assemble the seat ring gasket (11) into the valve body (25).
2. Assemble the liner (18) into the valve body (25) making sure that it aligns correctly on top of the seat ring gasket (11).
3. Assemble the plug (20) and stem (21) subassembly into the liner (18).
4. For the balanced trim design configuration (available in 1.5” size only), lubricate the seal ring and both back-up rings (9) and carefully assemble it over the plug (20). Make sure the lower back-up ring right angle corner is facing the extrusion gap between the liner and plug (see Figures 6A and 6B) and the open end of the seal faces upward or away from the seat. Use the seal retainer (step 5) to push the balance seal and back-up rings fully into the liner.
5. Install the seal retainer (8) into the liner (18). For the balanced configuration, use the seal retainer to push the seal ring and back-up rings fully into the liner.
6. Install the body gasket (10) and assemble the bonnet (23) onto the body (25). Be careful not to damage the stem (21) while installing the bonnet.

**Valve Sizes 2” to 8”**

1. Assemble one seat ring gasket (11) into the valve body (25).
2. Assemble the other seat ring gasket (11) onto the seat ring (19). **Note:** Make sure the seat ring gasket (11) is assembled onto the side of the seat ring (19), which mates with the liner (18). The correct side of the seat ring has the seating surface and a longer boss for alignment with the liner.
3. Assemble the seal ring (19) into the valve body (25) making sure that it aligns correctly on top of the seat ring gasket (11) located in the body.
4. Assemble the liner (18) into the valve body (25) making sure it aligns correctly on top of the seat ring (19) and seat ring gasket (11).
5. Assemble the plug (20) and stem (21) subassembly into the liner (18).
6. For the balanced trim design configuration, lubricate the seal ring and both back-up rings (9) and carefully assemble it over the plug (20). Make sure the lower back-up ring right angle corner is facing the extrusion gap between the liner and plug (see Figures 6A and 6B) and the open end of the seal faces upward or away from the seat. Use the seal retainer (step 7) to push the balance seal and back-up rings fully into the liner.
7. Install the seal retainer (8) into the liner (18). For the balanced configuration, use the seal retainer to push the seal ring and back-up rings (9) fully into the liner (18).

**Assembly Alignment**

Check the run out of the plug and stem to ensure they are within .005” (0.13mm) TIR. Use a plastic or rubber mallet to tap the parts into alignment if the assembly is out of tolerance.

**Drill a hole for the groove pin per dimension ‘X’ in Table 1. Place the plug and stem assembly on a V-block and drill into the plug and stem. Apply a small amount of grease on the replacement pin and press fit into the hole. See Figure 5 for details.**

**Note:** Make sure the pin is recessed by approximately .06” (1.5mm) below the stem surface on both ends.

**Figure 5: Groove Pin Details**

**Table 1A: Stem Assembly**

<table>
<thead>
<tr>
<th>Stem Size</th>
<th>Torque</th>
<th>Corner Angle</th>
<th>Dimension A</th>
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<tr>
<td>inches</td>
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<td>ft-lbs</td>
<td>daNm</td>
</tr>
<tr>
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<td>mm</td>
<td>inches</td>
<td>mm</td>
</tr>
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**Stem Size**

<table>
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<tr>
<th>Material</th>
<th>Bolting Requirements</th>
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<tbody>
<tr>
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<td></td>
</tr>
<tr>
<td>All Materials (Except 440C)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Valve Sizes 2” to 8”</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &amp; 1.5 25 &amp; 40 750-10 unc</td>
</tr>
<tr>
<td>2 50 1.125-Run</td>
</tr>
<tr>
<td>3 80 1.000-Run</td>
</tr>
<tr>
<td>4 100 1.250-Run</td>
</tr>
<tr>
<td>6 150 1.375-Run</td>
</tr>
<tr>
<td>8 200 1.875-Run</td>
</tr>
</tbody>
</table>

**Figure 6A: Incorrect Seal Ring Installation showing lower back-up ring 90° angle facing away from extrusion gap**

**Figure 6B: Correct Seal Ring Installation showing lower back-up ring 90° angle facing the extrusion gap**

**Table 2: Body Bolting Torque Requirements**

<table>
<thead>
<tr>
<th>Valve Size</th>
<th>Bolting Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &amp; 1.5 25 &amp; 40 750-10 unc</td>
<td>8</td>
</tr>
<tr>
<td>2 50 1.125-Run</td>
<td>8</td>
</tr>
<tr>
<td>3 80 1.000-Run</td>
<td>8</td>
</tr>
<tr>
<td>4 100 1.250-Run</td>
<td>8</td>
</tr>
<tr>
<td>6 150 1.375-Run</td>
<td>12</td>
</tr>
<tr>
<td>8 200 1.875-Run</td>
<td>12</td>
</tr>
</tbody>
</table>

**Note:** Tighten the body nuts (7) in the following increments (units of ft-lbs (daNm)): 10 (1.3), 20 (2.6), 40 (5), 75 (10), 140 (19), 225 (30), 400 (54), 650 (88), plus increments of 250 (34) until the required torque is reached. Between each pass check to make sure plug assembly strokes freely to ensure proper alignment.
Visually inspect the assembly for proper stud and nut installation by checking the number of exposed threads. If less than one stud thread or more than 2-1/2 threads are extended above the body nut after final tightening, then double check the assembly for proper installation and alignment.

### Packing Box Assembly

Visually inspect the stem and packing box for cleanliness and proper surface finish. Lubricate the I.D. of the packing box with Never-Seez or equivalent. Assemble the packing box components per the maintenance instructions on page 5.

#### Low Emissions LE* Packing (Optional)

The Masoneilan LE (Low Emissions) Packing is a high performance packing system capable of containing fugitive emissions well below the specifications of the most severe recommendations. It is also available in a fire-safe configuration.

#### CAUTION

Packing box should be clean and free of burrs, rust, and any foreign matter. Parts can be cleaned with denatured alcohol.

- **Note:** Packing box finish should be 125 AARH (Ra 0.8) or better.
- **Note:** Packing box finish should be 125 AARH (Ra 0.8).
- **Note:** Packing box may be bored or honed up to 0.890" (22.60 mm) above the finish. For instance, a nominal 0.875" (22.22 mm) packing box may be bored or honed up to 0.890" (22.60 mm) and the LE Packing will still seal properly.

#### Installation

- **Preparation**
  - Stem: Inspect stem for any nicks or scratches on the surface finish. Reject the stem for any of these reasons as they may damage packing.
- **Packing Box**
  - Note: Biornets that have a lube hole require installation of a lantern ring within the packing arrangement shown in Figure 12.
- **Packing Installation**
  - 1. The packing should be lubricated with Krytox® fluorinated grease prior to installation (Krytox GPL206 or equivalent).
  - 2. Packing should be lubricated as a set (not individually) to minimize getting lubricant between the rings.
  - 3. Packing should be lubricated with a generous application to the O.D. and I.D. of the packing set.

### Packing

Inspect packing rings. DO NOT use packing if any nicks or scratches on packing are observed. Check packing and ensure that it is in the proper arrangement (see Figure 13). PTFE material can be identified by the glass black molded finish. PTFE material has a dull black machined finish. PTFE material can be identified by the gloss black molded finish.

<table>
<thead>
<tr>
<th>Packing Set</th>
<th>Follower Assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part Qty</td>
<td>Part Qty</td>
</tr>
<tr>
<td>VESPEL Female Adapter</td>
<td>Upper Follower</td>
</tr>
<tr>
<td>KALREZ V-Ring</td>
<td>Disc Spring</td>
</tr>
<tr>
<td>VESPEL V-Ring</td>
<td>Lower Follower</td>
</tr>
<tr>
<td>VESPEL Male Adapter</td>
<td>1</td>
</tr>
</tbody>
</table>

### Spring Loaded Follower

The spring loaded follower (lavallable for applications rated ANSI 300 and below) consists of an upper and lower follower and eight (8) disc springs (see Figure 14). The springs are installed inside the lower follower and positioned alternately. The assembly is held together by tape, which must be removed before installation.

### Packing Box Assembly

Figure 8: Standard Packing

1 V-Ring Packing Adapter
7 pieces V-Ring Packing

Figure 9: 285C or Latty 326.1M Packing
6 pieces 285C
6 pieces Latty 326.1

Figure 10: Graphite Packing
F: 3 pieces Filament Graphite
G: 3 pieces Graphite Ring
Z: 3 pieces Zinc Washer

Low Emissions LE* Packing (Optional)

The Masoneilan LE (Low Emissions) Packing is a high performance packing system capable of containing fugitive emissions well below the specifications of the most severe recommendations. It is also available in a fire-safe configuration.

The packing is provided as a set of five pieces. It consists of two adapter rings and three V-rings. An alternating pattern of Perfluoroelastomer (PFE) and long carbon fiber filled PTFE V-rings are used.

Applied properly, this packing exhibits very little cold flow or creep. Consequently, it can effectively prevent fugitive emissions leaks from a control valve. The LE Packing system can directly replace conventional packing, requiring no modification to the control valve or actuator.

A spring loaded, two-piece follower assembly is used to maintain a constant load on the packing, and is necessary for thermal cycling applications. As the definition of thermal cycling can vary, and processes are potentially subject to unpredicted thermal gradients, LE Packing is only available with the spring loaded follower.

Spring Loaded Follower

The spring loaded follower is installable for applications rated ANSI 300 and below consists of an upper and lower follower and eight (8) disc springs (see Figure 14). The springs are installed inside the lower follower and positioned alternately. The assembly is held together by tape, which must be removed before installation.

1. The packing must be lubricated with Krytox® fluorinated grease prior to installation (Krytox GPL206 or equivalent).
2. Packing should be lubricated as a set (not individually) to minimize getting lubricant between the rings.
3. Packing should be lubricated with a generous application to the O.D. and I.D. of the packing set.
4. PFE/PTFE is to be installed as a set. Carefully slide the packing set down the stem. Do not cock or force the packing on the threads.
5. If the packing set separates while on the stem, do not remove. Continue installing the remaining pieces to put the set back together.
6. Gently press the packing into the packing box. Do not tap the packing down into the box.
7. The spring loaded follower is installed on top of the packing. This follower is installed as an assembly held together by tape. This tape should be removed after assembly. Proper assembly of the packing box will leave the top of the Lower Follower 0.25 - 0.50 inches (6 to 13 mm) above the bottom.
8. A groove is scribed into the O.D. of the upper follower. The packing flange is tightened evenly until the top of the Lower Follower aligns with the scribe mark (groove) in the Upper Follower.

**Note:** This is the optimum loading for this packing. Further tightening will shorten life of the packing. Thread locking compound can be used on packing nuts.

6. The packing should be checked for leakage.
7. Packing load should be checked after the valve has cycled approximately 500 times. Adjust if necessary. No further adjustment should be required for the life of the packing.
Valve Travel Requirements
See table below for rated travel by specific valve size.

<table>
<thead>
<tr>
<th>Valve Size</th>
<th>Travel</th>
</tr>
</thead>
<tbody>
<tr>
<td>inches</td>
<td>DN</td>
</tr>
<tr>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>1.5</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>80</td>
</tr>
<tr>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>6</td>
<td>150</td>
</tr>
<tr>
<td>8</td>
<td>200</td>
</tr>
</tbody>
</table>

Table 3: Valve Travel

Note: Actuator over travel of 0.12" (3 mm) past the rated travel noted above is necessary to achieve required seat loading.

Parts References
Valve Sizes 2 Inch and Smaller

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Packing Stud</td>
</tr>
<tr>
<td>2</td>
<td>Packing Flange Nut</td>
</tr>
<tr>
<td>3</td>
<td>Packing Flange</td>
</tr>
<tr>
<td>4</td>
<td>Packing Follower</td>
</tr>
<tr>
<td>5</td>
<td>Yoke Nut</td>
</tr>
<tr>
<td>6</td>
<td>Body Stud</td>
</tr>
<tr>
<td>7</td>
<td>Body Nut</td>
</tr>
<tr>
<td>8</td>
<td>Retainer</td>
</tr>
<tr>
<td>9</td>
<td>Seal Ring and Back-up Rings</td>
</tr>
<tr>
<td>10</td>
<td>Metal Seal</td>
</tr>
<tr>
<td>11</td>
<td>Seat Ring Gasket</td>
</tr>
<tr>
<td>17</td>
<td>Lantern Ring if Applicable</td>
</tr>
<tr>
<td>18</td>
<td>Liner</td>
</tr>
<tr>
<td>19</td>
<td>Seat Ring</td>
</tr>
<tr>
<td>20</td>
<td>Plug</td>
</tr>
<tr>
<td>21</td>
<td>Stem</td>
</tr>
<tr>
<td>22</td>
<td>Packing S/A</td>
</tr>
<tr>
<td>23</td>
<td>Bonnet</td>
</tr>
<tr>
<td>24</td>
<td>Bonnet Flange</td>
</tr>
<tr>
<td>25</td>
<td>Body</td>
</tr>
</tbody>
</table>

Valve Sizes 3 Inch and Larger

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Packing Stud</td>
</tr>
<tr>
<td>2</td>
<td>Packing Flange Nut</td>
</tr>
<tr>
<td>3</td>
<td>Packing Flange</td>
</tr>
<tr>
<td>4</td>
<td>Packing Follower</td>
</tr>
<tr>
<td>5</td>
<td>Yoke Nut</td>
</tr>
<tr>
<td>6</td>
<td>Body Stud</td>
</tr>
<tr>
<td>7</td>
<td>Body Nut</td>
</tr>
<tr>
<td>8</td>
<td>Retainer</td>
</tr>
<tr>
<td>9</td>
<td>Seal Ring and Back-up Rings</td>
</tr>
<tr>
<td>10</td>
<td>Metal Seal</td>
</tr>
<tr>
<td>11</td>
<td>Seat Ring Gasket</td>
</tr>
<tr>
<td>17</td>
<td>Lantern Ring if Applicable</td>
</tr>
<tr>
<td>18</td>
<td>Liner</td>
</tr>
<tr>
<td>19</td>
<td>Seat Ring</td>
</tr>
<tr>
<td>20</td>
<td>Plug</td>
</tr>
<tr>
<td>21</td>
<td>Stem</td>
</tr>
<tr>
<td>22</td>
<td>Packing S/A</td>
</tr>
<tr>
<td>23</td>
<td>Bonnet</td>
</tr>
<tr>
<td>24</td>
<td>Bonnet Flange</td>
</tr>
<tr>
<td>25</td>
<td>Body</td>
</tr>
</tbody>
</table>

• Recommended Spare Parts

Table 4: Valve Parts List

Figure 15 - 1" Size Unbalanced Assembly
**Correct Seal Ring Installation**

Showing lower back-up ring 90° angle facing the extrusion gap.

---

**Figure 16 - 1.5” Size Balanced Assembly**

- Correct Seal Ring Installation
- Showing lower back-up ring 90° angle facing the extrusion gap

---

**Figure 17 - 2” Size Balanced Assembly**

- Correct Seal Ring Installation
- Showing lower back-up ring 90° angle facing the extrusion gap

---

**Soft Seat Option**

- Filled PTFE "Reservoir"
- Seat Ring
- Metal Sliding Collar
**Actuation**

![Diagram of Actuation](image)

**Correct Seal Ring Installation**

- Showing lower back-up ring 90° angle facing the extrusion gap

**Figure 18 - 3” to 8” Size Balanced Assembly**

- Soft Seat Option
- Metal Sliding Collar
- Filled PTFE “Reservoir”

**Table 5: Type 88, Air to Open - Valve Seating**

<table>
<thead>
<tr>
<th>Plug Stem Diameter</th>
<th>N1 (turn)</th>
<th>in</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4”</td>
<td>0.75</td>
<td>0.03</td>
<td>0.8</td>
</tr>
<tr>
<td>1”</td>
<td>0.9</td>
<td>0.06</td>
<td>1.5</td>
</tr>
</tbody>
</table>

**Type 87/88 Multi-Spring Diaphragm Actuators**

**Connecting Type 87 (Air to Close) No. 6 Actuator**

(Refer to schematic page 18)

1. Tightly assemble the hex nuts (1) onto the plug stem.
2. Push down the actuator, and screw on the yoke nut (3) at the same time. Then assemble the bottom stem connector (2). As soon as it becomes possible, insert the valve stem into the actuator stem (10). The stem must be inserted far enough so that when there is no air in the actuator, the valve plug does not touch the seat.
3. Tighten the yoke nut (33).
4. Supply air to the actuator at the final pressure.
5. Use the pointer (7) to set the travel scale (9) to the valve open position.
6. Supply the actuator with air at a sufficiently high pressure to obtain a travel equal to the nominal travel of the valve as specified in Table 5.
7. Unscrew the plug stem until the valve plug is in contact with the seat. Do not turn the valve plug on the seat as this could damage the sealing surfaces.
8. Screw the hex nuts (1) as far as they will go and check that operation is correct.

**Connecting Type 88 (Air to Open) No. 6 Actuator**

(Refer to schematic page 19)

1. Tightly assemble the hex nuts (1) onto the plug stem.
2. Push down the actuator, and screw on the yoke nut (33) at the same time. Then assemble the bottom stem connector (2). As soon as it becomes possible, insert the valve stem into the actuator stem (10). The stem must be inserted far enough so that when there is no air in the actuator, the valve plug does not touch the seat.
3. Tighten the yoke nut (33).
4. Unscrew the valve plug until the valve plug is in contact with the seat. Do not turn the valve plug on the seat as this could damage the sealing surfaces.
5. Supply air to the actuator until the stem has travelled at least 0.40 inches (10 mm).
6. Unscrew the plug stem by the number of turns N1 specified in Table 5.
7. Screw the hex nuts (1) as far as they will go and check that operation is correct.
8. Use the pointer (7) to set the travel scale (9) to the valve closed position.

**Note:** All 1” and 1.5” LincolnLog valves equipped with Type 88 actuators shall have up travel stops installed in order to control overtravel. To set the travel stop, position limit stop (88) so that travel is not limited. Apply sufficient air pressure to locate the stem at the specified limit. Turn limit stop (88) until contact is made and lock it in place with the jam nut (82).

**Connecting Type 87 (Air to Close) No. 10, 16 and 23 Actuators**

(Refer to schematic page 18)

1. Tightly assemble hex nut (1) onto the plug stem.
2. Screw the top stem connector (4) assembly tightly onto the actuator stem (10).
3. Push down the actuator, and screw on the yoke nut (33) at the same time. Then assemble the bottom stem connector (2) assembly by screwing until it comes into contact with the hex nut (1).
4. Push down the actuator and tighten the yoke nut (33).
5. Supply the actuator with air at the initial pressure indicated on the spring scale.
6. Position the stem connector assembly at distance “X” indicated in Table 6.
7. Use the pointer (7) to set the travel scale (9) to the valve open position.
8. Supply the actuator with air at a high enough pressure to obtain a travel equal to the nominal travel of the valve.
9. With the plug correctly positioned on the seat, unscrew the bottom stem connector (2) assembly until it comes into contact with the top stem connector (4). Tighten the socket head cap screws (5), hex nut (1) and lock nut (32) and check that the operation is correct.

**Connecting Type 88 (Air to Open) No. 10, 16 and 23 Actuator**

(Refer to schematic page 19)

1. Supply the actuator with air to retract stem.
2. Unscrew the top stem connector (4) in accordance with dimension “X” in Table 6.
3. Tightly assembly hex nut (1) onto the plug stem.
4. Tightly screw the top stem connector (4) assembly onto the actuator stem (10).
5. Push down the actuator, and screw on the yoke nut (33) at the same time. Then assemble the bottom stem connector (2) assembly by screwing until it comes into contact with the hex nut (1).
6. Push down the actuator and tighten the yoke nut (33). With the plug correctly positioned on the seat, unscrew the bottom stem connector (2) assembly to bring it into contact with the top stem connector (4).
7. Supply air to the actuator until the stem has travelled at least 0.40 inches (10 mm).
8. Unscrew the top stem connector (4) by the number of turns N1 specified in Table 5 then lock manually with lock nut (32).
10. Release the pressure in the actuator. Use pointer (7) to set the travel scale (9) to the actuator supply pressure so that the two stem connectors come into contact. Then tighten the socket head cap screws (5), hex nut (1), and lock nut (32).

11. Shut off the closed valve pressure and check that operation is correct.

Note: All 2” and 1.5” LincolnLog valves equipped with type 88 actuators shall have up travel stops installed in order to control overtravel. To set the travel stop, position limit stop (86) so that travel is not limited. Apply sufficient air pressure to locate the stem at the specified limit. Turn limit stop (86) until contact is made and lock it in place with the jam nut (82).

<table>
<thead>
<tr>
<th>Actuator Size</th>
<th>Travel</th>
<th>&quot;X&quot;Actuator 87</th>
<th>&quot;X&quot;Actuator 88</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>in mm</td>
<td>in mm</td>
</tr>
<tr>
<td>10</td>
<td>0.250</td>
<td>6.35</td>
<td>5.12</td>
</tr>
<tr>
<td>10</td>
<td>0.375</td>
<td>9.53</td>
<td>8.00</td>
</tr>
<tr>
<td>16</td>
<td>0.625</td>
<td>15.88</td>
<td>8.50</td>
</tr>
<tr>
<td>16</td>
<td>0.750</td>
<td>19.05</td>
<td>8.62</td>
</tr>
<tr>
<td>23</td>
<td>1.000</td>
<td>25.40</td>
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<td>7.02</td>
<td>178.3</td>
<td>231.6</td>
</tr>
</tbody>
</table>

Table 6: Position of Top Stem Connector

Parts Reference Table – 87/88 Actuators

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Description</th>
<th>Ref. No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hex Nut</td>
<td>10</td>
<td>Actuator stem</td>
</tr>
<tr>
<td>2</td>
<td>Stem Connector, bottom</td>
<td>31</td>
<td>Yoke, machining</td>
</tr>
<tr>
<td>3</td>
<td>Cap Screw, Hex head</td>
<td>33</td>
<td>Yoke Nut</td>
</tr>
<tr>
<td>4</td>
<td>Stem Connector, top</td>
<td>34</td>
<td>Yoke Nut</td>
</tr>
<tr>
<td>5</td>
<td>Cap Screw, socket head</td>
<td>35</td>
<td>Travel Stop</td>
</tr>
<tr>
<td>6</td>
<td>Connector insert</td>
<td>36</td>
<td>Upper Diaphragm Case</td>
</tr>
<tr>
<td>7</td>
<td>Pointer</td>
<td>80</td>
<td>Stopper</td>
</tr>
<tr>
<td>8</td>
<td>Screw, Pan head</td>
<td>82</td>
<td>Jam Nut</td>
</tr>
<tr>
<td>9</td>
<td>Scale - Travel</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Not provided for Size 8 Actuator
Type 51/52/53 Cylinder Actuators

Connecting Double Acting (Model 51)

1. Install actuator on the valve body with drive nut.
2. Connect manual loading panel tubing to the top plate (17).
3. Apply required air pressure through the manual loading panel to completely extend the actuator stem.
4. Reconnect manual loading panel tubing from the top plate (17) to the yoke (1).
5. Retract the actuator stem either pneumatically or with a handwheel approximately .1" (2mm) using the visual stroke scale.
6. Assemble the Split Clamp (22).

Note: If the split clamp does not engage with both stems, then retract the actuator stem until alignment and engagement is achieved.

Connecting Air to Extend (Model 52)

1. Install actuator on the valve body with drive nut.
2. Connect manual loading panel tubing to the top plate (17).
3. Apply required air pressure through the manual loading panel to completely extend the actuator stem.
4. Extend the actuator stem either pneumatically or with a handwheel approximately .1" (2mm) using the visual stroke scale.
5. Assemble the Split Clamp (22).

Note: If the split clamp does not engage with both stems, then extend the actuator stem until alignment and engagement is achieved.

Connecting Air to Retract (Model 53)

1. Install actuator on the valve body with drive nut.
2. Connect manual loading panel tubing to the yoke (1).
3. Retract the actuator stem either pneumatically or with a handwheel approximately .1" (2mm) using the visual stroke scale.
4. Assemble the Split Clamp (22).

Note: If the split clamp does not engage with both stems, retract the actuator stem until alignment and engagement is achieved.

Make sure the valve is fully extended.

7. Assemble and tighten Indicator Arm (23), Spring Lock Washers (25), and Hexagon Bolts (24).
8. Line up the indicator plate (26), with Indicator arm (23) and check actuator for proper operation.

CAUTION

Make sure the valve is fully extended.

Connecting Air to Extend (Model 52)

1. Install actuator on the valve body with drive nut.
2. Connect manual loading panel tubing to the top plate (17).
3. Apply required air pressure through the manual loading panel to completely extend the actuator stem.
4. Extend the actuator stem either pneumatically or with a handwheel approximately .1" (2mm) using the visual stroke scale.
5. Assemble the Split Clamp (22).

Note: If the split clamp does not engage with both stems, then extend the actuator stem until alignment and engagement is achieved.

Make sure the valve is fully extended.

7. Assemble and tighten Indicator Arm (23), Spring Lock Washers (25), and Hexagon Bolts (24).
8. Line up the indicator plate (26), with Indicator arm (23) and check actuator for proper operation.

CAUTION

Make sure the valve is fully extended.

Connecting Air to Retract (Model 53)

1. Install actuator on the valve body with drive nut.
2. Connect manual loading panel tubing to the yoke (1).
3. Retract the actuator stem either pneumatically or with a handwheel approximately .1" (2mm) using the visual stroke scale.
4. Assemble the Split Clamp (22).

Note: If the split clamp does not engage with both stems, retract the actuator stem until alignment and engagement is achieved.

Make sure the valve is fully retracted.

5. Assemble and tighten Indicator Arm (23), Spring Lock Washers (25), and Hexagon Bolts (24).
6. Line up the indicator plate (26), with Indicator arm (23) and check actuator for proper operation.
Model 51 Double Acting
Without handwheel without volume chamber

Model 51 Double Acting
Without handwheel with volume chamber

Model 52
Air to Extend with Handwheel

Model 52
Air to Extend without Handwheel
Model S3
Air to Retract with Handwheel

Model S3
Air to Retract without Handwheel

CM and DM Handwheel
Typical for Actuators Models 51/52/53
## Parts Reference Table – 51/52/53 Actuators

<table>
<thead>
<tr>
<th>Ref No</th>
<th>Description</th>
<th>Ref No</th>
<th>Description</th>
<th>Ref No</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yoke</td>
<td>24</td>
<td>Hexagon bolt</td>
<td>47</td>
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<td>Spring</td>
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<td>27</td>
<td>Cross recessed head screw</td>
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<td>Hexagon socket head cap screw</td>
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<td>28</td>
<td>Exhaust pipe</td>
<td>51</td>
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<td>52</td>
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<td>Spacer tube</td>
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<td>Guide bushing</td>
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<td>54</td>
<td>Adapter</td>
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<td>Guide bushing</td>
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<td>Set screw</td>
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<td>Upper spring button</td>
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<td>O ring (Piston rod)</td>
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<td>Rod scraper</td>
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<td>Bearing</td>
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<td>Spring lock washer</td>
<td>59</td>
<td>Handwheel shaft</td>
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<td>14</td>
<td>Cylinder tube</td>
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<td>Gear box</td>
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<td>Cylinder tube</td>
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<td>Gear box cover S/A</td>
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<td>*39</td>
<td>O ring</td>
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<td>Top plate</td>
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<td>Thrust bearing</td>
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<td>41</td>
<td>Adjustment screw</td>
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<td>Grip</td>
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<td>Center bolt</td>
<td>42</td>
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<td>Adjustment nut</td>
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<td>Self locking nut</td>
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<td>O ring (Piston, Top plate)</td>
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<td>Piston rod engagement</td>
<td>67</td>
<td>Operating information plate</td>
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<tr>
<td>22</td>
<td>Split clamp</td>
<td>*45</td>
<td>Bearing</td>
<td>68</td>
<td>Drive screw</td>
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<tr>
<td>23</td>
<td>Indicator arm</td>
<td>46</td>
<td>Retaining pin</td>
<td>69</td>
<td>Separator plate (Model 51)</td>
</tr>
</tbody>
</table>

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