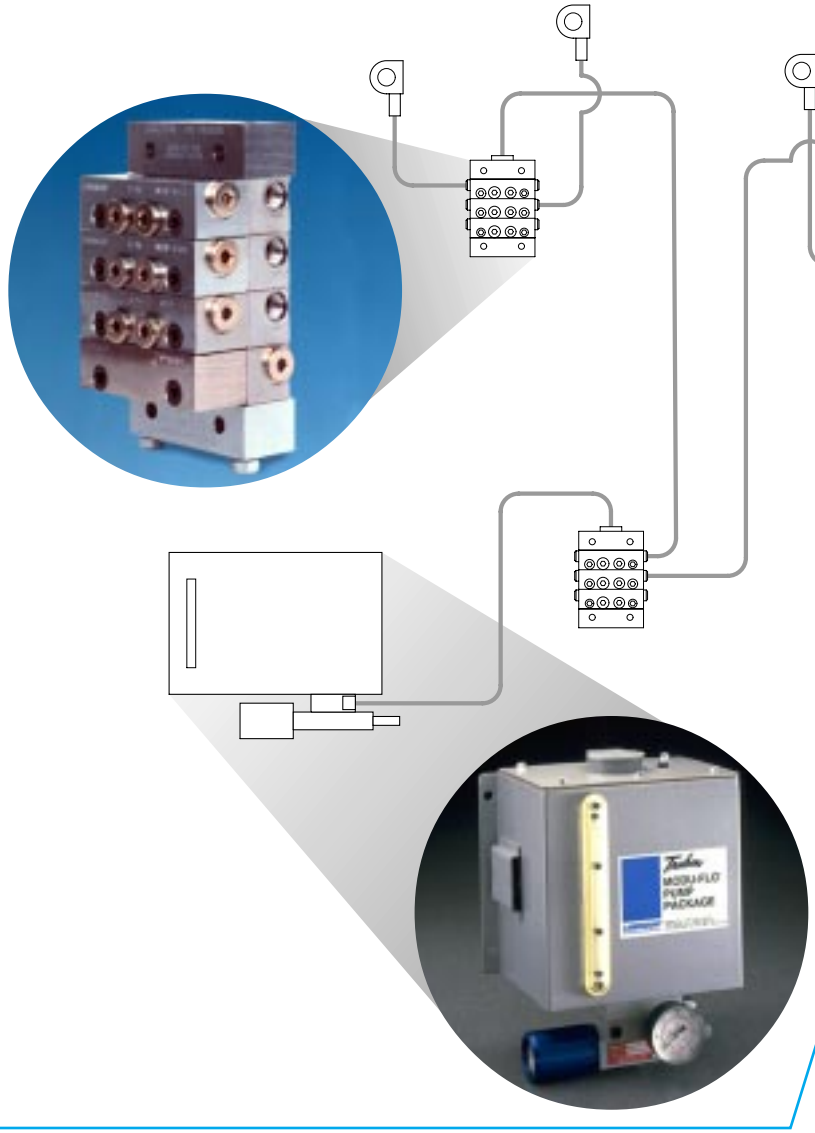
LUBRIQUIP®
Centralized Lubrication Systems

Series Progressive Lubrication Systems Installation Guide

Bulletin 40000



- COMPONENT INSTALLATION
- TUBING AND PIPE CLEANING
- SYSTEM LUBRICANT PREFILLING

40000

Revised May 1996

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1.0 INTRODUCTION

When installing a Series-Progressive lubrication system, the installer must have a copy of the lubrication schematic diagram that was developed when the system was designed. The schematic diagram illustrates the approximate layout of the components, their relationship to each other, and is the authoritative and guiding document to be followed and referred to during the installation process. It should include specifications for the lengths and diameters of the tubing, pipes, and hoses that were calculated into the overall system design, as well as the types and styles of the fittings to be used for the hydraulic connections. This Installation Guide segment addresses lubrication system installations in general terms with recommendations specific to Series-Progressive centralized lubrication systems where applicable.

Depending upon the individual application requirements, some system components are assembled at the factory prior to shipment while others require assembly at the installation site during the installation process. For instance, a series-progressive system divider valve may be shipped fully assembled and ready for assembly whereas some peripheral accessories, such as limit switches, performance indicators, proximity switches, etc., may be packed separately to reduce risk of damage during shipment. Refer to the lubrication schematic to determine the location of each component and accessory. For those components and accessories that are shipped unassembled, refer to the literature that accompanies each of them for specific instructions regarding their assembly and installation.

System installation procedures for specific components utilized in a series-progressive lubrication system are detailed in the following paragraphs in this Installation Guide:

- General Installation Guidelines (para 2.0)
- Mounting the Pump (para 3.0)
- Mounting Divider Valves (para 4.0)
- Installing Check Valves (para 5.0)
- Installing Tubing, Pipes, and Hoses (para 6.0)
- Cleaning Tubing and Pipes (para 7.0)
- Lubricant Filtration Requirements (para 8.0)
- Prefilling the System with Lubricant (para 9.0)

Whenever possible, these guidelines and recommendations should be followed during installation of the Series-Progressive lubrication system by the machine manufacturer or any other installer. This will enable the final customer or user to conveniently monitor and maintain the system integrity and trouble-free operation efficiently and economically.

2.0 GENERAL INSTALLATION GUIDELINES

The positioning and orientation of components relative to each other is essential to ensure the correct function and operation of any centralized lubrication system. Even if the proper components have been selected, improper positioning may make it more difficult to purge air out of the total system when air-bleeding procedures are performed. Any trapped air left in the lines or components of the lubrication system will impede and degrade performance and response time capabilities.

The basic rules to be followed for proper component placement are:

1. Place the pump at the lowest point in the system.

2. In smaller systems with only one or two lubrication zones, position the master divider valve at the same level as the pump, or slightly higher.

3. Place the master divider valve as close to the pump or header line as possible.

4. Place the secondary divider valves above the master divider valve(s), but below the majority of lubrication points. Ideally, all of the secondary divider valves should be located above all of the master divider valve(s), but below all of the lubrication points.

5. In larger systems with multiple lubrication zones, a header line may be used. In this case, the header should be configured to rise up-ward from the pump connection with a continuous positive slope. Also, a convenient means of purging air out of the line, such as a T-connector with a check valve and plug, should be installed at the highest point of the header line, i.e., at the end point furthest from the pump. See Figure 1.

6. If lubrication points are located on a portion of the equipment that is moving, the divider valves should be located to minimize the number of connecting hoses that are required to be moving and flexing. See Figure 2.

7. Keep the lengths of installed tubing, pipes, and hoses as short as possible in order to minimize the total line volume/capacitance. Large line volumes increase the time necessary to build up to system operating pressure when the pump is activated, resulting in a slower system response time. The system response time delay may cause lube system fault indications when the allotted time to achieve lubrication of all lube points (Monitor Time) is exceeded. Therefore, designing and installing the system overall configuration to minimize the total line lengths and size is very important in optimizing the system performance capabilities and minimizing response time.

See Figures 1 and 2 for examples and diagrams of these general system configuration guidelines.
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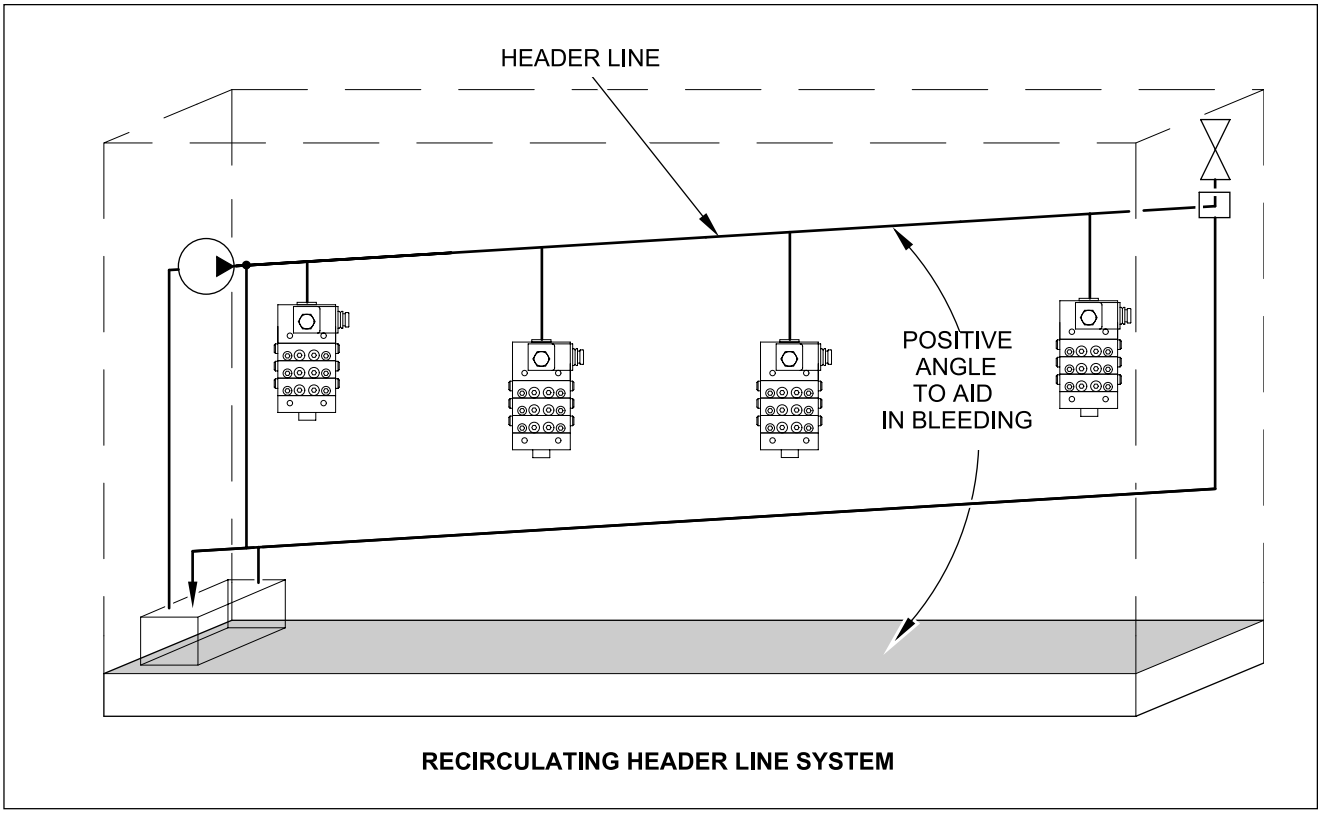


Figure 1

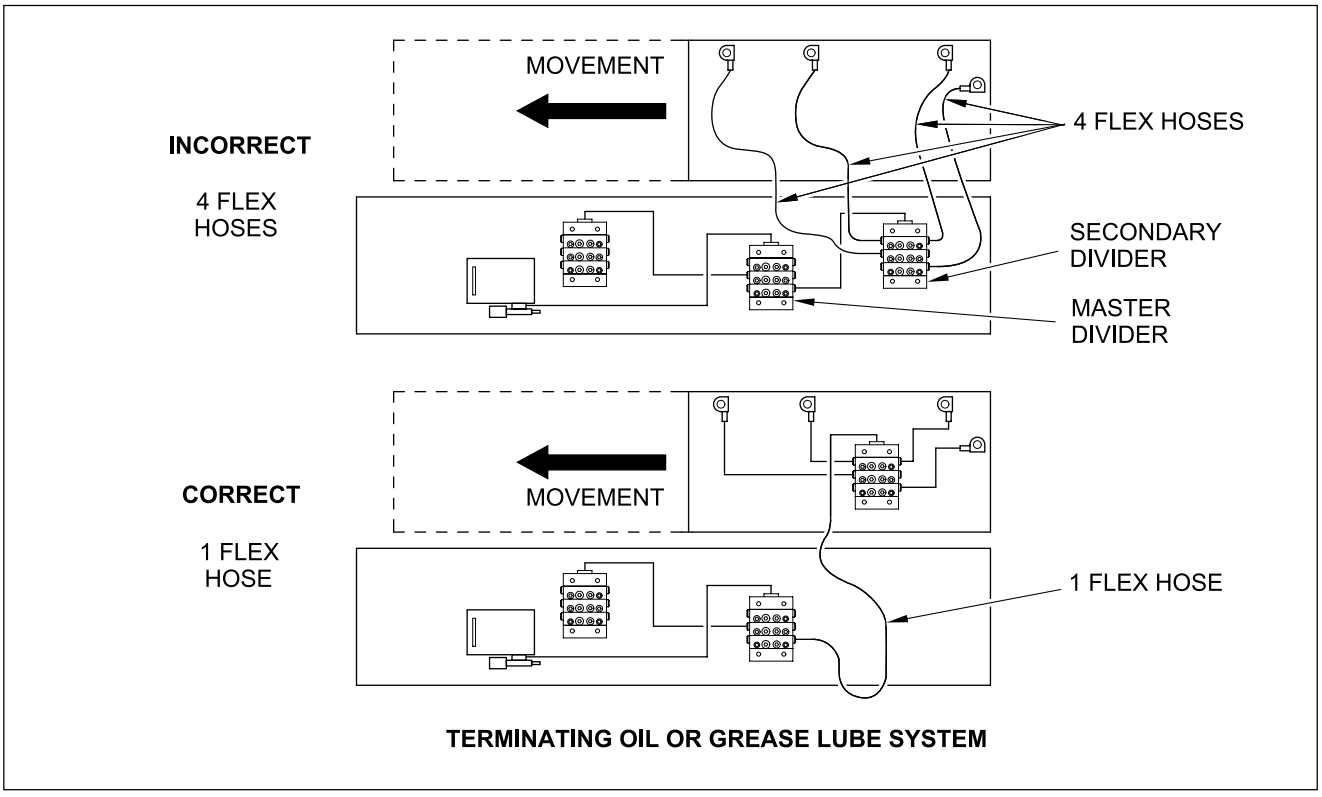


Figure 2

3.0 MOUNTING THE PUMP

All pump and reservoir package combinations incorporate a method for attaching them to a suitable mounting surface. The pump should be located such as to make it the lowest component in the lubrication system. Considerations for placement of the pump include:

- Mount the pump/reservoir package in a location that allows the reservoir to be easily accessible for observation of its lubricant level and for easy refilling.
- Locate the pump and reservoir in an area that is not subjected to heavy traffic and/or heavy debris or by-products from the machine it is located on (see Figure 3).

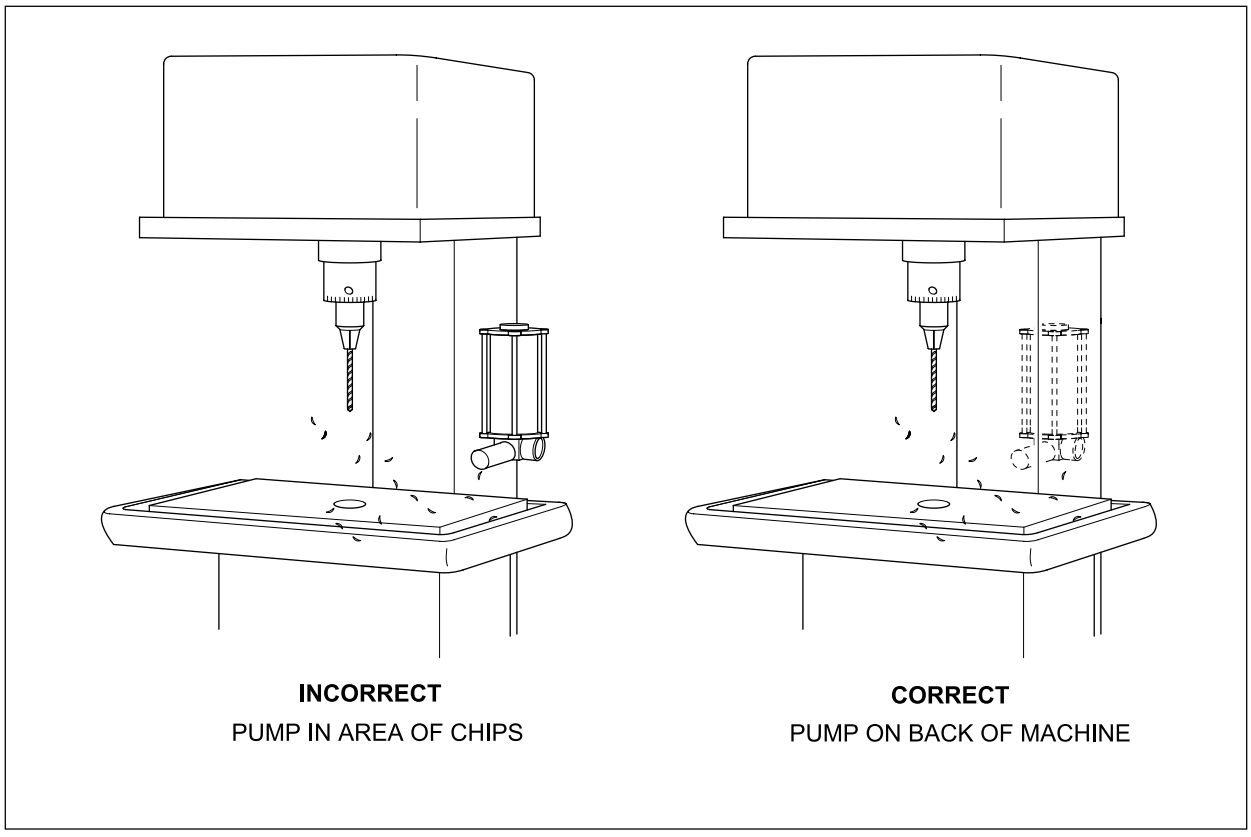


Figure 3

4.0 MOUNTING DIVIDER VALVES

The following recommendations apply when locating and mounting divider valve blocks and should be adhered to as closely as possible to assure that the lubrication system will operate efficiently and accurately:

- The divider valve assembly should be oriented so that the lube inlet port is at the top 12:00 o'clock position in order to make the purging/ bleeding procedures easier and more efficient.

- The divider valve assembly should be oriented so that the spools in the working-valve sections operate parallel to the floor. Avoid mounting the divider valves in such a way that they are tilted relative to the floor plane or perpendicular to it (see Figure 4).

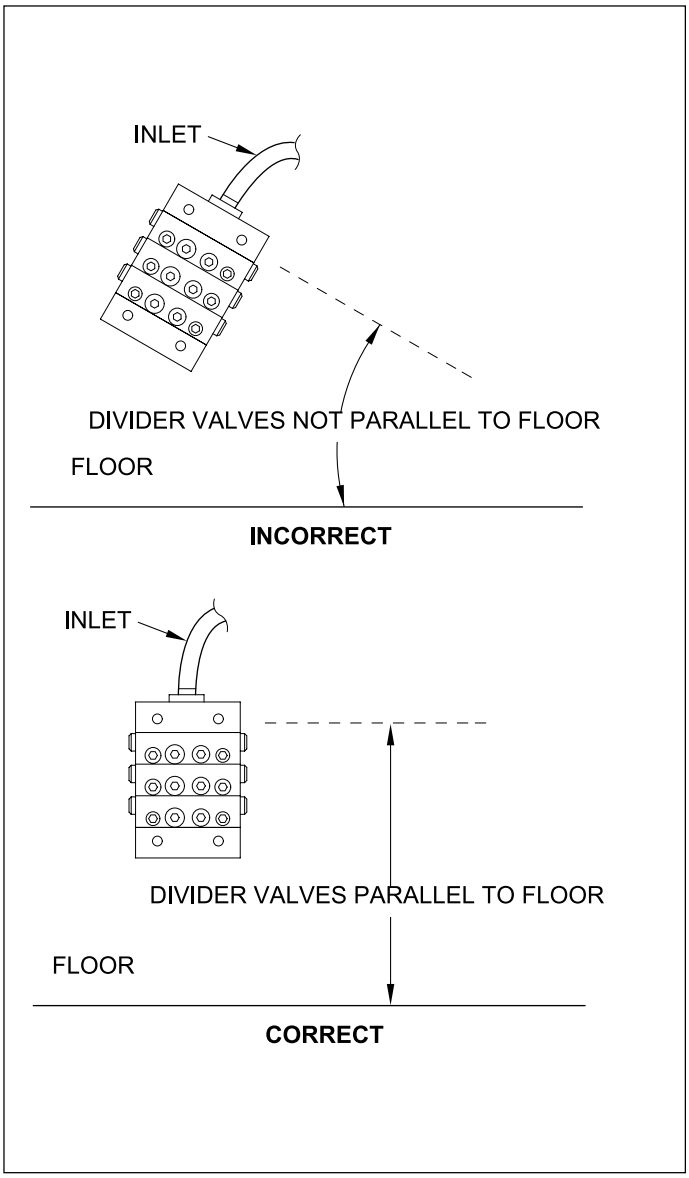


Figure 4

- Avoid locating the divider valve assembly in locations that restrict access to it. The ports on the front of the divider valves should be accessible for prefilling and purging procedures (see Figure 5).

The inlet and end sections of each divider valve have two holes each to enable the installer to attach it to an appropriate surface with properly-sized bolts. The valves may be attached directly to one of the machine surfaces if the surface can be drilled and tapped, but the mounting surface should be flat in order to prevent the divider valve from being deformed. Other mounting variations may require the use of a mounting plate interface. Lubriquip has several styles of mounting plates available for straightforward installations. Also, a customized design can be developed for those installations that require special considerations and hardware.

CAUTION

If a weld-in-place mounting plate is being installed, the plate should be welded in place prior to mounting the divider valve assembly in order to prevent damage to the internal 0-rings by heat generated during the welding operation.

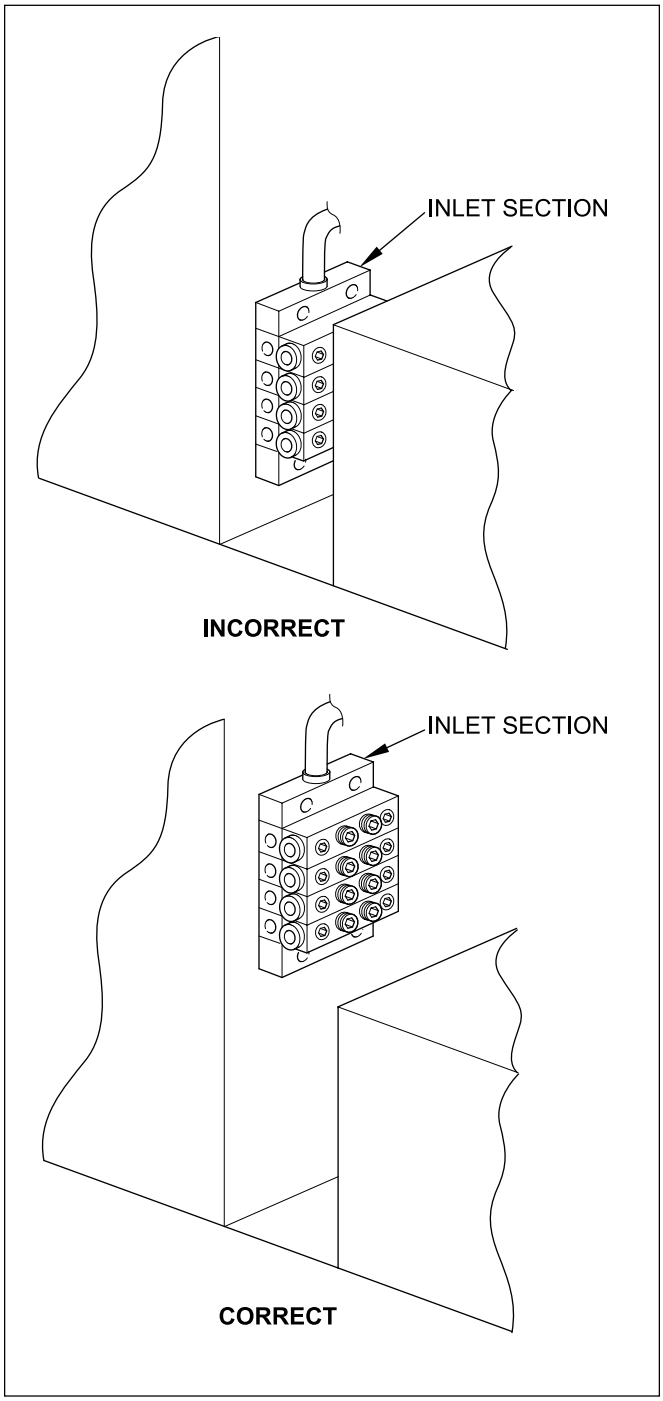


Figure 5

5.0 INSTALLING CHECK VALVES

After the divider valves have been located, the check valves should be installed with each one oriented so that it faces toward the particular divider valve outlet port that supplies it with lubricant. This helps to determine the minimum length of connecting tubing or hose.

There are several locations within any lubrication system that benefit from the use of a check valve, including the outlet of the pump and the ends of all lube lines. The check valve should be placed as close as possible to the final lubrication point (see Figure 6). This prevents drainage of lubricant from the lube lines should disassembly be required. However, systems using grease as the lubricant may not experience lubricant self-flow when components are removed and, therefore, may not require lube point check valves.

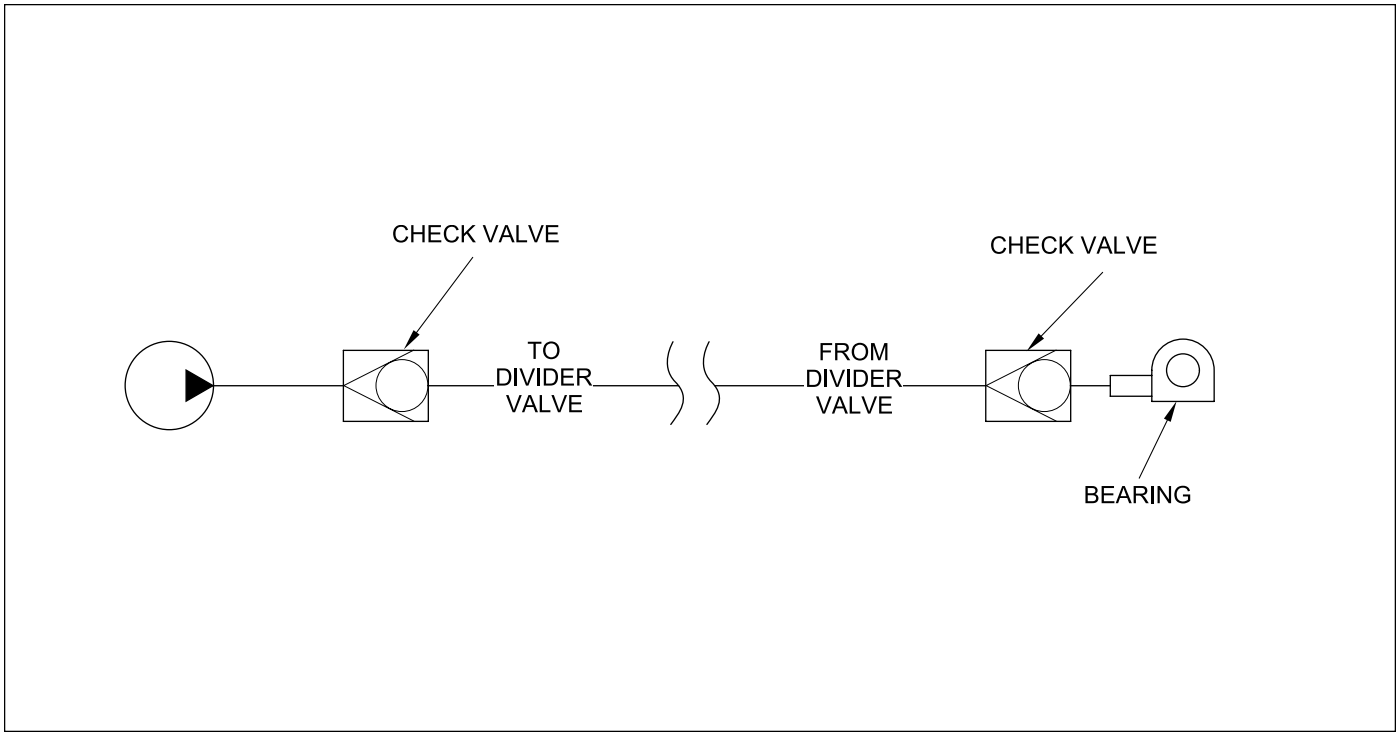


Figure 6

In systems utilizing header lines, check valves should be placed upstream and in close proximity to all Zero-Leak solenoid valves that control the lubricant input to the master feeder valve assemblies. This prevents the lubricant in the line from draining out should a lubrication point fitting require loosening or disconnecting (see Figure 7).

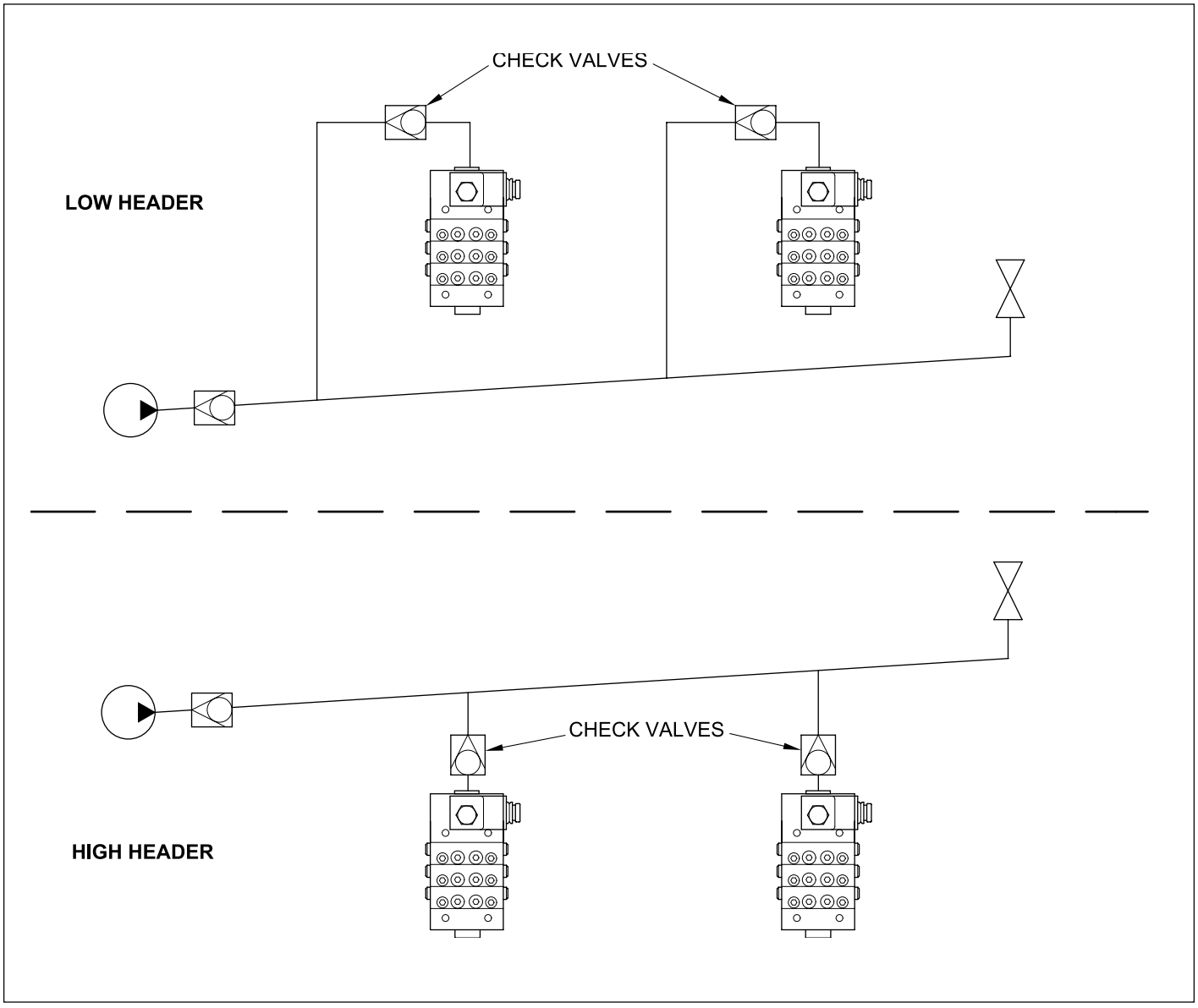


Figure 7

It is usually not necessary to install check valves at the outlet of distribution assemblies. Series-Progressive divider valves incorporate an integral check valve internally located at each outlet port, which is effective in preventing lubricant backflow through the feeder. However, it is important to note that the pressure will eventually equalize due to metal-to-metal seal not being "bubble-tight". Therefore, if it is desired to retain normal operating pressures within the lubrication lines for long periods of time without running the pump, soft-seat or garter check valves should be used at the divider valve outlet (see Figure 8). This also applies to Series-Progressive systems.

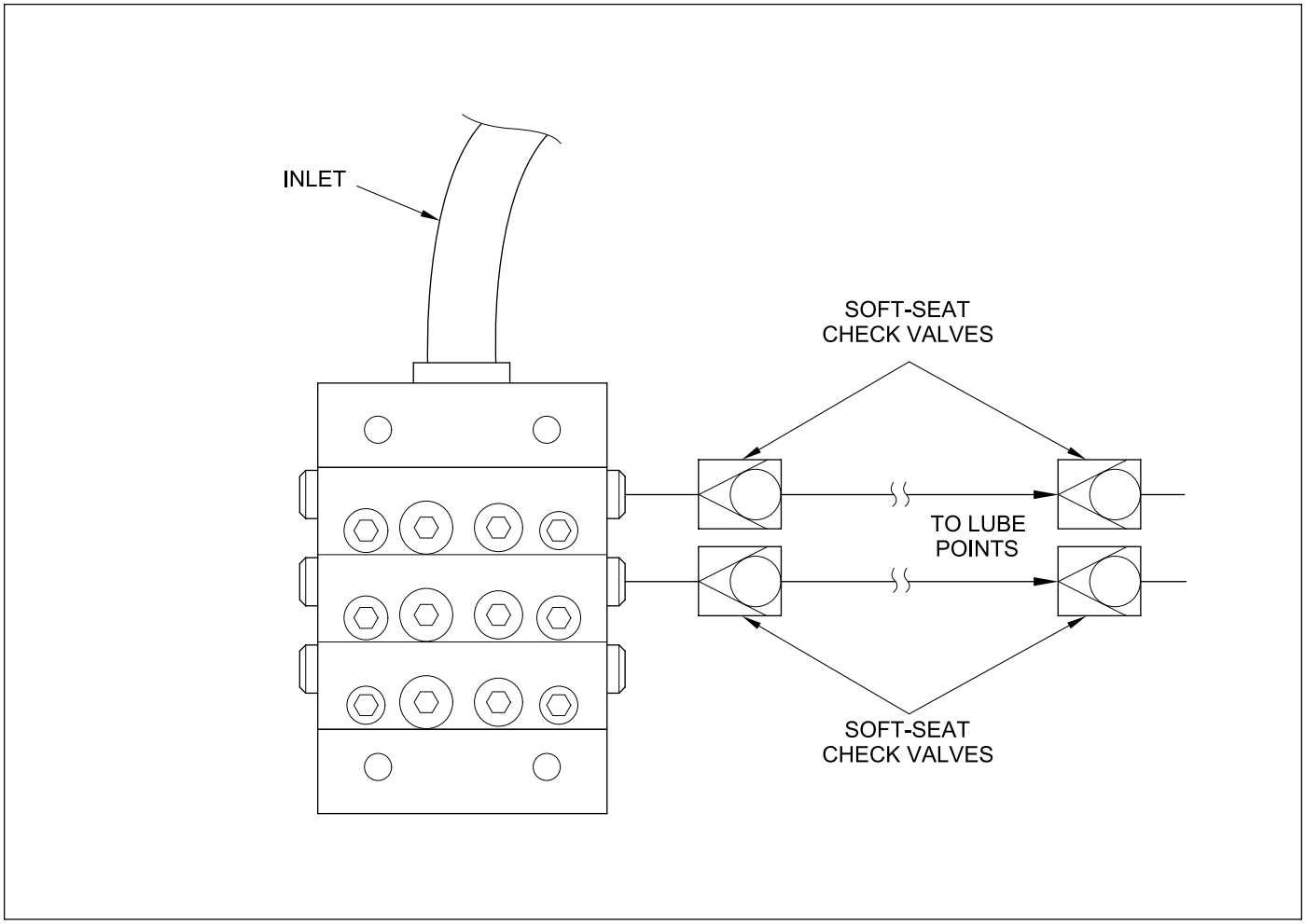


Figure 8

6.0 INSTALLING TUBING, PIPES, AND HOSES

The lubrication system schematic diagram specifies the type of tubing, pipes, or hose to be used to connect the various system components. The basic rule to remember and follow is to keep all lines as short as possible with a minimum number of bends that are consistent with ease of installation and removal. Adhering to this strategy reduces the cumulative pressure drop in any type of system and results in reduced stress upon all of the system components. Some additional related guidelines offered by the manufacturers of the components are:

- Avoid straight short runs of tubing. These require a bend to facilitate removal and to allow it to compensate for the strains generated in a pressurized system. Figures 9, 10, and 11 illustrate some examples of suggested methods of bending tubing to conform to given conditions.

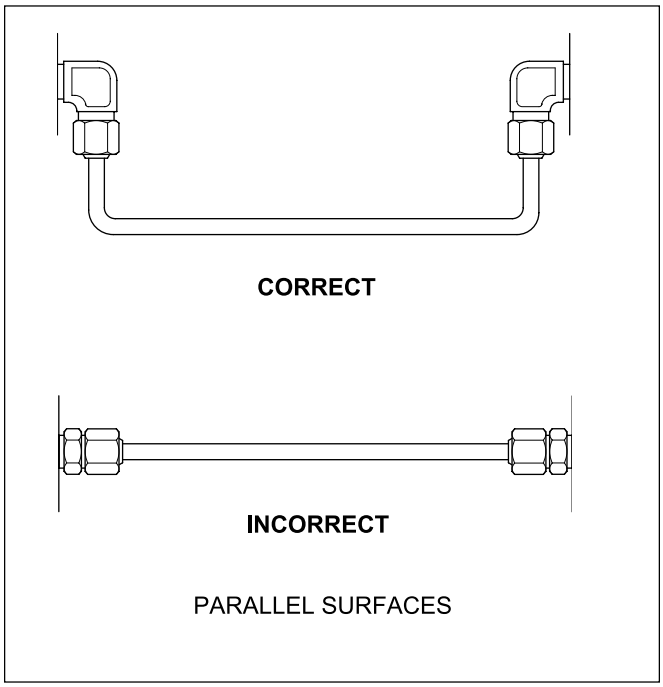


Figure 10

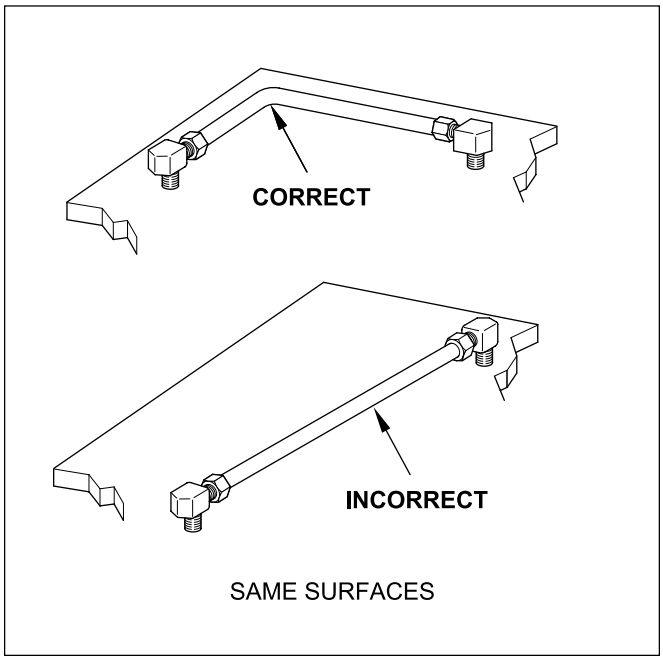


Figure 9

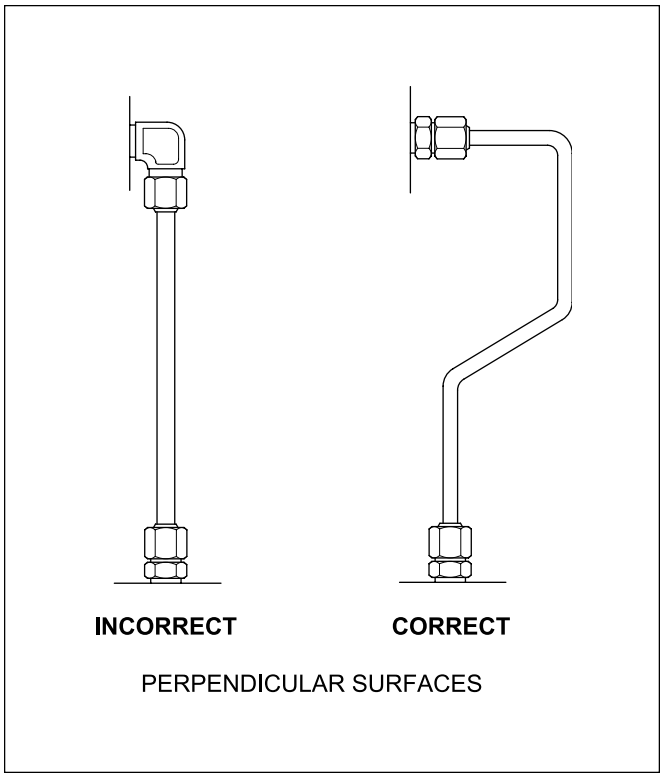


Figure 11

- Keep tubing away from walkways or areas where it could present a safety hazard or be damaged by pedestrian or vehicular traffic (see Figure 12). When installing the tubing, take into consideration how the machine will be operated and serviced.

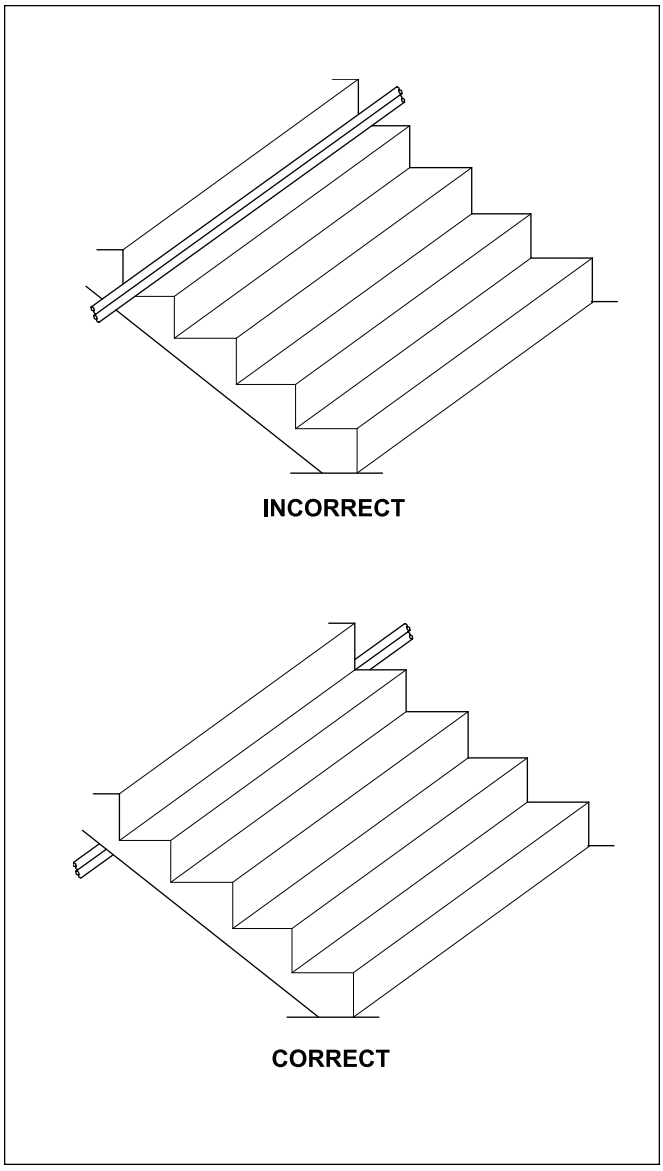


Figure 12

- Use as many tube clips as necessary to keep tubing securely in place (see Figure 13).

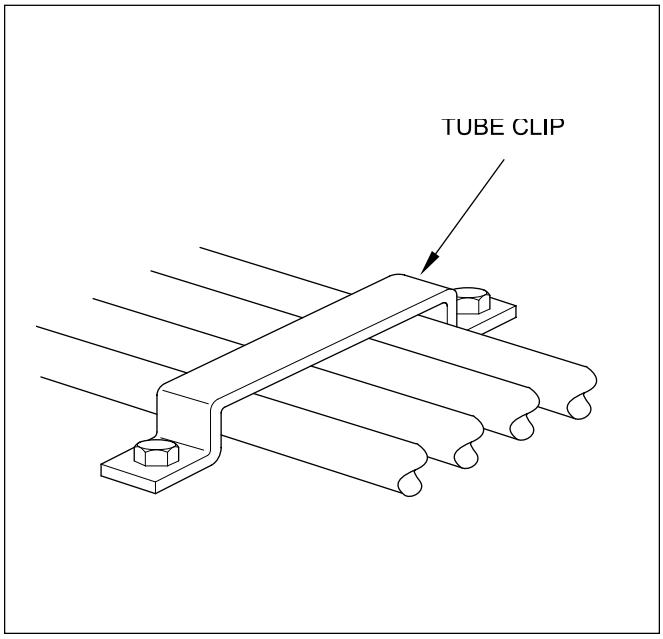
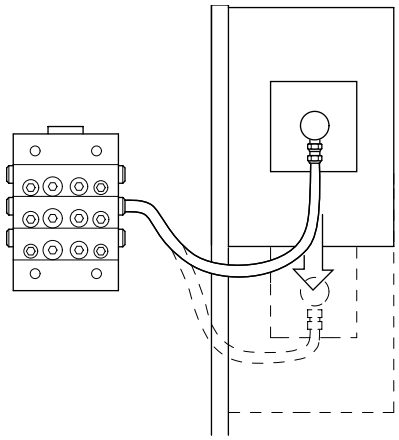


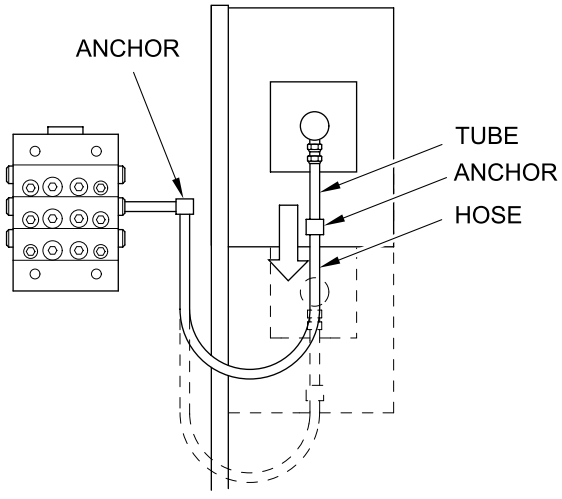
Figure 13

- When installing hose on a moveable component, cycle the component to both extremes of its range of travel. Then use anchor blocks or swivel fittings to ensure that the hose is not crushed or severely bent when the machine is operating (see Figure 14).
- Bend tubing so that it conforms as closely as possible to the contour of the surface or object it is mounted on. Avoid free-standing tubing or hose that might cause interference or be subject to damage due to increased vulnerability (see Figure 15).



INCORRECT

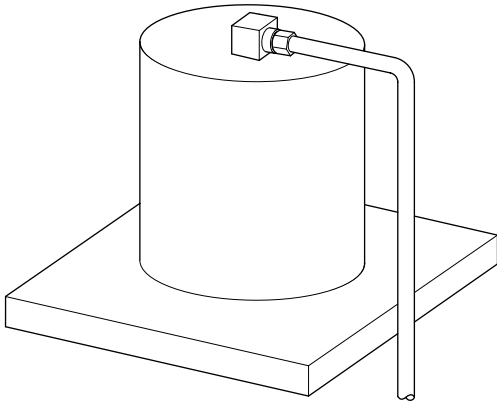
BEND IS TOO SEVERE
WHEN LOWERED



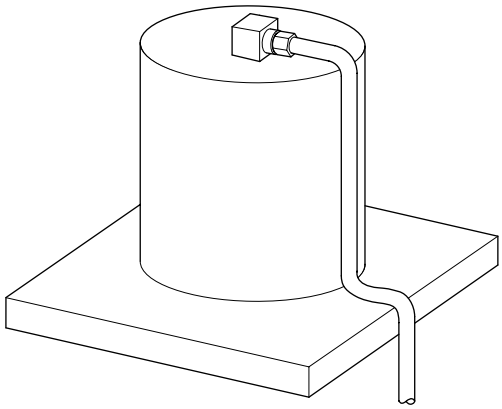
CORRECT

USE OF ANCHORS AND
LONGER HOSE ELIMINATES
EXCESSIVE BEND

Figure 14



INCORRECT



CORRECT

Figure 15

- Use a deburring tool to remove all burrs from the bore of all tubing sections that have been cut (see Figure 16).

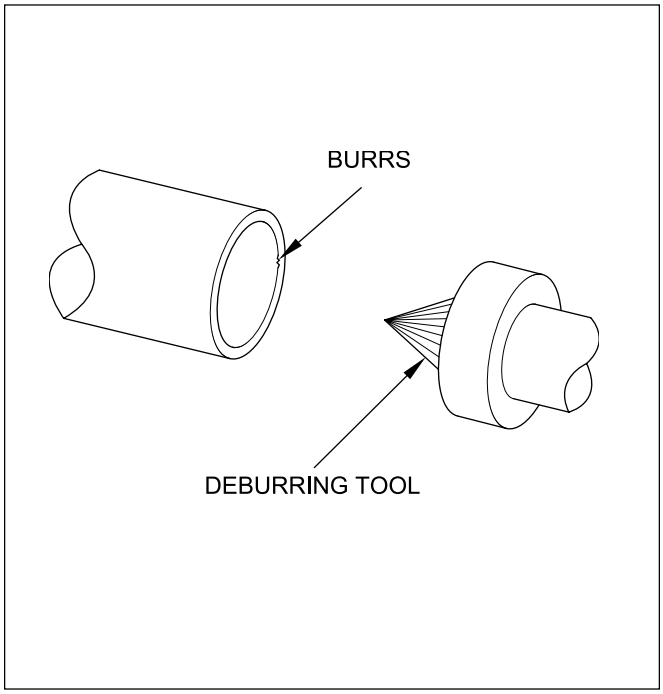


Figure 16

- Make sure all fittings are properly tightened to recommended torque levels to prevent small leaks or weeping of lubricant.

Several manufacturers of tubing and pipe fittings offer detailed training regarding proper installation practises should additional information be desired or required.

7.0 CLEANING TUBING AND PIPES

When installing any type of fluid system, including lubrication systems, thorough cleaning of tubing and pipes is essential in order to ensure proper functioning and reliable operation. The most critical time in the life of a fluid system is the initial operating period. Any component manufacturing debris or any contaminants added during the installation process that are not cleaned out of the system before the first operating period will be available for transport to other components, bearings, etc. Depending upon the amount and size, the debris that has not been cleaned out of tubing or pipes and any particulate contamination that has not been filtered out of the fluid can potentially cause immediate damage, or else cause future operating problems via cumulative degradation of any components damaged during the first operating period of the system. Therefore, to avoid any partial or complete failure of the equipment when it is placed in operation, conductors and other system components must be thoroughly cleaned and inspected prior to the system installation, assembly, and operation.

There are two recommended procedures for properly cleaning tubing:

- Pickling and Passivating Procedure

This method removes contamination such as corrosion, scale, slag, and weld spatter from pipes or tubing. The pickling process uses an acidic solution that chemically loosens the contaminants. This process should be used after any hot bending, brazing, silver soldering, or welding without anti-slag gas.

NOTE

The pickling process is the preferred method of cleaning pipes and tubing. However, due to the acidic chemicals and detailed procedures required for performing the cleaning operation properly, it is recommended that pickling be performed only by an experienced professional pickling service.

- Component Flushing Procedure

The flushing method is designed for cleaning tubing before its assembly into a system. This procedure is especially recommended for use after brazing tube fittings onto a piece of tubing. The process mechanically loosens contaminants from the inside of the tubing. High-pressure fluid is then applied to flush out the loosened contaminants. This process is described in greater detail in Paragraph 7.1.

7.1 Component Flushing Procedure

This procedure is designed to flush each piece of tubing free of contaminants before it is installed into the system. The procedure consists of the following seven steps:

1. Use a properly-sized stiff stainless steel wire brush to loosen existing contaminants from the tube inside diameter, extending as far as possible into any bends in the tubing (see Figure 17).

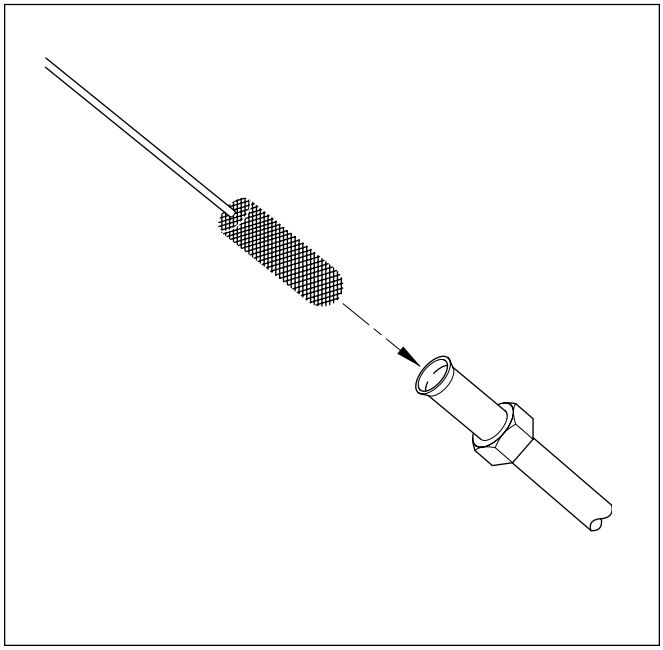


Figure 17

2. After loosening the contaminants by brushing from both ends of the tubing, blow out the loose debris with a compressed air gun using clean, *filtered* air (see Figure 18).

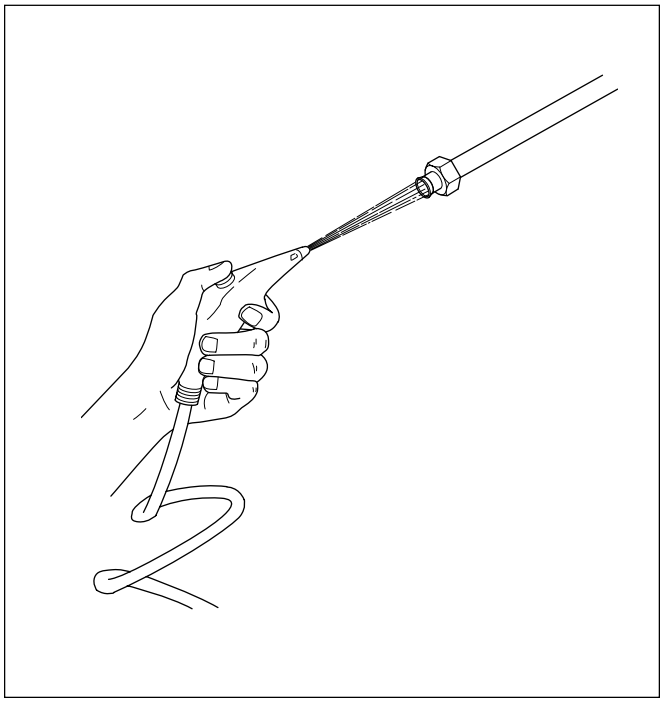


Figure 18

3. Clean the inner surface of the tubing by injecting fluid into both ends with a high-pressure (approximately 500 psi) water jet gun similar to those used at a self-serve car wash (see Figure 19).

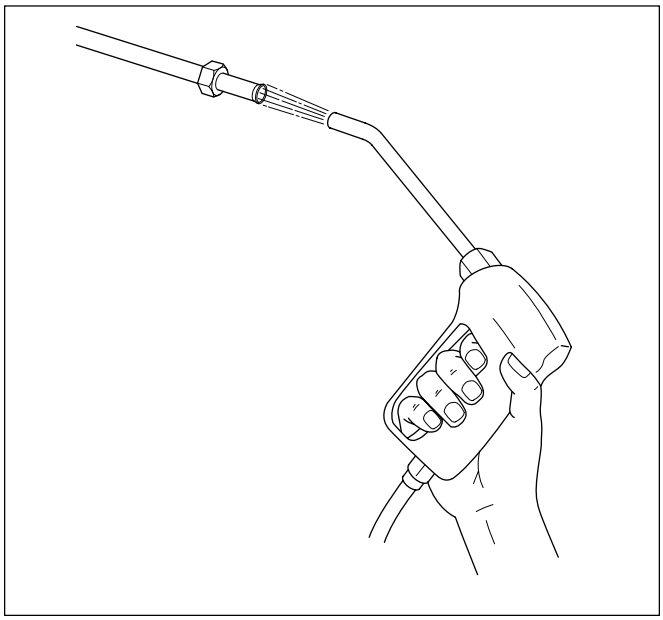


Figure 19

4. Prepare a cleaning fluid mixture by adding four ounces of Bemite 136 to one gallon of water. This mixture will clean the tubing, neutralize any acidic residue and provide temporary surface protection for a period of up to four weeks.

5. Flush the tubing by performing one of these procedures:

a. Pump the cleaning fluid through the tubing at a velocity of 20 ft/sec or greater for a minimum of 30 seconds.

b. Cap one end of the tubing and fill it to approximately 3/4 full. Then cap the remaining open end and slosh the cleaning fluid from end to end vigorously several times before draining it. Repeat the sloshing process a second time (see Figure 20).

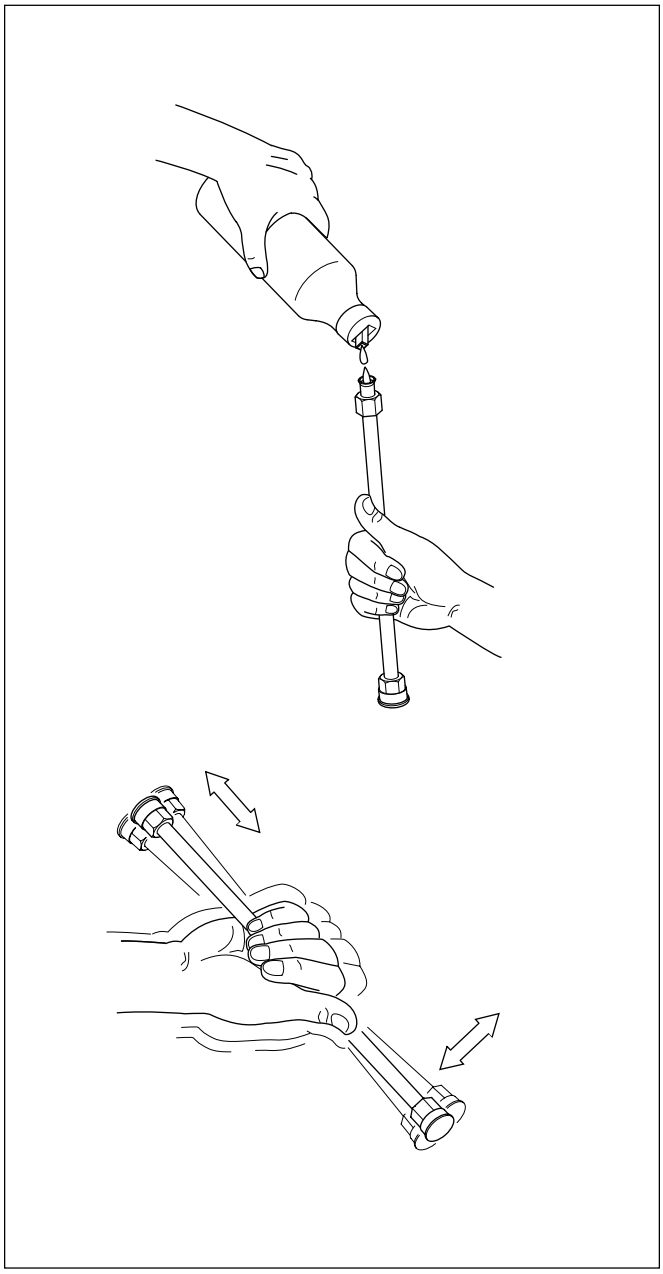


Figure 20

6. Coat the I.D. of the tubing with a clean rust inhibitor such as WD 40 or SP-350. This is best accomplished by filling the tubing with the fluid and then allowing it to drain out (see Figure 21).

NOTE

It is not necessary to wait for the tubing to become dry after Step 5 since the rust inhibitors recommended in Step 6 are water displacing types.

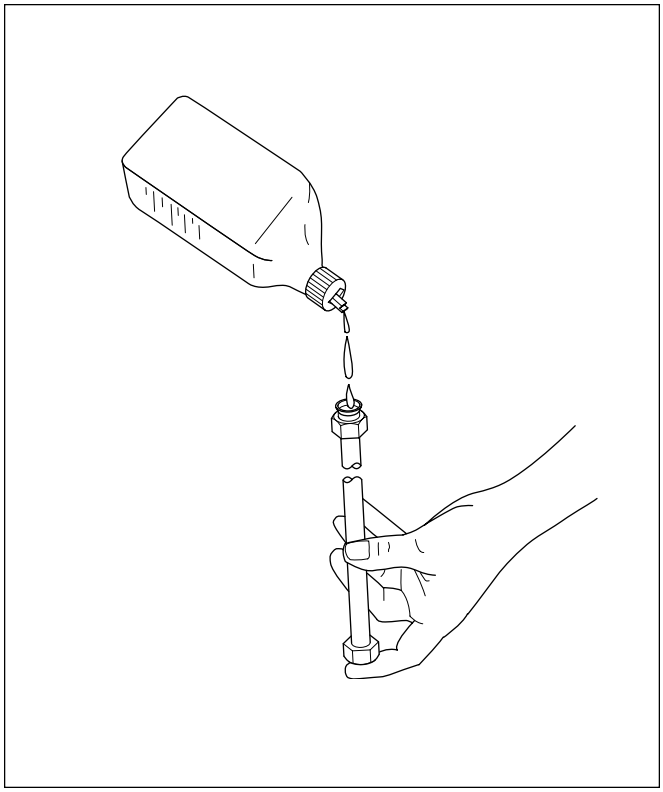


Figure 21

7. Cap the open ends of the tubing. If the capped tubes are to be stored before installation, this prevents humid air, dirt, and airborne contaminants from entering the clean tubes. During installation leave the caps on the tubes as long as possible to minimize the risk of contamination. If the tubing is installed directly onto a machine after the cleaning operations, cap any open ends during the installation process until all connections are made and checked in order to prevent humid air and dirt or dust gaining access to the cleaned surfaces.

The above procedures will completely clean tubing of all contaminants except for any rust that may be present in the bends and middle portion of the tubing where the brush may not have been able to reach. The rust inhibitors will provide protection for up to six months of storage.

8.0 LUBRICANT FILTRATION REQUIREMENTS

System problems often caused by contaminated fluid can be avoided.

Potential sources of fluid or lubricant contamination are:

- Contaminated new oil
- Built-in contamination resulting from inadequate component cleaning procedures before or during system installation
- Ingressed contamination from open reservoir vents and fill ports, inadequate or worn seals, or components left open during maintenance procedures

Lubriquip lubrication system components are designed and manufactured to high standards intended to maximize tolerance to particulate and chemical contaminants. However, Lubriquip's products, as well as those provided by other manufacturers of fluid-handling components, can operate at their optimum design capability only when supplied with properly cleaned and filtered fluids and lubricants.

Proper filtration of the lubricant is essential if system and equipment damage is to be avoided.

Some machine components, such as high-speed bearings, may require higher levels of lubricant filtration than others. Filters are available in several micron and pressure ratings to satisfy a variety of system filtration requirements. It is recommended that the lubricant in any lubrication system should be filtered to the minimum level recommended by the Society of Automotive Engineers (SAE) which corresponds to the ISO Standard 4406 ratings/specifications of ISO 18/14. It should be noted that although Series-Progressive system components are designed to tolerate contamination levels worse than ISO 18/14, individual components in the machine may require even higher levels of cleanliness and filtration.

Figure 22 demonstrates several examples of the types of filters recommended for use in lubricant dispensing systems and their proper locations within the system. Proper selection and location of filters will ensure compliance with the bearing or machine tool manufacturer's cleanliness requirements for maintaining the operating specifications and warranty.

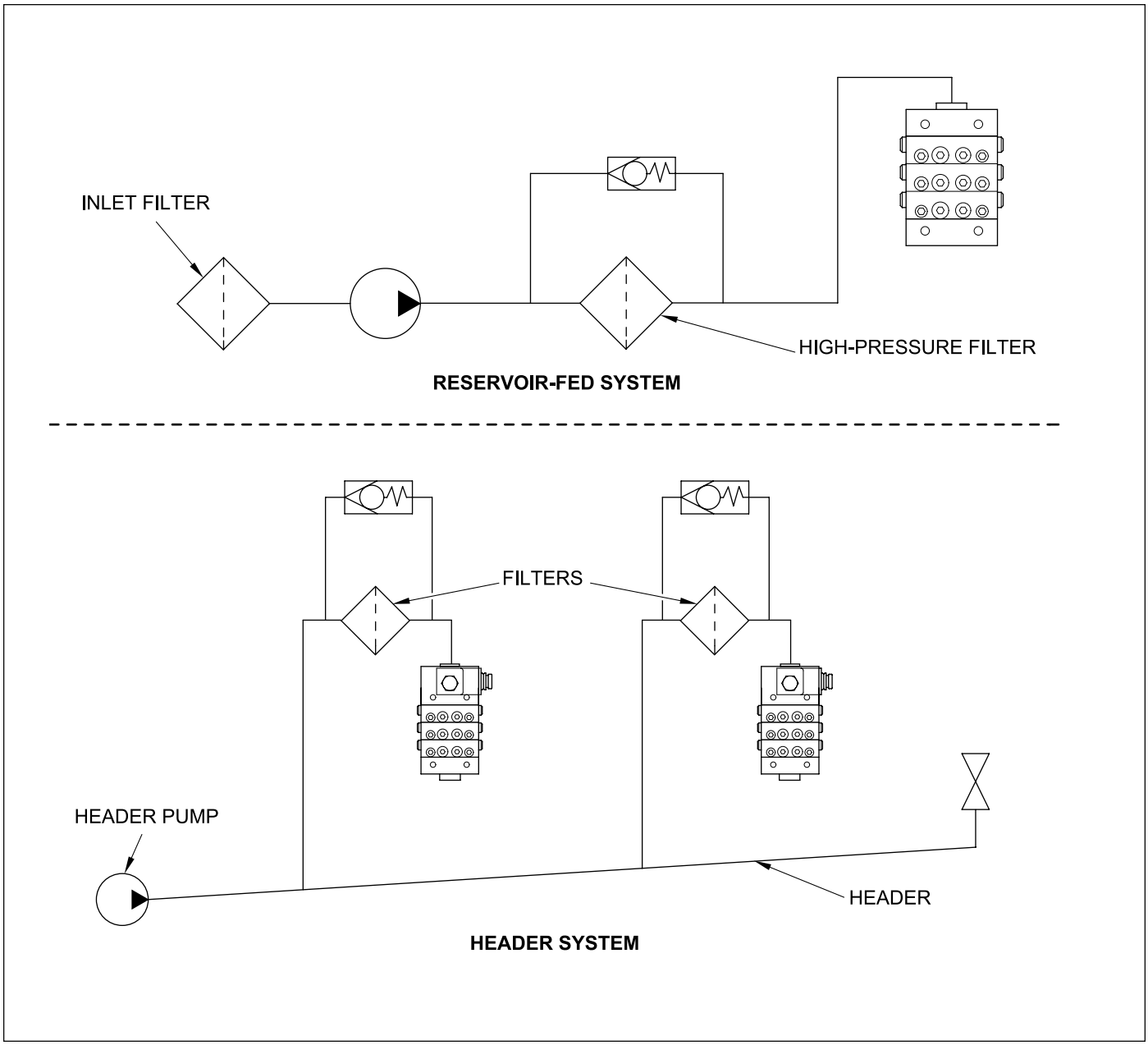

INLET FILTER
HIGH-PRESSURE FILTER
RESERVOIR-FED SYSTEM
FILTERS
HEADER PUMP
HEADER
HEADER SYSTEM

Figure 22

9.0 PREFILLING THE SYSTEM WITH LUBRICANT

Once the lubrication system installation has been completed, it is necessary to prefill all of the lines (tubing/pipes/hoses) and all of the divider valves before operation of the lubrication system can be started. Proper adherence to the following procedures will help to reduce and alleviate machine start-up problems caused by residual air in the lubrication system lines and components during their installation process. Leaving entrapped air in the lube lines could prevent lubricant from gaining access to the lube points during the critical initial start-up period. Proper prefilling of the lubrication system will insure that lubricant is immediately available to every lube point upon machine startup, protecting them from any potential damage. In order to simplify prefilling, it is divided into three separate procedures:

- Filling the lines connecting the secondary divider valves to the lube points (para 9.1).
- Filling the lines connecting the master divider valve to the secondary divider valves (para 9.2).
- Filling the master divider valve (para 9.3).

These three procedures should always be performed as a complete group in the sequence listed in order to ensure that every component in the system is completely filled with lubricant prior to machine start-up.

CAUTION

Use only clean oil filtered to the SAE recommended cleanliness level of ISO *18114* (ISO Standard 4406) when prefilling a system. The manufacturers of the machine tool and its component bearings should be consulted to ensure that the ISO 18114 cleanliness level is adequate.

9.1 Filling Secondary-to-Lube Point Lines

Refer to Figure 23 when performing this procedure:

1. Remove the port plugs or performance indicators from all of the indicator ports on the front of the secondary divider valves.

2. Connect a hand pump filled with clean, filtered lubricant to the indicator port closest to the first line to be filled that corresponds to the output port that is feeding the line to be filled.

3. In order to verify when the lubricant is flowing and has reached the end of the lube line, loosen the connector at the lube point of the line that is to be filled.

4. Stroke the hand pump until air-free lubricant is observed flowing from the end of the lube line.

5. Tighten the lube line connector at the lube point, but do not replace the port plugs or performance indicators into the ports on the front of the working section.

6. Repeat Steps 1 through 5 for each of the other lube lines connected to the other outlet ports in the secondary divider valve assembly and for any other secondary divider assemblies in the system.

NOTE

Do not replace any of the performance indicators or port plugs removed in Step 1 until the line-filling procedure described in Paragraph 9.2 (Filling Master-to-Secondary Lube Lines) has also been completed.

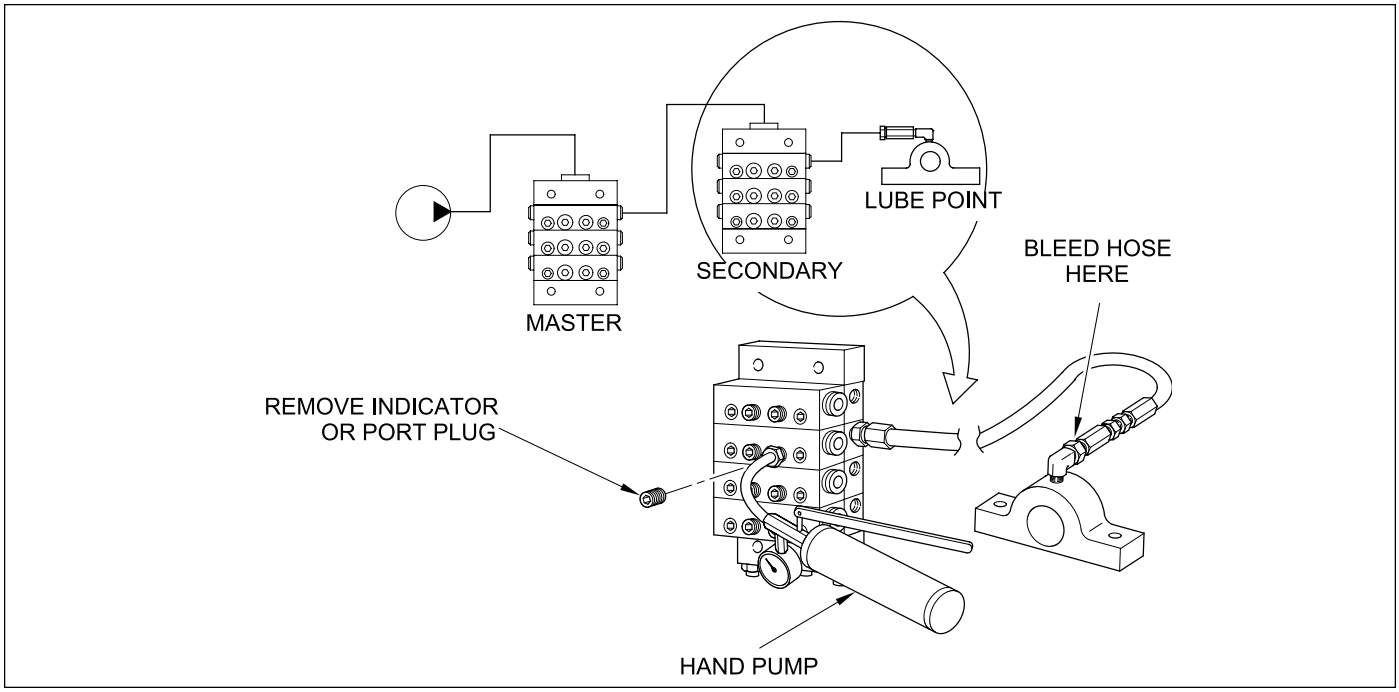


Figure 23

9.2 Filling Master-to-Secondary Lube Lines

Refer to Figure 24 when performing this procedure:

1. Remove the port plugs or performance indicators from all of the indicator ports on the front of the master divider valve.

2. Connect a hand pump filled with clean, filtered lubricant to the indicator port closest to the lube output port that is feeding the line to the secondary divider valve.

3. Stroke the hand pump to fill the line between the master divider valve and secondary divider valve.
4. Continue to stroke the pump until the lubricant purges all of the air out of the internal passages of the secondary divider valve and lubricant flows freely from all indicator ports with no evidence of included air.

5. Reinstall the port plugs or performance indicators in their respective positions in the secondary divider valve. Do not replace the port plugs or performance indicators in the master divider valve yet.

6. Repeat Steps 1 through 5 for each of the other lube lines between the master divider valve and all other secondary divider valves.

7. Do not replace any of the performance indicators and port plugs removed in Step 1 from the master divider valve assembly until the air-purging procedure described in Paragraph 9.3 (Filling the Master Divider Valve) has also been completed.

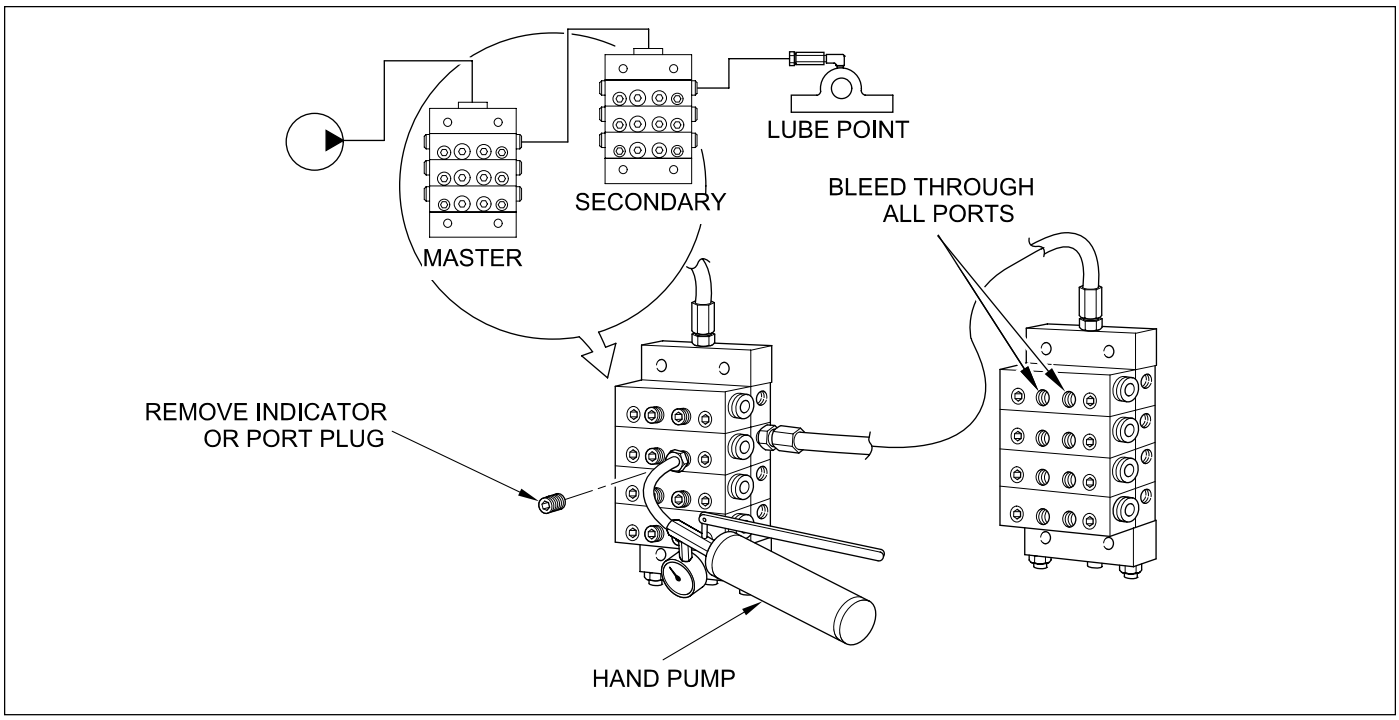


Figure 24

9.3 Filling The Master Divider Valve

Refer to Figure 25 when performing this procedure:

1. Verify that all port plugs or performance indica**tors have** been removed from all indicator ports in the master divider valve.

2. Verify that the system pump is properly connected to the inlet port of the master divider valve.

3. Cycle the system pump sufficiently to fill the main feeder line between the pump and the master divider valve, and lubricant is observed being discharged from all of the indicator ports on the front of the master divider valve with no evidence of included air.
4. Reinstall the master divider valve port plugs or performance indicators into their respective positions.

NOTE

If any maintenance procedures requiring loosening or disconnecting of any connectors or fittings are performed subsequent to completion of the prefilling procedures described above, but prior to machine start-up, the prefilling procedures should be repeated to assure that the lubrication system is completely filled with lubricant and is air-free. Since the most critical operating period for a newly installed machine, in terms of potential for being damaged by unremoved/unfiltered lubricant contaminants and lack of adequate lubrication, is the initial start-up and operation, compliance with the recommended prefilling procedures is crucial for attaining a problem-free start-up of the machine tool and continued reliable long term operating capability.

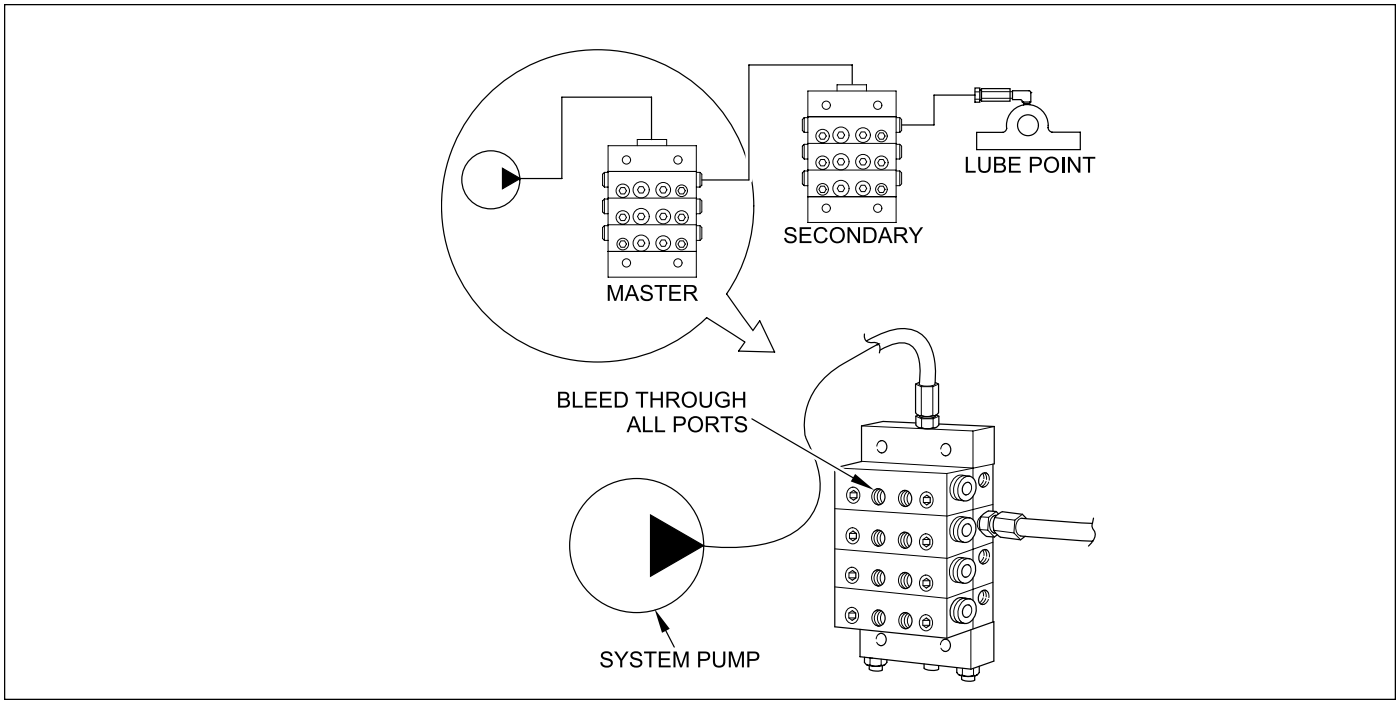


Figure 25