

Submitted for recognition as an American National Standard

**HYDRAULIC POWER UNITS 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.

Hydraulic power units provided to the automotive industry have historically been designed around a diversity of specifications/standards that often do not meet cost or performance expectations. The automotive industry and machine tool suppliers are pursuing common specifications that use worldwide industry standards as a base.

These recommended practices represent a consensus of automotive users and power unit manufacturers created to compliment ISO, ANSI, and other industry hydraulic power unit standards and to provide more commonality. These recommended practices enhance:

- a. Reliability
- b. Value added designs
- c. New technology
- d. Maintainability
- e. Commitment for zero leakage

1. Scope—This SAE Standard defines the expectations for free-standing, nonintegral, nonpressurized reservoir, flooded inlet type, industrial hydraulic power units used on machine tools and equipment for the automotive industry.

These exclude power units used for intermittent and/or noncontinuous duty cycle and pressurized vessels, such as accumulators and air over oil systems.

Objectives were set and accomplished to develop a consensus of common features which enhance the power unit performance, manufacturing quality, and maintainability. Some of those features are:

- a. Identification
- b. Common sizes and construction
- c. Conductors and connectors
- d. Pump/motor groups
- e. Filters

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Documents

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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 J518—Hydraulic Flanged Tube, Pipe, and Hose Connections, Four-Bolt Split Flange Type

SAE J1926-1988—Straight Thread O-Ring Boss Port

SAE J2244—Connections for Fluid Power and General Use—Ports and Stud Ends with ISO 261 Threads and O-Ring Sealing

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

ANSI B3.1.1—Power Piping

ANSI B93.41M-1976(R1982)—Requirements for Non-Integral Industrial Fluid Power Hydraulic Power Units

ANSI/(NFPA/JIC) T2.24.1-1991—Hydraulic Fluid Power—Systems Standard for Stationary Industrial Machinery

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

ISO 6149-2 (SAE J2244/2)—Connections for fluid power and general use—Ports and stud ends with ISO 261 threads and O-ring sealing—Part 2: Heavy-duty (S series) stud ends—Dimensions, design, test methods and requirements

ISO 4406—Hydraulic fluid power—Fluids—Methods for coding level of contamination by solid particles

ISO 6162—Hydraulic fluid power—Four-screw split-flange connections for use at pressures of 2.5 MPa to 40 MPa (25 bar to 400 bar)—Type I metric series and type II inch series

2.1.4 NEMA PUBLICATION—Available from National Electrical Manufacturers Association, 2101 L Street, NW, Suite 300, Washington, DC 20037.

Nema MG1-11.01

2.2 Related Publication—The following publications are provided for information purposes only and are not a required part of this document.

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

SAE J1227-1986—Assessing Cleanliness of Hydraulic Fluid Power Components and Systems

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

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

ANSI B93.18-1978(R1987)—Non-Integral Industrial Fluid Power Hydraulic Reservoirs

ANSI B93.2-1986—Fluid Systems and Products—Glossary

ANSI B93.19-1972—Hydraulic Fluid Power—Particulate Contamination Analysis—Extraction of Fluid Samples from Lines of an Operating System

ANSI B93.30M-1980—Hydraulic Fluid Power—Contamination Analysis Data—Reporting Method

2.2.3 DIN PUBLICATION—Available from Deutsches Institut für Normung, Bismarckstrasse 4, D-1000 Berlin 30, West Germany.

DIN 24339—Standards for Reservoirs

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

ISO 1000-1981—SI units and recommendations for the use of their multiples and of certain other units

ISO 1219-1—Fluid power systems and components—Graphic symbols

ISO 5598—Fluid power systems and components—Vocabulary

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

NFPA/T2.10.1M-1978—Metric Units for Fluid Power Applications

3. **Definitions**

3.1 Overhead Power Unit—Hydraulic power unit with pump(s) and motor mounted under reservoir. Pump/motor group can be inline with reservoir length or when using multiple pumps and motors, the pumps and motors are 90 degrees to the reservoir length.

3.2 L-Shape Power Unit—Hydraulic power unit with reservoir elevated high enough to provide bottom entry for pump inlet connection. Pump(s) and motor mounted inline and alongside of reservoir.

3.3 T-Shape Power Unit—Same as L-Shape but provides for multiple pumps and motors by mounting on both sides of reservoir.

3.4 Miniature Power Unit—Power units as catalogued by various manufacturers with vertically mounted pump and motor. Submerged pump with reservoir volumes up to 113.5 L (30 gal). Unique recommended practices for these power units are detailed in 4.9.

4. **Requirements**

4.1 Identification—All power units shall have an identification nameplate stating: "This power unit meets or exceeds the latest revisions of ANSI/B93.41 and the recommended practices of SAE J1689" (see Figure 1).

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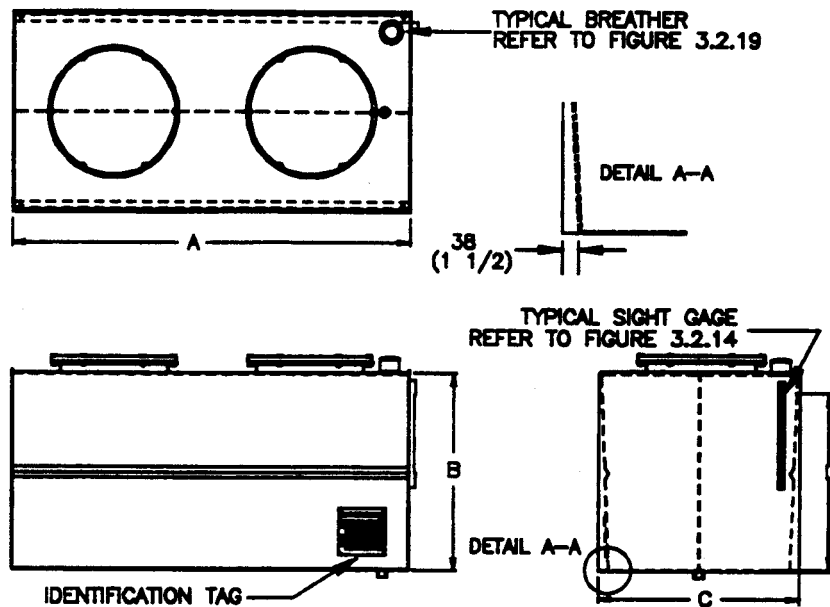
ALL DIMENSIONS IN MILLIMETERS
(INCHES IN PARENTHESIS)

FIGURE 1—IDENTIFICATION PLATE

- 4.1.1 The identification plate shall be made of a metal, a minimum of 0.8 mm (0.031 in) thick with stamped or etched figures, or shall be engraved laminated plastic, a minimum of 1.6 mm (0.063 in) thick, having a light surface and a dark core.
- 4.1.2 The identification plate shall be mechanically fastened to a raised pad that is in a visible location. The plate shall include the following information:
- A. System design operating pressure, kPa (psi)
 - B. Maximum system operating temperature, °C (°F)
 - C. Reservoir capacity, liters (gallons)
 - D. Fluid type and viscosity range, description, and ISO grade
 - E. Design maximum contamination level, ISO code (design target)
 - F. Purchaser's hydraulic drawing number, same as schematic
 - G. Equipment supplier's name and serial number
 - H. Date of manufacture
 - I. Flow for each pump, liters/min (gpm)
- 4.1.3 Machines using more than one hydraulic power unit shall designate the stations or operations being supplied from each unit on the nameplate.
- 4.1.4 Nameplate character size shall not be smaller than 6 mm (0.25 in).

4.2 Construction—(See Figure 2.)

There are 7 reservoir sizes: SAE 10, SAE 20, SAE 40, SAE 60, SAE 80, SAE 100, SAE 120.



S.A.E. PART NUMBER	TANK DIMENSIONS									
	'A' LENGTH	'B' HEIGHT	'C' WIDTH	LITERS (GAL)	'D' FULL MARK	LOW LEVEL WARNING HEIGHT	SHUT DOWN CAPACITY	SHUT DOWN HEIGHT	SHUT DOWN CAP.	CAPACITY ACTUAL % AIRSPACE
SAE10	914 (36)	356 (14)	457 (18)	106 (28)	298 (11.75)	225 (8.875)	77 (20)	152 (6)	52 (13.7)	127 (33.65) 20%
SAE20	1219 (48)	506 (20)	457 (18)	208 (55)	432 (17)	342 (12.75)	147 (39)	216 (8.50)	98 (26)	245 (64.75) 14%
SAE40	1270 (50)	686 (27)	610 (24)	416 (110)	603 (23.75)	452 (17.812)	294 (78)	302 (12.0)	198 (52)	473 (125) 14%
SAE60	1524 (60)	864 (34)	610 (24)	625 (165)	759 (29.875)	565 (22.25)	441 (117)	381 (15)	298 (79)	712 (188) 12%
SAE80	1829 (72)	864 (34)	711 (28)	833 (220)	718 (28.25)	565 (22.25)	632 (167)	381 (15)	426 (113)	1006 (268) 17%
SAE100	1829 (72)	864 (34)	864 (34)	1041 (275)	721 (28.375)	565 (22.25)	788 (208)	381 (15)	531 (140)	1245 (329) 16%
SAE120	1829 (72)	914 (36)	914 (36)	1248 (330)	813 (32)	565 (22.25)	842 (223)	381 (15)	568 (150)	1404 (371) 11%

ALL DIMENSIONS IN MILLIMETERS or LITERS
(INCHES or GALLONS IN PARENTHESIS)

FIGURE 2—STANDARD RESERVOIRS

4.2.1 Reservoir material thickness shall be a minimum of:

Ends and bottom: 4.5 mm (0.179 in) for all sizes.

Top and sides: 3 mm (0.119 in) sizes 10 through 60 and 4.5 mm (0.179 in) sizes 80 through 120 (see Figure 3).

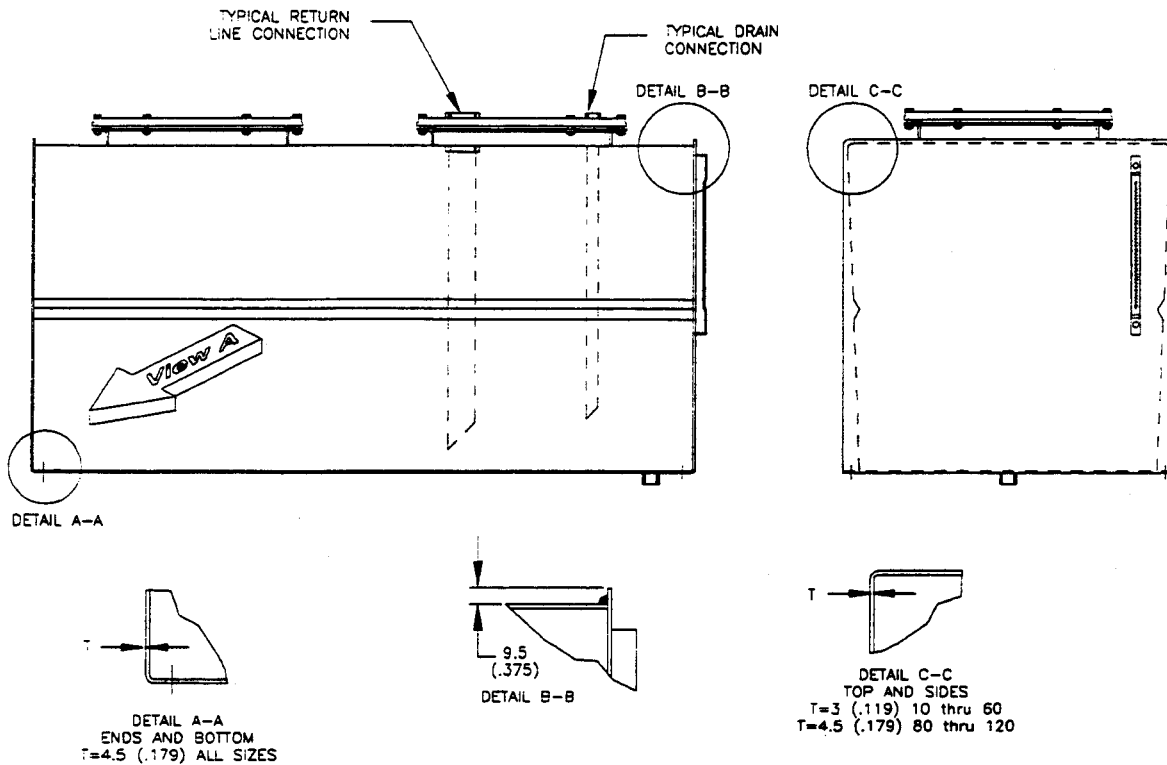


FIGURE 3—MATERIAL THICKNESS

4.2.2 Reservoir feet are integral (see Figure 4).

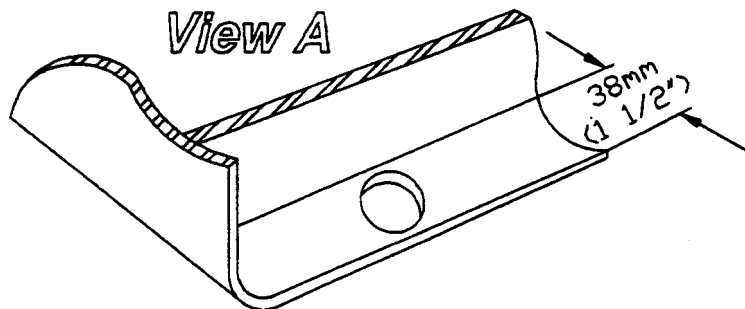
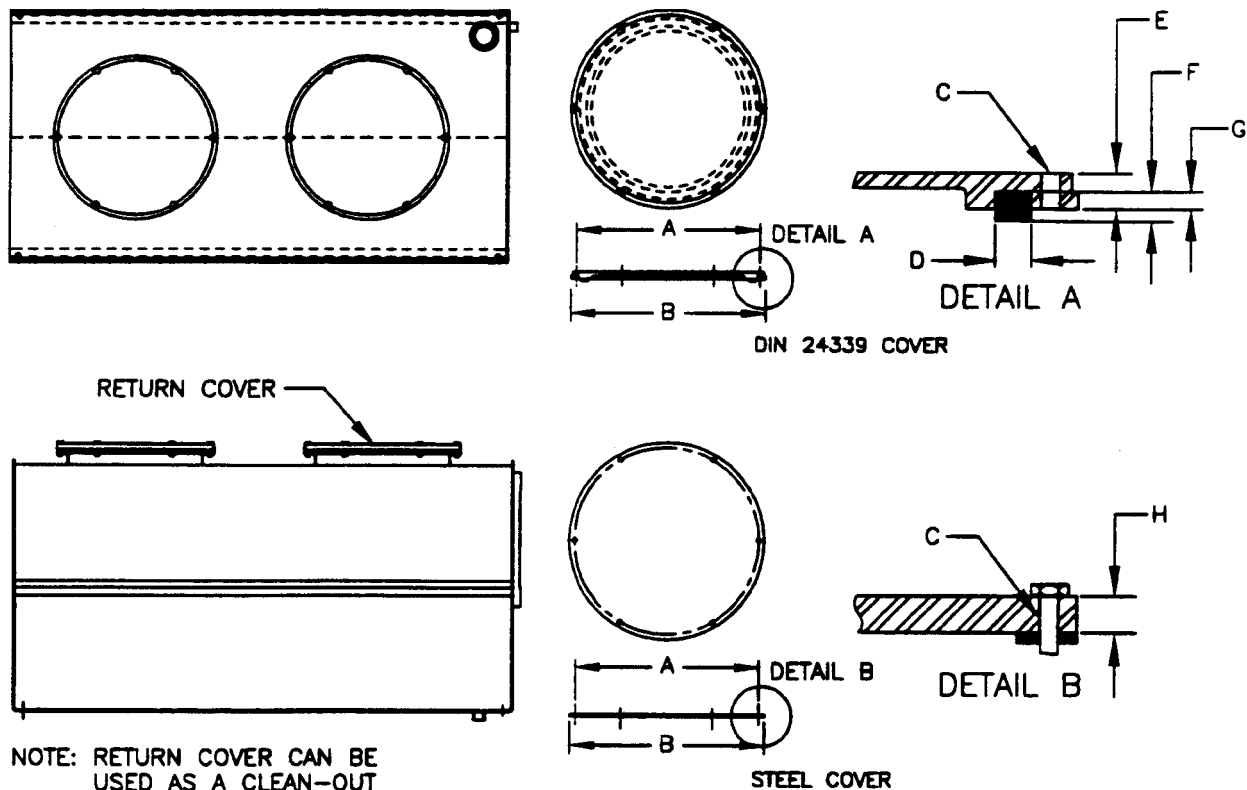


FIGURE 4—INTEGRAL FEET

4.2.3 Reservoirs shall use round, top mounted clean-out covers (see Figure 5).

4.2.3.1 Reservoir sizes SAE10 through 60 are constructed with 349 mm (14 in) covers.

4.2.3.2 Reservoir sizes SAE80 through 120 are constructed with 476 mm (19 in) covers.



S.A.E. PART NUMBER	COVER DIMENSIONS								NO. OF HOLES
	A BOLT CIRCLE	B COVER O.D.	C	D	E	F	G	H	
SAE10 thru SAE40	324 (12.75)	350 (13.78)	CLEAR. HOLE FOR M10x30	18 (.708)	18 (.708)	16 (.630)	10 (.393)	6.3 (.25)	6
SAE60 thru 120	449 (17.68)	475 (18.7)	CLEAR. HOLE FOR M10x30	18 (.708)	18 (.708)	16 (.630)	10 (.393)	6.3 (.25)	

FIGURE 5—CLEAN-OUT COVERS

- 4.2.4 Top covers shall be mounted to a raised lip on the reservoir to prevent entry of contamination when cover is removed (see Figure 6).
- 4.2.4.1 Top covers shall have a seal that remains with the cover when removed.
- 4.2.4.2 The cover seal material shall be compatible with the fluids being used in the reservoir.
- 4.2.4.3 Torque specifications (9 N-m (7 lb-ft)) for the cover attachment bolts shall be identified on the covers.

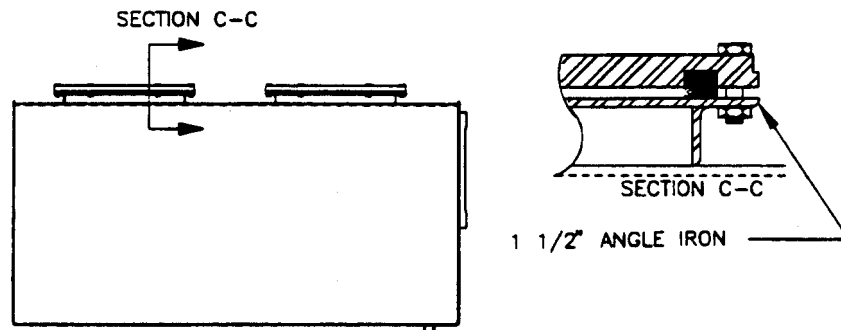


FIGURE 6—COVER RAISED LIP

4.2.5 Power units frame material shall be (see Figure 7):

Sizes 10 through 60: 50 mm (2 in) square tubing, minimum
 Sizes 80 through 120: 75 mm (3 in) square tubing, minimum

4.2.5.1 Alternative frame construction materials and methods may be considered, and/or encouraged, where there is engineering evidence available resulting in noise reduction and/or other enhancements. Materials and methods should be appropriate to the design.

4.2.6 Power units shall be a maximum height of 2.2 m (7 ft).

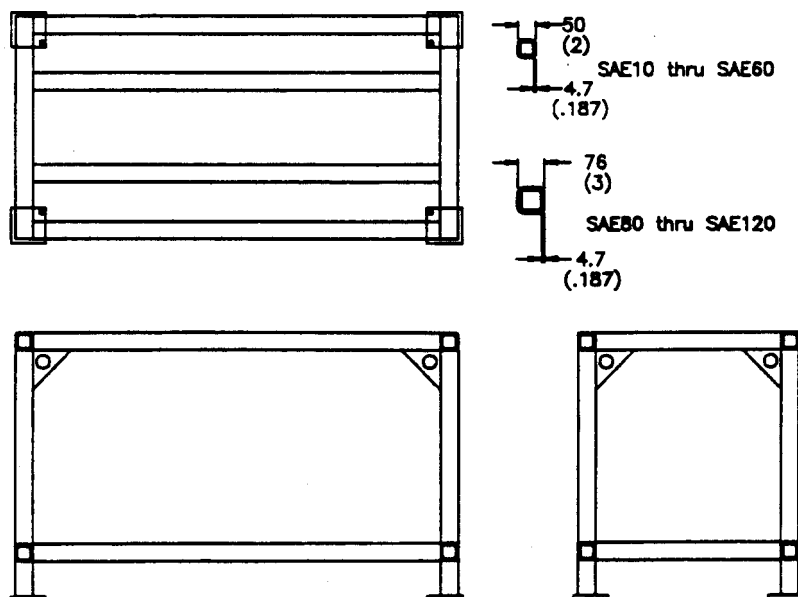


FIGURE 7—FRAME MATERIAL

4.2.7 Power unit layout shall assign access dimensions for one side, one end, or both for components requiring preventive maintenance services like filters and accumulators (see Figure 8).

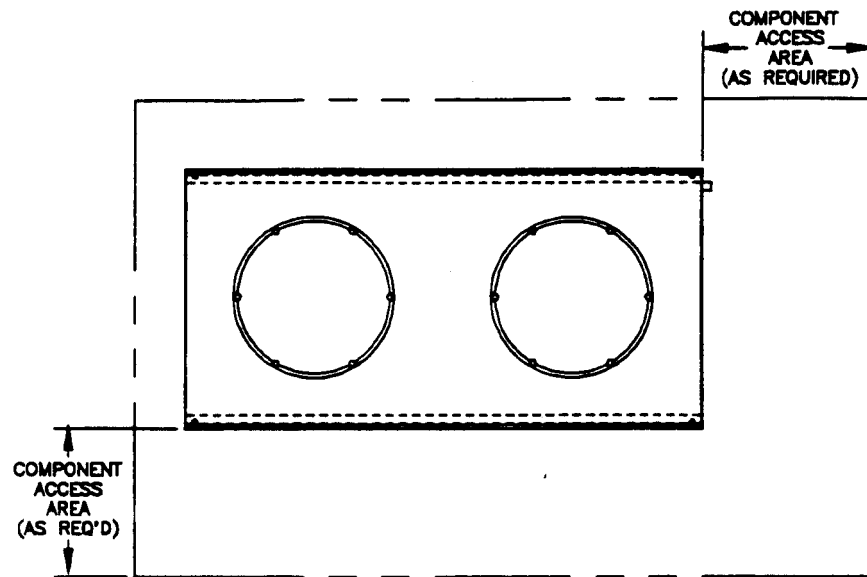


FIGURE 8—EXAMPLE ACCESS LAYOUT

4.2.8 Provision is made for engineering selection/preference of the items in Figure 9:

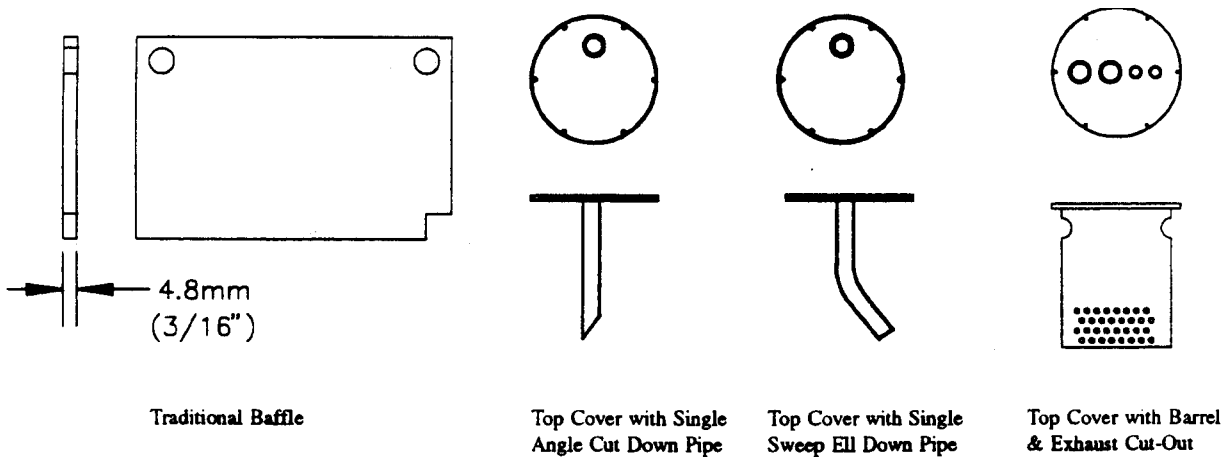


FIGURE 9—BAFFLE AND TOP COVERS OPTIONS

4.2.8.1 Baffle cut-out dimensions, when used, shall be calculated to obtain a reservoir circulation velocity of 61 cm (2 ft)/s at a volume rate equal to 50% of the reservoir volume (see Figure 10).

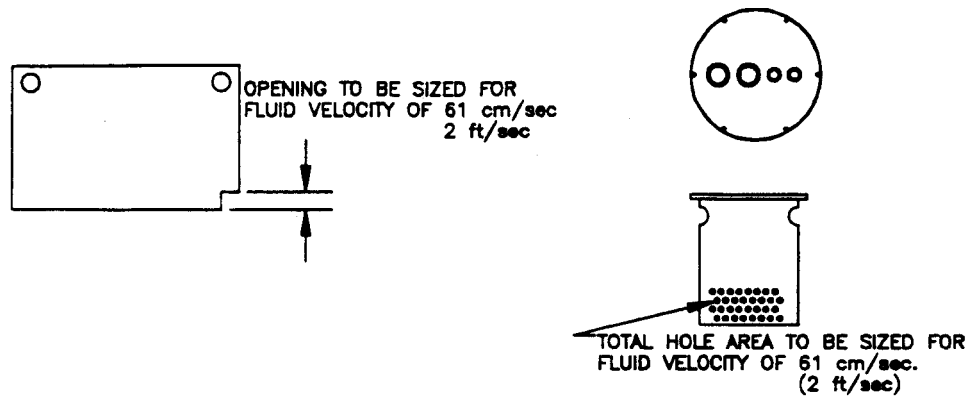


FIGURE 10—BAFFLE CUT-OUT DIMENSIONS

- 4.2.9 A stiffening "crease" or "cross break" in reservoir sidewall for noise attenuation is recommended (see Figure 11).

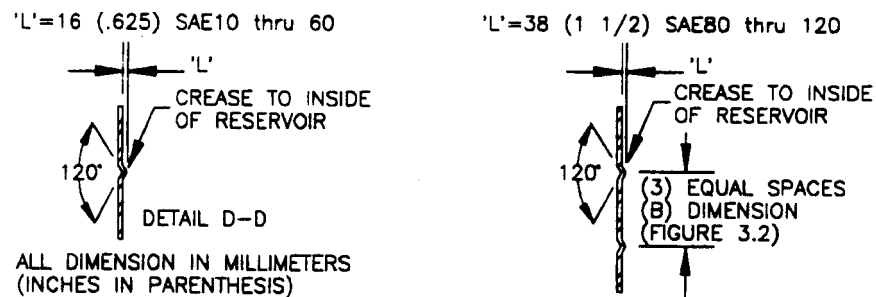


FIGURE 11—STIFFENING CREASE

- 4.2.10 Lifting provisions for handling of the power unit shall be included and attached to the containment tray or framework assembly. They shall not be attached to the reservoir (see Figure 12).

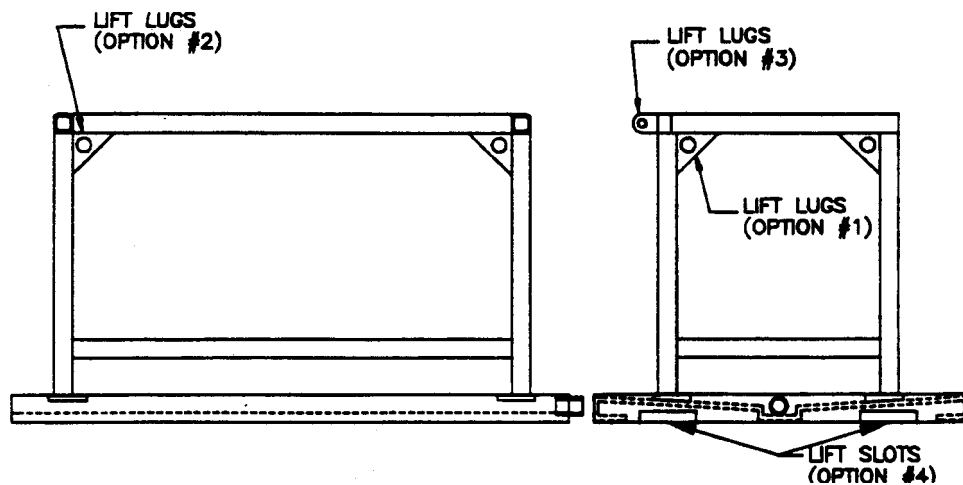


FIGURE 12—LIFTING PROVISIONS

4.2.11 System line connections to the reservoir should be through the top cover.

4.2.11.1 Reservoirs shall have a spare return port (plugged) and a spare system drain port (plugged).

4.2.11.2 Top cover connections should be minimized. Manifolds shall be used to join multiple drain and/or return connections. Only one line shall then be routed from the manifold to a single connection on the cover (see Figure 13).

4.2.11.3 Manifolds shall be mounted at, or adjacent to the machine.

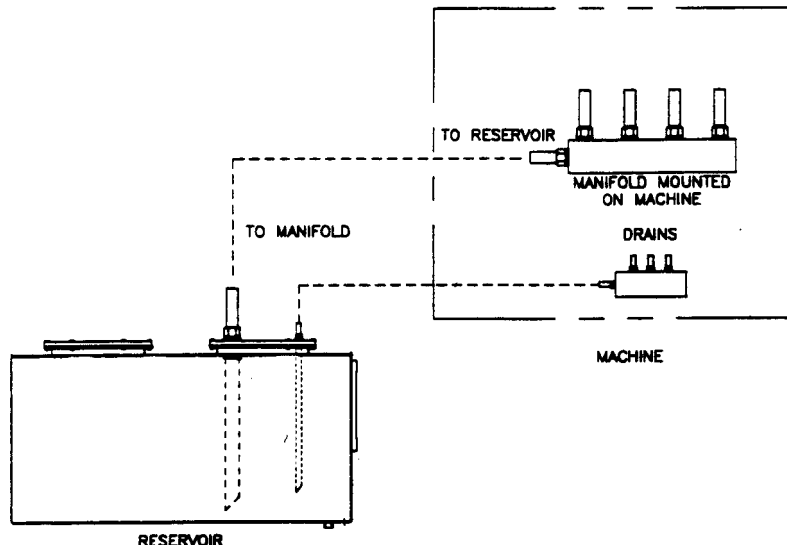


FIGURE 13—RETURN AND DRAIN LINE MANIFOLDS

4.2.11.4 Pump case drain(s) and gage drain(s) should be through the bottom of the reservoir. Provide labels to identify connections on reservoir (see Figure 14).

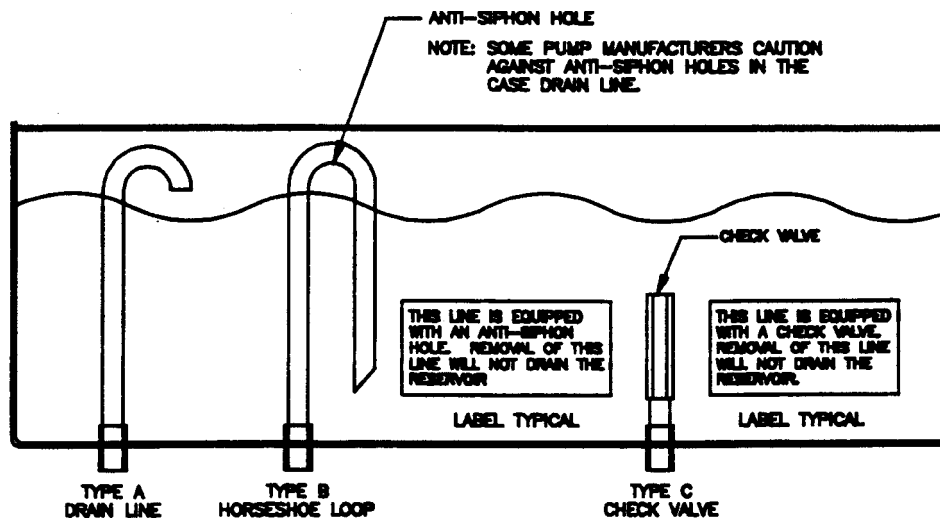


FIGURE 14—PUMP CASE AND GAGE DRAIN CONNECTIONS

4.2.12 Connection for emptying of the reservoir shall be in the bottom (see Figure 15).

4.2.12.1 The connection shall be M42 x 2 (ISO 6149) or SAE #16 (SAE J1926).

4.2.12.2 The connection shall include a shut-off valve with plug.

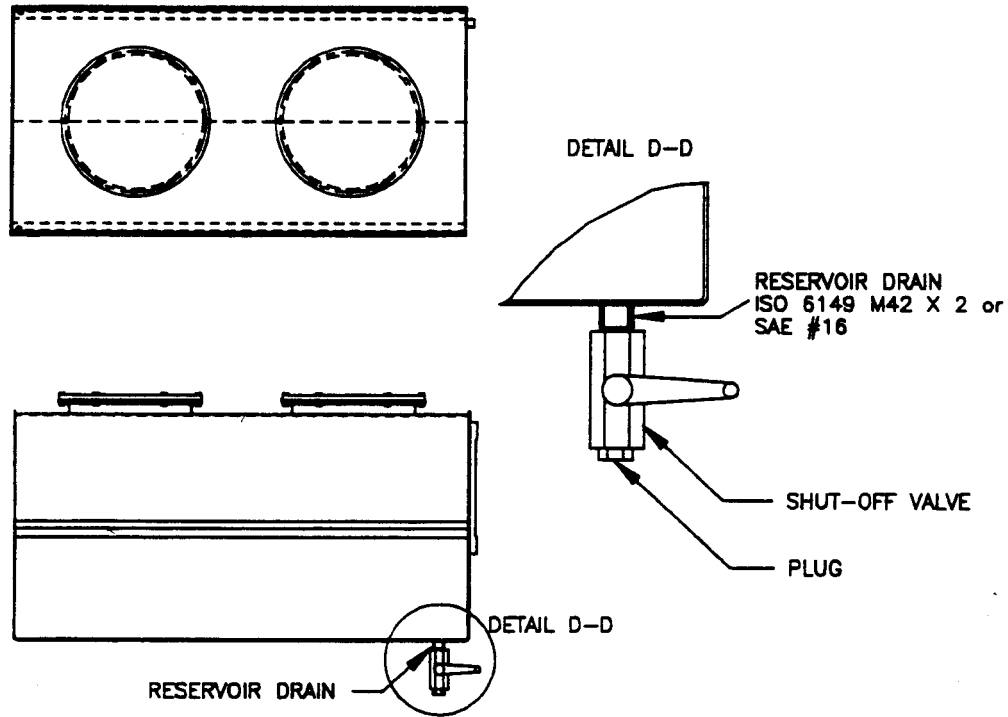


FIGURE 15—RESERVOIR DRAIN

4.2.13 Low levels dimensions are predetermined to fit the SAE reservoir sizes (see Figure 16).