

**LUBRICATION COMPONENTS AND SYSTEMS USED ON MACHINE TOOLS
AND EQUIPMENT FOR THE AUTOMOTIVE INDUSTRY**

Foreword—This Document has not changed other than to put it into the new SAE Technical Standards Board Format.

The automotive industry, machine tool suppliers, and lubrication component suppliers are pursuing common specifications to improve the reliability and performance of lubrication systems and machines. The recommended practices contained within this document represent a consensus of automotive users, machine tool suppliers, lubrication component and system manufacturers, and suppliers.

Deviations from those parts of these recommended practices included in contractual agreements shall be agreed to in writing by the purchaser and supplier.

Design enhancements which improve equipment reliability, maintainability, and machine performance are encouraged.

Recommendations which contain the verb "shall" are good engineering practices widely applicable with rare exceptions. Use of the word "should" in the document is not an indication of choice but an indication that the desirable engineering practices described may have to be modified due to peculiarities of certain processes, environmental conditions, or equipment size.

Use of this document assists:

- a. In establishing safety requirements and safe practices
- b. A purchaser in producing a specification for lubrication equipment
- c. A purchaser in establishing the relative merits of similar lubrication equipment
- d. A supplier in producing acceptable lubrication equipment of either his design or at the request of a customer
- e. Reliability
- f. Maintainability
- g. Designs and installations in accordance with the recommendations of the lubrication equipment manufacturer

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Lubrication is required due to tribological considerations. Tribologists have determined the rationale for the lubrication of machine parts by using lubricant metered in predetermined amounts to separate the surfaces which have relative motion to each other (slides, ways, gear clusters, spindles, etc).

- a. Lubrication may serve other than tribological needs, like purging of contaminants.

The application of lubrication systems to industrial equipment requires an understanding and communication between supplier and purchaser.

When lubrication is absent or incorrectly applied, the machine may fail and/or the quality of the parts being produced may be affected.

The lubrication system shall be designed and installed in accordance with the recommendations of the lubrication equipment supplier. All slides, ways, bearings, and wear surfaces should be lubricated as recommended by the machine manufacturer.

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1. **Scope**—These recommended practices are applicable for lubrication components and systems supplied on machines and equipment used in the automotive industry; for the purpose of this document, any equipment dispensing lubricant used in manufacturing and/or assembly processes.

These practices do not apply to injection of pneumatic components.

2. **References**

- 2.1 **Applicable Publications**—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the latest revision of SAE publications shall apply.

- 2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J517—Hose, Hydraulic

SAE J524—Seamless Low Carbon Steel Tubing Annealed for Bending and Flaring

SAE J525—Welded and Cold Drawn Low Carbon Steel Tubing Annealed for Bending and Flaring

SAE J1065—Pressure Ratings for Hydraulic Tubing and Fittings

SAE J1689—Hydraulic Power Units Used on Machine Tools and Equipment for the Automotive Industry

SAE J2066—Filter and Filter Element for Hydraulic System(s) Used on Manufacturing and Assembly Equipment

- 2.1.2 AAMA PUBLICATION

AAMA 502—Designation of lubricants and marking of lubricant containers, equipment and lubricating points

2.1.3 ANSI PUBLICATIONS—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ANSI B93.2—Glossary - Fluid Power Systems and Products
ANSI/IEEE 268—American National Standard for Metric Practice
ANSI/T2.24.1 (NFPA/JIC)—Hydraulic Fluid Power—Systems Standard for Stationary Industrial Machinery
ANSI/SAE J534—Lubrication Fittings

2.1.4 ISO PUBLICATIONS—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ISO 1000—SI units and recommendations for the use of their multiples and of certain other units
ISO 1436—Rubber hoses and hose assemblies—Wire reinforced hydraulic type-Specification
ISO 3448—Industrial liquid lubricants - ISO viscosity classification
ISO TR3498—Lubricants, industrial oils and related products (class L)—Recommendations for the choice of lubricants for machine tools
ISO 3862—Rubber hoses and hose assemblies—Rubber covered, spiral wire reinforced, hydraulic type
ISO 3949—Plastic hoses and hose assemblies—Thermoplastics, textile reinforced, hydraulic type
ISO 4406—Hydraulic fluid power - Fluids - Method for coding level of contamination by solid particles
ISO 4413—Hydraulic fluid power—General rules for the application of equipment to transmission and control systems
ISO 5169—Machine tools—Presentation of lubrication instructions
ISO 5170—Machine tools—Lubrication systems
ISO 5598—Fluid power systems and components—Vocabulary.
ISO 6149-1—Connections for fluid power and general use—Ports and stud ends with ISO 261 threads and O-ring sealing—Part 1.
ISO 6743—Lubricants, industrial oils and related products (class L)—Classification.
ISO 10763—Hydraulic fluid power—Plain-end seamless and welded precision steel tubes—Dimensions and nominal working pressures
ISO 12151—Connections for hydraulic fluid power and general use—Hose fittings
ISO R369—Symbols for indications appearing on machine tools

2.1.5 NFPA PUBLICATION—Available from National Fluid Power Association, 3333 North Mayfair Road, Milwaukee, WI 53222-3219.

NFPA/T2.24.2—Hydraulic fluid power systems - Methods to improve sealing reliability

2.2 Other Publications

General Motors Corporation—Basic Lubrication Standard LS1 for Industrial Equipment and Machine Tools
General Motors Powertrain Lubrication Specifications Supplement - Revision 1.2 - August 3, 1992
Chrysler Trenton Engine Lubrication Specification # 66377
Ford Motor Company—Lubrication Standard of Industrial Equipment, LX1
Ford Powertrain—Lubrication Process Principles

3. Definitions and Glossary of Terms

3.1 Definitions

- 3.1.1 The Term "EQUIPMENT" includes single, transfer, dial and pallet machines, automation and conveyor systems, washers, flushers, testers, dust collectors, chip drags, central coolant systems, and other process equipment and/or special machinery.
- 3.1.2 For terms used with lubrication systems, see Glossary.
- 3.1.3 Units of measurement are given in both metric (ISO 1000) and inch. Conversions use ANSI/IEEE 268 Metric Practice (exception: piping - U. S. units are used for piping where they are employed for identification, rather than measurement).

3.2 Glossary of Lubrication Terms

- 3.2.1 AUTOMATIC CONTROLS—Control method that operates without human intervention.
- 3.2.2 AUTOMATIC FEEDBACK DEVICES
- a. Fluid Level Switch—For automatic sensing of fluid level by means of an electrical device. Used to provide an electrical signal prior to the loss of lubricant reservoir supply.
 - b. Pressure Switch—For automatic sensing of system pressure by means of an electrical device. When a pressure level higher or lower than design intent is encountered, the device provides the appropriate signal to the control circuit.
 - c. Cycle Switch—For automatic sensing of metering device actuation by means of an electrical device.
 - d. Flow Switch—For automatic sensing of lubricant flow by means of an electrical device. Upon a no-flow or low-flow condition, provides a signal to be used for an alarm or shutdown. Commonly used in circulating oil systems.
 - e. Flow Divider Device—Devices that equally divide the flow of lubricant into separate outlets and provide an electrical signal as to lubricant flow.
 - f. Temperature Switch—For automatic sensing of lubricant temperature by means of an electrical device. Device provides a signal to indicate when lubricant temperature is not to design intent (high and/or low). Used where temperature is critical to proper system function.
- 3.2.3 BREATHER—Device to equalize to atmosphere, air or vapor pressures or vacuums in a container.
- 3.2.4 CENTRAL STATION—Common assembly of which the reservoir, pump, filter, valves and related components are mounted, and from which the primary dispensing of lubricant is originated.
- 3.2.5 CENTRALIZED LUBRICATION SYSTEMS—When all points on a machine or group of machines requiring the same lubricant are connected to a common system for application.
- 3.2.6 CROSS PORTING—Method used with single line series progressive systems as a means by which a measured amount of lubricant from one metering device outlet is combined with a measured amount of lubricant from an adjacent metering device outlet. Purpose is to provide an increase in lubricant output volume beyond the capability of a single metering valve.
- 3.2.7 DRAIN LINE—Pipe which returns internal leakage fluid to the reservoir.
- 3.2.8 FAULT TIME—The length of time counted by an automatic control that has been determined to exceed the time required to complete a cycle. If this time setting is reached, the control displays that a fault has occurred and some operator warning.

- 3.2.9 **FILL OPENINGS**—Openings leading into tanks, reservoirs, gear boxes, etc., through which the lubricant can be poured.
- 3.2.10 **FILM THICKNESS**—The depth of the lubricant on the bearing. It is a factor of load between the bearing surfaces and the load carrying properties of the lubricant, of which viscosity or stiffness, and molecular bonds are factors.
- 3.2.11 **GEAR BOX**—An enclosed unit whose primary purpose is to transmit mechanical power. It normally consists of a gear train, bearings, shafts, and other allied parts in a housing.
- 3.2.12 **HIGH PRESSURE FAULT**—A system failure and/or control signal produced from operating pressure exceeding the design limit of the system where pressure is higher than necessary for proper operation.
- 3.2.13 **LUBRICATING GREASES**—Lubricating greases are refined petroleum oils with thickeners and soaps added. Frequently the soaps used to form greases have a metallic base like lithium and calcium. When these additives are used, the grease is referred to as lithium base grease or calcium base grease. Common terms:
- a. **DROP POINT**—The temperature at which a grease releases its thickened consistency and reverts to oil.
 - b. **GRADE**—A measure of the thickness (consistency) of the grease. The grades are established by the National Lubrication Grease Institute (NLGI) and represent worked penetration values from grade 000 (fluid grease) to grade 6 (extremely thick). Most industrial applications use greases from 000 to 2.
 - c. **WORKED PENETRATION**—Generally refers to the consistency of the grease after it has been churned (worked) for a length of time.
- 3.2.14 **LUBRICATING OILS**—Lubricating oils are generally refined petroleum oils with specific additives blended into them to create properties and characteristics to best fit a particular application. Terms used for some common oil properties:
- a. **EXTREME PRESSURE (EP)**—A measure of the film strength qualities of the oil. More commonly used with gear lubricants but may also be useful in the lubricants for heavily loaded bearings.
 - b. **FLASH POINT**—The lowest temperature at which an oil will ignite when exposed to a flame.
 - c. **POUR POINT**—The lowest temperature that an oil will still flow.
 - d. **STICK-SLIP**—Measures the ability of a lubricant to prevent jerky or erratic movement of the machine table or slide even when it is moving at extremely slow speeds.
 - e. **VISCOSITY**—A measure of the fluidity, frequently referred to as the "resistance to flow," of lubricating oils when tested under specific conditions of temperature and pressure.
 - f. **VISCOSITY INDEX**—A measure of a lubricant's change in viscosity relative to the change in temperature.
- 3.2.15 **LUBRICATION FREQUENCY**—How often the lubrication system needs to cycle for proper lubrication of the machine/equipment. Normally expressed in minutes between cycles or number of cycles/hour.
- 3.2.16 **LUBRICATION POINT**—Connection or drip point where lubricant is to be dispensed and which leads to the bearing surface.

3.2.17 METERING DEVICES

- a. Single Line Series Progressive Metering Valve—Valve body(s) fitted with a piston, which proportions and delivers the lubricant in sequence. Requires $\geq$ three valve bodies per assembly to function. Each piston can discharge only its lubricant if the preceding one has discharged its lubricant (series progressive) and subsequently, if any piston fails to complete its actuation, the entire assembly will stop sequence.
- b. Dual Line Parallel Metering Valve—Valve body(s) fitted with a piston or piston with sealing, which proportions and delivers lubricant independently. Dual line metering valves receive supply from two inlet lines which are alternately filled and pressurized. When line pressure is adequate, the metering valves actuate, dispensing lubricant to the bearing. The system control and design establishes suitable level at which supply lines reverse or the cycle completes.
- c. Single Line Parallel Piston Distributors (Piston With Sealing) and Injectors (Body Fitted With a Piston)-Device(s) which proportion and deliver lubricant independently. When line pressure is adequate, the metering devices actuate, dispensing lubricant to the bearing. The metering devices accept lubricant for the next cycle in an internal chamber as part of the operation. After the supply line has filled and pressurized to a pre-determined level, a sensor signals and the line is vented.
- d. Single Line Parallel Restrictor—Pump feed points via restrictors placed in distribution manifolds or fitted directly into the threads of the lubrication point. Lubricant is distributed proportionally to the resistance values of the restrictors.
- e. Pump to Point—A single or multi outlet pump which supplies lubricant directly to the lubrication point(s).
- f. Oil Mist Reclassifier—Mist system fittings used to increase the size (reclassify) of the oil particle used for lubrication. (Spray and condensing fittings are examples.)

3.2.18 PIPING SYSTEM—Any combination of fittings, couplings, or connectors with pipes, hoses, or tubes which allows fluid flow between components.

3.2.19 PRESSURE FILL—To fill a reservoir from a pressurized lubricant supply.

3.2.20 RESERVOIR, INTEGRAL—Reservoir formed by a portion of the machine base or related equipment structure.

3.2.21 RESERVOIR, NON-INTEGRAL—Reservoir that is independent or removable from the machine-tool or related equipment.

3.2.22 SINGLING—Means by which the outlet of two ports of a metering device can be combined into a single outlet volume. Used on single line series progressive and dual line parallel metering devices with differing methods. When singling is performed, visible identification shall be provided.

3.2.23 TOTAL LOSS SYSTEM—System which dispenses lubricant and no lubricant is returned to the reservoir.

3.2.24 VISUAL FEEDBACK DEVICES

- a. Fluid Level Indicators—For indication of fluid levels. Typically are sight gages used on reservoirs (integral and non-integral).
- b. Pressure Gage—For indication of system pressure(s). Typically placed into system locations where adjustments affecting operating pressures are performed.
- c. Cycle Indicator—For indication of system function. Cycle indicators may be pin(s) or counter.
- d. Pilot Lights—Electrically operated lights from automatic control system used to indicate system status. May be incorporated in an operator panel or remotely mounted diagnostic panel. Visual indication may also be incorporated into a man-machine interface (MMI) control system. When used in MMI controls, the information display and capabilities are enhanced.

- e. Over-Pressure Indicator—For indication of excessive system pressure. They may be pin type, pin type reset, or rupture disc (atmospheric indicator).
- f. Flow Indicator—For monitoring lubricant flow. They may be sight gage with a floating ball(s) or flow meter.

4. General Requirements

4.1 Safety

- 4.1.1 Lubrication items requiring maintenance servicing, fill points of reservoirs, or other service points should be located so that people do not have to reach around moving tools, spindles, or other similar equipment elements for access.
- 4.1.2 The placement of reservoirs, fill openings, and items like grease fittings should consider the machine work area, serviceability from working level, accessibility, and need to remove machine guarding or physical barriers. Location shall not constitute a hazard to personnel.
- 4.1.3 Non-integral reservoirs should be positioned so that fill points and level indicators are external to machine guarding. They should be serviceable and accessible without guard removal.
- 4.1.4 Integral reservoirs (worm gear drives, cone drives, transmissions, drill heads, etc.) are by necessity located to suit machine design, and therefore fill points may be inside machine safety guards. Maintenance procedures for these items should be as agreed between supplier and purchaser.
 - 4.1.4.1 Where possible, fill points and drains for integral reservoirs should be located or piped to working height and external to guarding.

4.2 Lubricants—The use of industry standard, commercially available lubricants is recommended. Reference ISO TR 3498 and ISO 6743.

- 4.2.1 Lubricants and lubrication systems should be isolated from hydraulic and coolant systems.
 - 4.2.1.1 Simultaneous engineering is recommended to address issues and designs to prevent intermixing of fluids.

EXAMPLE—Total loss lubrication sub-system contamination of metal working fluids sub-system.
- 4.2.2 Lubricating oil cleanliness recommendation $\leq$ ISO 18/14 (ISO 4406).
- 4.2.3 Specifications for cleanliness of components and systems should be as agreed between supplier and purchaser.

NOTE—Cleanliness is critical to lubrication system performance.
- 4.2.4 Filters should be used on all fluid delivery and handling processes. Appropriate strainers should be used for grease.
 - 4.2.4.1 Recommendations for filter placements with oils, see Figure 1.
 - 4.2.4.2 Recommendations for strainer placements with greases, see Figure 2.
- 4.2.5 All dispensing containers and devices should be kept clean.
- 4.2.6 Caps, covers, fillers, grease fittings, and similar devices should be cleaned prior to dispensing lubricant.

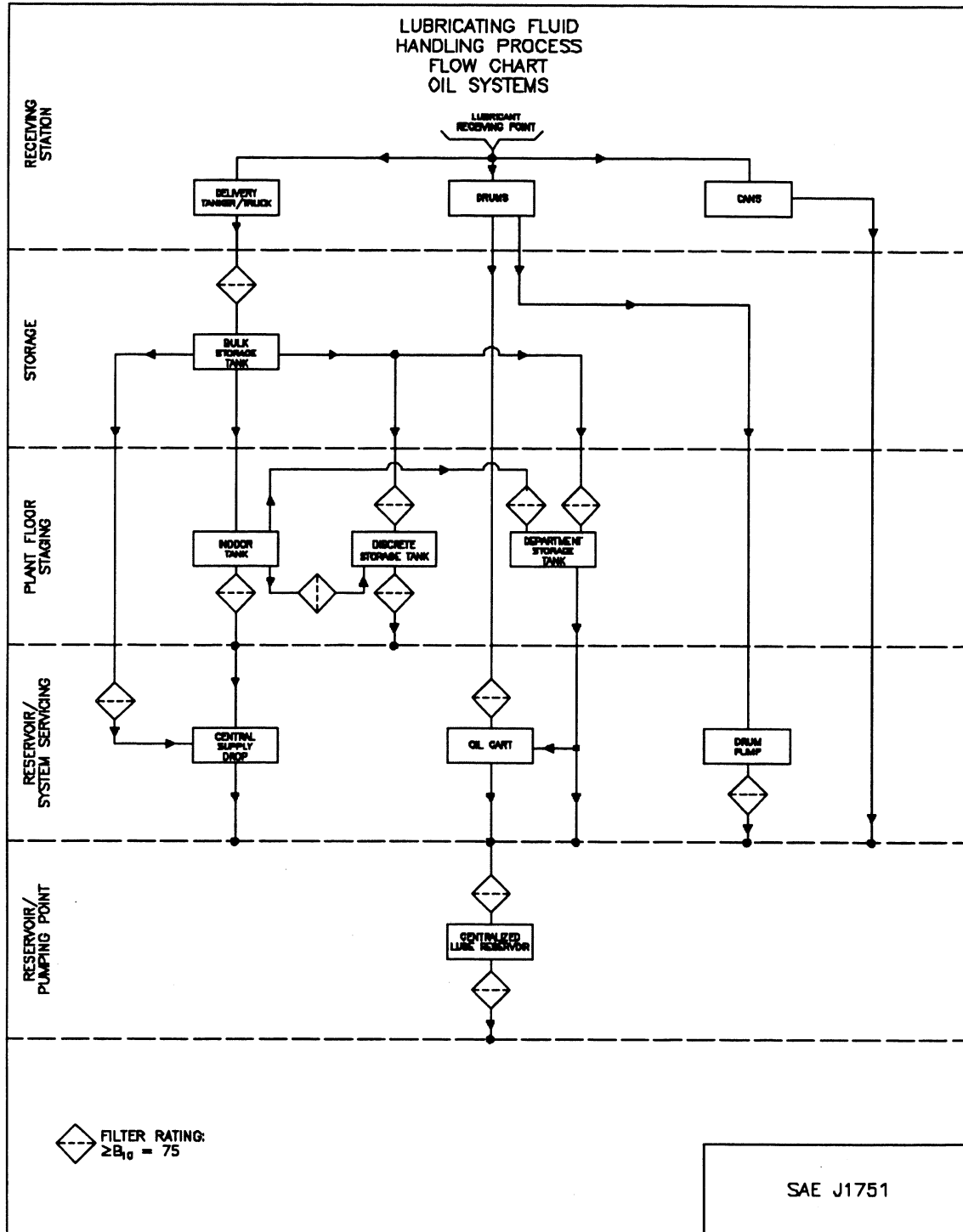


FIGURE 1—RECOMMENDATIONS FOR FILTER PLACEMENTS WITH OILS

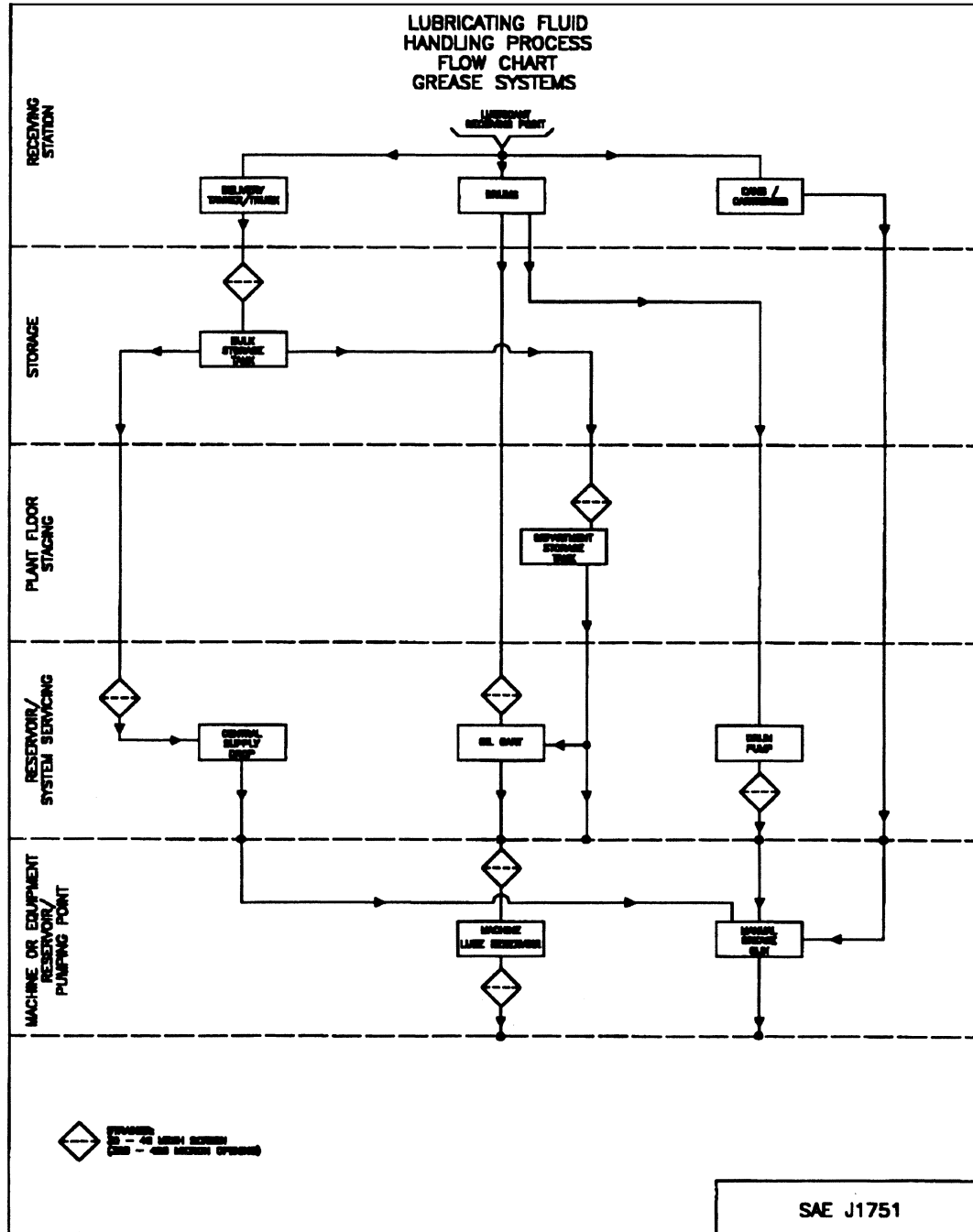


FIGURE 2—RECOMMENDATIONS FOR STRAINER PLACEMENTS WITH GREASES

- 4.2.7 Lubricant storage areas should be kept clean. Special containers for lubricants should be utilized.
- 4.2.8 Storing lubricants outdoors without protection from environmental conditions is not recommended.
- 4.2.9 Lubrication service carts are recommended and should include the following features:
- a. Dedicated lubricant reservoirs
 - b. Necessary filters/breathers
 - c. Appropriate hoses and nozzles
 - d. Necessary pumps
 - e. Pneumatic or electric power for pumps
 - f. Tool boxes
 - g. Storage for new and used filter elements
 - h. Fill procedures
- 4.2.10 Dedicated storage and handling systems for dispensing lubricants are recommended and should include the following features:
- a. Labeled storage reservoirs with fluid level gages
 - b. Reservoir numbering with matching spigot number for operator identification
- 4.2.11 Equipment for lubrication maintenance should be considered:
- a. Equipment for reservoir pump-outs
 - b. Bulk tank pumps
 - c. Equipment for transporting lubricant
 - d. Manual equipment for drum handling
 - e. Drum pumps for oils and greases
 - f. Drum accessories, covers, follower plates (grease drums), bung bushings, pump hoists
 - g. Transfer pumps
 - h. Portable filler pumps, control valves, metering valves, and nozzles
 - i. Various oil containers by size and type
 - j. Grease guns, connectors, and hoses
 - k. Hose reels and accessories
- 4.2.12 Filling of reservoirs should consider centralized lubricant service areas. Large or complex equipment may require the use of more than one service area.
- 4.2.12.1 Elevated and difficult to access lubrication points should be piped to a working level service area.
- 4.2.12.2 Lubrication fill points should be 0.6 m to 1.5 m (24 in to 60 in) from working level wherever possible.
- NOTE—Working level may not be same as floor level.
- 4.2.13 Sealed reservoirs should be used to minimize contamination.
- NOTE—Sealed reservoirs require precautions to prevent hazards of pressurizing.
- 4.2.13.1 The lubricant filling process used to replenish sealed reservoirs should include breathers, where appropriate.
- 4.2.13.2 Fill points on sealed reservoirs should be equipped with a quick disconnect fitting and dust cap as agreed between supplier and purchaser.
- 4.2.14 Where automatic oil fill systems are used, the reservoir shall include a float valve or similar means to control the oil level.

4.3 Specification Requirements

- 4.3.1 SPECIAL SITE CONDITIONS—The supplier and purchaser shall discuss special site conditions and the design of the system shall take into account these conditions. Examples of the information required are:
- Vibration, excessive contamination, high humidity
 - The siting of equipment at altitudes that could affect operating performance
 - The possible existence of a fire hazard
 - The standard of maintenance available
 - Electrical network details: i.e., voltage and its tolerance, frequency, available power, etc.
 - Protection for electrical devices
- 4.3.2 The full range of ambient temperatures to which the equipment will be subjected shall be stated. The equipment shall operate satisfactorily under these conditions.
- 4.3.3 MAINTENANCE REQUIREMENTS
- 4.3.3.1 Lubrication equipment and piping shall be accessible and so mounted as to not interfere with the adjustment or maintenance of the equipment. Particular attention shall be given to the location of equipment which needs regular maintenance.
- 4.3.3.2 Components should be installed so that they can be easily replaced without dismantling other machine components.
- Total loss system reservoirs shall provide ≥ 200 h of operation without filling.
 - Reservoir lubricant level indicators shall be visible to personnel while filling.
 - All components shall be installed in accordance with the manufacturer's recommendations.
- 4.3.4 Where requested on the purchaser's inquiry and confirmed on the supplier's quotation, a piping layout shall be furnished by the supplier. Photographs which clearly show the piping arrangement and assembly may be substituted by agreement.
- 4.3.5 The supplier should use commercially available parts (keys, bearings, packings, seals, washers, plugs, fasteners, etc.) and part configurations (shaft and spline sizes, port sizes, mountings, interface patterns, etc.) which are manufactured to established International and National Standards and which provide for uniform coding.
- 4.3.6 The supplier shall provide the purchaser with maintenance data for all lubrication equipment that clearly:
- Describe start-up and shut-down procedures
 - Describe adjustment procedures
 - Indicate external lubrication points and the type of lubricant required
 - State maintenance procedures for unique assemblies
 - Locate all equipment that require regularly scheduled maintenance
 - Give further identification of parts in the lubrication system which are commercially available or manufactured to an International or National Standard that provides for uniform coding. The identification shall be the manufacturer's part number or as provided by the code in the standard.
 - List recommended spare parts.
- 4.3.7 TESTING AND VERIFICATION
- 4.3.7.1 Lubrication systems shall be performance tested and verified to conformance with this document and the purchaser's specifications.

4.3.7.2 There shall be no unintentional leakage at the time of purchaser's acceptance.

4.3.8 Data to be provided by the supplier:

4.3.8.1 *Final Data*

- a. Final diagrams, drawings, and texts, including the maintenance data, shall conform to the equipment shipped and be forwarded to the purchaser not later than the time of equipment delivery, unless otherwise agreed between supplier and purchaser.
- b. Where requested on the purchase order or the inquiry, final diagrams and drawings shall be on reproducible material which shall not be folded.

4.3.8.2 *Maintenance Manuals*—The supplier shall advise the purchaser regarding the availability of maintenance manuals for standard equipment as described in 4.3.6.

4.3.8.3 *Modifications*—Whenever modifications are made by the supplier, they shall be recorded and the purchaser shall be notified.

4.3.9 PREPARATION FOR TRANSPORTATION

4.3.9.1 *Identification of Piping*—Where construction of the equipment requires transporting in sections, removed piping runs and their corresponding terminal ports and/or connectors shall be identically marked.

4.3.9.2 *Packaging*—All equipment shall be packaged in a manner that protects it from damage and distortion and preserves its identification during transportation.

4.3.9.3 *Sealing of Openings*—Exposed openings in equipment shall be sealed and male threads shall be protected from damage during transportation. These seals shall only be removed immediately prior to reassembly. Only sealing caps that require their removal before reassembly can take place shall be used.

4.3.9.4 *System Cleanliness*—Strainer and filter elements shall be cleaned or changed, as applicable, before the equipment is reassembled.

4.4 Presentation of Technical Data—In the preparation of circuit diagrams and technical data, the following shall be adopted.

4.4.1 Circuit diagrams shall use symbols from ISO 1219-1 or as agreed between supplier and purchaser.

4.4.2 The symbols shall, unless otherwise indicated, represent units at rest (that is, all power off, circuits depressurized and ready for start).

4.4.3 Symbols shall be positioned on the diagram so that the circuit is easy to follow.

4.4.4 Cross-over of lines should be kept to a minimum.

4.4.5 Each item on the circuit diagram should have a separate designation or identification .

4.4.6 Lubrication points, test points, bleed points, and orifice fittings should be identified .

4.4.7 TECHNICAL DATA—The following information shall be included on or with the circuit diagram.

- a. Identification of all lubrication equipment by name, catalog number, serial or design number, and the manufacturer's name
- b. The size, wall thickness, and/or specification of pipe, tube, and hose lines
- c. The pressure setting of each pressure control device
- d. Type of strainers and filters, and details and quantities of replacement elements
- e. When specified, a sequence chart, for example: time (or other method) range of cycle, and data or text, or both, showing operation of system including function(s) of the related electrical and mechanical controls
- f. The type and location of test and bleed points in the circuit
- g. All lubricant information
- h. Pump displacement
- i. Reservoir capacity(s)
- j. Cycling frequency and monitor time (as applicable)
- k. Diagnostics
- l. Associated electrical devices

4.4.8 Where specified, a system data chart should be provided. The chart should harmonize with the circuit diagram and include but not be limited to the following information.

- a. Identification and location of each lubrication point coincident with circuit diagram
- b. Number of lubrication points/bearing (as applicable)
- c. Bearing type (as applicable)
- d. Speed and load of each bearing (as applicable)
- e. Bearing size (as applicable)
- f. Bearing area (as applicable)
- g. Bearing lubricant volume/hour
- h. Total lubricant volume/hour
- i. Metering valve adjustment settings

4.5 Identification

4.5.1 COMPONENTS—The following particulars shall be shown in a permanent and readily visible form on all components.

- a. Manufacturer's name and identification (type or model number)
- b. Test and bleed ports shall be plainly and permanently identified with the same identification used in the circuit diagram
- c. Fill point identification labels to identify the type of lubricant and the customer's identification code number for the lubricant, at each fill point on the machine

4.5.2 ELECTRICAL DEVICES—Electrical operators shall be identified on the electrical and lubrication circuit diagrams with the same device and electrical address identification.

4.5.3 When internal filters are used (pump outlets, etc.), labels to identify their location and maintenance information shall be posted adjacent to the equipment.

4.5.4 CENTRAL STATION IDENTIFICATION—A label shall be provided for each central station component and located where it can be easily read by the equipment operator. The information shall be relevant and easily understood.

4.5.4.1 Signal lamps and push buttons shall be identified as to their purpose or function.