



SURFACE VEHICLE RECOMMENDED PRACTICE

J1273™

SEP2020

Issued 1979-09
Revised 2019-10
Reaffirmed 2020-09

Superseding J1273 OCT2019

Recommended Practices for Hydraulic Hose Assemblies

RATIONALE

SAE J1273 has been reaffirmed to comply with the SAE Five-Year Review policy.

FOREWORD

This SAE Recommended Practice is intended as a guide to consider when selecting, routing, fabricating, installing, replacing, maintaining, and storing hose for fluid-power systems. It is subject to change to keep pace with experience and technical advances. For those new to hose use in fluid-power systems, this guide outlines practices to note during each phase of system design and use. Experienced designers and users skilled in achieving proper results, as well as the less experienced, can use this outline as a list of considerations to keep in mind.

Fluid power systems are complex and require extensive knowledge of both the system requirements and the various types of hose. Therefore, all-inclusive, detailed, step-by-step instructions are not practical and are beyond the scope of this document. Less experienced designers and users who need more information can consult specialists such as hose suppliers and manufacturers. This guide can improve the communication process.

SAFETY CONSIDERATIONS

These recommended practices involve safety considerations; note these carefully during all phases of design and use of hose systems. Improper selection, fabrication, installation, or maintenance of hose and hose assemblies for fluid-power systems may result in serious personal injury or property damage. These recommended practices can reduce the likelihood of component or system failure, thereby reducing the risk of injury or damage.

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2020 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
<http://www.sae.org>

SAE WEB ADDRESS:

Full document details: SAE J1273_202009

For more information on this standard, visit
https://www.sae.org/standards/content/J1273_202009

Documents
Document Sharing Hub

TABLE OF CONTENTS

1.	SCOPE.....	4
2.	REFERENCES.....	4
2.1	Applicable Publications	4
2.1.1	SAE Publications.....	4
2.1.2	ISO Publications.....	4
3.	DEFINITIONS	4
4.	SAFETY CONSIDERATIONS.....	5
4.1	Fluid Injections	5
4.2	Whipping Hose.....	5
4.3	Burns from Conveyed Fluids.....	5
4.4	Fire and Explosions from Conveyed Fluids	5
4.5	Fire and Explosions from Static-Electric Discharge	6
4.6	Electrical Shock.....	6
4.7	Mechanisms Controlled by Fluid Power.....	6
5.	HOSE SELECTION AND ROUTING	6
5.1	System Pressures	6
5.2	Suction	6
5.3	External Pressure.....	6
5.4	Temperature.....	7
5.5	Permeation.....	7
5.6	Compatibility Between Hose Materials and Hydraulic Fluids.....	7
5.7	Environment.....	7
5.8	Static-Electric Discharge	8
5.9	Sizing.....	8
5.10	Unintended Uses.....	8
5.11	Specifications and Standards	8
5.12	Unusual Applications.....	8
5.13	Hose Cleanliness	8
5.14	Hose Fittings	8
5.15	Vibration	8
5.16	Hose Cover Protection	8
5.17	External Physical Abuse	9
5.18	Swivel-Type Adapters	9
5.19	Live Swivels	9
5.20	Slings and Clamps	9
5.21	Minimum Bend Radius	10
5.22	Elbows and Adapters	11
5.23	Lengths	11
5.23.1	Motion Absorption	11
5.23.2	Hose and Machine Tolerances	12
5.23.3	Hose Length Change Due to Pressure	12
5.24	Hose Movement and Bending.....	12
5.24.1	Bend in Only One Plane to Avoid Twisting	13
5.24.2	Prevent Hose Bending in More Than One Plane.....	14
6.	HOSE-ASSEMBLY FABRICATION	14
6.1	Component Inspection	14
6.2	Hose Fittings	15
6.3	Hose and Fitting Compatibility	15
6.4	Hose Assembly Equipment.....	15
6.5	Safety Equipment.....	15
6.6	Reuse of Hose and Fittings.....	15
6.7	Cleanliness of Hose Assemblies.....	15

6.8	Temperature.....	15
6.9	Assembly inspection	15
6.10	Marking.....	15
7.	HOSE INSTALLATION AND REPLACEMENT	16
7.1	Pre-Installation Inspection.....	16
7.2	Handling During Installation	16
7.3	Twist Angle and Orientation.....	16
7.4	Securement and Protection	16
7.5	Routing	16
7.6	Assembly Torque	17
7.7	System Checkouts	17
7.7.1	To avoid injury during system checkouts:	17
8.	MAINTENANCE INSPECTION	17
8.1	Inspection Frequency.....	17
8.2	Visual Inspection (Hose and Fittings)	17
8.3	Visual Inspection (All Other Components).....	18
8.4	Functional Test.....	19
9.	HOSE STORAGE	19
9.1	Age Control	19
9.2	Storage.....	19
10.	NOTES	20
10.1	Revision Indicator.....	20
APPENDIX A	(INFORMATIVE) EXAMPLES OF ACTUAL FAILURE RESULTING FROM IMPROPER USE.....	21
Figure 1	Prevention of external damage	9
Figure 2A	Minimum bend radius.....	10
Figure 2B	Minimum bend radius.....	10
Figure 3	Elbows and adapters.....	11
Figure 4	Motion absorption.....	11
Figure 5	Hose and machine tolerances	12
Figure 6	Hose length change due to pressure	12
Figure 7A	Bend in only one plane to avoid twisting.....	13
Figure 7B	Bend in only one plane to avoid twisting.....	13
Figure 8	Prevent hose bending in more than one plane	14
Figure 9	Twist angle and orientation	16
Table 1	Items related to visual inspection of hose and hose fittings.....	18

1. SCOPE

SAE J1273 provides guidelines for selection, routing, fabrication, installation, replacement, maintenance, and storage of hose and hose assemblies for hydraulic fluid-power systems. Many of these SAE Recommended Practices also may be suitable for other hoses and systems.

2. REFERENCES

2.1 Applicable Publications

The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J343	Test and Test Procedures for SAE 100R Series Hydraulic Hose and Hose Assemblies
SAE J514	Hydraulic Tube Fittings
SAE J517	Hydraulic Hose
SAE J1754-1	Hose Assemblies, Rubber, Hydraulic, Steel Wire Reinforced - Part 1: Procurement Document
SAE J1754-2	Hose Assemblies, Rubber, Hydraulic, Steel Wire Reinforced - Part 2: Ordering Information
SAE J1754-3	Hose Assemblies, Hydraulic, J517 100R Series Hose - Part 3: Procurement and Ordering Information

2.1.2 ISO Publications

Copies of these documents are available online at <http://webstore.ansi.org/>.

ISO 3457	Earth Moving Machinery - Guards and Shields - Definitions and Specifications
ISO 8331	Rubber and Plastics Hoses and Hose Assemblies - Guide to Selection, Storage, Use and Maintenance

3. DEFINITIONS

These explanations serve only to clarify this document and are not intended to stand alone. They are presented sequentially, with the former helping to explain the latter.

3.1 FLUID POWER

Energy transmitted and controlled using pressurized hydraulic fluids or compressed air.

3.2 HOSE

Flexible conductor. In this document, the term hose also may refer to a hose assembly with related accessories used in fluid power applications.

3.3 HOSE FITTING OR FITTING

Connector which can be attached to the end of a hose.

3.4 HOSE ASSEMBLY

Hose with hose fittings attached.

3.5 HOSE FAILURE

Occurrence in which a hose stops meeting system requirements.

3.6 HOSE SERVICE LIFE

Length of time a hose meets system requirements without needing replacement.

4. SAFETY CONSIDERATIONS

Listed in 4.1 to 4.7 are some potential conditions and situations that may lead to personal injury and/or property damage. This list is not necessarily all inclusive. Consider reasonable and feasible means, including those described in this section, to reduce the risk of injuries or property damage.

Training, including the information in this document, for operators, maintenance personnel, and other individuals working with hose assemblies under pressure is encouraged.

4.1 Fluid Injections

Fine streams of escaping pressurized fluid can penetrate skin and enter a human body. These fluid injections may cause severe tissue damage and loss of limb.

Consider various means to reduce the risk of fluid injections, particularly in areas normally occupied by operators. Such means include: careful routing, adjacent components, warnings, guards, shields, and training programs.

Relieve pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

Avoid contact with escaping fluids. Treat all leaks as though pressurized and hot enough to burn skin. Never use any part of your body to check a hose for leaks.

If a fluid-injection accident occurs, see a doctor immediately. **DO NOT DELAY OR TREAT AS A SIMPLE CUT!** Any fluid injected into the skin must be surgically removed *within a few hours* or gangrene may result. Doctors unfamiliar with this type of injury should consult a knowledgeable medical source.

4.2 Whipping Hose

If a pressurized hose assembly blows apart, the fittings can be thrown off at high speed, and the loose hose can flail or whip with great force. This is particularly true in compressible-fluid systems.

When this risk exists, consider guards and restraints to protect against injury.

4.3 Burns from Conveyed Fluids

Fluid-power media may reach temperatures that can burn human skin. If there is risk of burns from escaping fluid, consider guards and shields to prevent injury, particularly in areas normally occupied by operators.

4.4 Fire and Explosions from Conveyed Fluids

Most fluid-power media (hydraulic fluid), including fire-resistant hydraulic fluids, will burn under certain conditions. Fluids which escape from pressurized systems may form a mist or fine spray which can flash or explode upon contact with an ignition source.

Consider selecting, guarding, and routing hose to minimize the risk of combustion (see Section 5 and ISO 3457).

4.5 Fire and Explosions from Static-Electric Discharge

Fluid passing through hose can generate static electricity, resulting in static-electric discharge. This may create sparks that can ignite system fluids or gases in the surrounding atmosphere.

When this potential exists, select hose specifically designed to carry the static-electric charge to ground.

4.6 Electrical Shock

Electrocution could occur if hose conducts electricity through a person. Most hoses are conductive. Many contain metal or have metal hose fittings attached. Even nonconductive hoses can be conduits for electricity if they carry conductive fluids.

Be aware of routing or using hose near electrical sources. When this cannot be avoided, select appropriate hose. Nonconductive hoses should be considered. SAE J517 - 100R7 and 100R8 hoses, with orange covers marked "nonconductive" are available for applications requiring nonconductive hose.

4.7 Mechanisms Controlled by Fluid Power

Mechanisms controlled by fluids in hoses can become hazardous when a hose fails. For example, when a hose bursts, objects supported by fluid pressure may fall, or vehicles or machines may lose their brakes or steering.

If mechanisms are controlled by fluid power, consider safe modes of failure that minimize risks of injury or damage.

5. HOSE SELECTION AND ROUTING

A wide variety of interacting factors influence hose service life and the ability of each hydraulic fluid-power system to operate satisfactorily, and the combined effects of these factors on service life are often unpredictable. Therefore, hydraulic hose specification documents should not be construed as design standards. For applications outside the specifications in SAE J517, SAE J514, or other relevant design standards, performance of hose assemblies should be determined by appropriate testing.

Carefully analyze each system. Then design routings and select hose and related components to meet the system-performance and hose-service-life requirements, and to minimize the risks of personal injury and/or property damage. Consider the following factors:

5.1 System Pressures

Excessive pressure can accelerate hose assembly failure. Analyze the steady-state pressures, and the frequency and amplitude of pressure surges, such as pulses and spikes. These are rapid and transient rises in pressure which may not be indicated on many common pressure gages and can be identified best on high-frequency-response electronic measuring instruments.

For maximum hose assembly service life, hose selection should be based on a system pressure, including surges, that is less than the hose assembly maximum working pressure.

The maximum working pressure of a hose assembly comprised of hose and hose fittings shall not exceed the lower of the maximum working pressure specified for the respective hose and the connection end of the hose fittings.

5.2 Suction

For suction applications, such as inlet flow to pumps, select hose to withstand both the negative and positive pressures the system imposes on the hose.

5.3 External Pressure

In certain applications, such as in autoclaves or under water, the external environmental pressures may exceed the fluid pressure inside the hose. In these applications, consider the external pressures, and if necessary, consult the hose manufacturers.

5.4 Temperature

Exceeding hose temperature ratings may significantly reduce hose life. Select hose so the fluid and ambient temperatures, both static and transient, fall within the hose ratings. The effects of external heat sources should not raise the temperature of the hose above its maximum operating temperature. Select hose, heat shields, sleeving, and other methods for these requirements, and route or shield hose to avoid hose damage from external heat sources.

5.5 Permeation

Permeation, or effusion, is seepage of fluid through the hose. Certain materials in hose construction are more permeable than others. Consider the effects of permeation when selecting hose, especially with gaseous fluids. Consult the hose and fluid manufacturers for permeability information.

5.6 Compatibility Between Hose Materials and Hydraulic Fluids

Variables that can affect compatibility of system fluids with hose materials include, but are not limited to:

- a. Chemical properties
- b. Fluid pressure
- c. Temperature
- d. Concentration level
- e. Exposure duration

Because of permeation (see 5.5), consider compatibility of system fluids with the hose, tube, cover, reinforcement, and fittings. Consult the fluid and hose manufacturers for compatibility information.

Rubber hoses should not be painted without consulting the hose manufacturer.

NOTE: Many fluid/elastomer compatibility tables in manufacturers' catalogs show ratings based on fluids at 21 °C, room temperature. These ratings may change at other temperatures. Carefully read the notes on the compatibility tables, and if in doubt, consult the manufacturer.

5.7 Environment

Environmental conditions can cause hose and fitting degradation. Conditions to evaluate include, but are not limited to:

- a. Ultraviolet light
- b. Saltwater
- c. Air pollutants
- d. Temperature (see 5.4)
- e. Ozone
- f. Chemicals
- g. Electricity
- h. Abrasion
- i. Paint

If necessary, consult the manufacturers for more information about the effect of these and other environmental conditions.