TECHNICAL SPECIFICATION

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Hydraulic fluid power — Hose assemblies —

Part 2: Practices for hydraulic hose assemblies

Transmissions hydrauliques — Flexibles de raccordement —

Partie 2: Pratiques pour les flexibles de raccordement hydrauliques

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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The committee responsible for this document is ISO/TC 131, *Fluid power systems*, Subcommittee SC 4, *Connectors and similar products and components*.

This first edition of ISO/TS 17165-2 cancels and replaces ISO/TR 17165-2:2006, which has been technically revised.

ISO 17165 consists of the following parts, under the general title *Hydraulic fluid power – Hose assemblies*:

— *Part 1: Dimensions and requirements*

— *Part 2: Practices for hydraulic hose assemblies*

Introduction

In hydraulic fluid power systems, power is transmitted and controlled through a liquid under pressure within an enclosed circuit.

To allow fluid flow between components, they are interconnected by piping, both rigid (tubes and tube connectors) and flexible (hose assemblies, which consist of hose and hose fittings).

Hydraulic fluid power — Hose assemblies —

Part 2: Practices for hydraulic hose assemblies

1 Scope

This part of ISO 17165 provides guidelines for selection, routing, fabrication, installation, replacement, maintenance and storage of hose and hose assemblies for hydraulic fluid power systems which are manufactured from hoses conforming to ISO 1436, ISO 3862, ISO 3949, ISO 4079 and ISO 11237, and hose fittings conforming to ISO 12151-1 to ISO 12151–6.

NOTE 1 Many of these practices also can be suitable for use with other types of hoses and systems.

NOTE 2 Annex A lists examples of actual failure resulting from improper use of hydraulic hose and hose assemblies.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1436, *Rubber hoses and hose assemblies — Wire-braid-reinforced hydraulic types for oil-based or water-based fluids — Specification*

ISO 2230, *Rubber products — Guidelines for storage*

ISO 3457, *Earth-moving machinery — Guards — Definitions and requirements*

ISO 3862, *Rubber hoses and hose assemblies — Rubber-covered spiral-wire-reinforced hydraulic types for oil-based or water-based fluids — Specification*

ISO 3949, *Plastics hoses and hose assemblies — Textile-reinforced types for hydraulic applications — Specification*

ISO 4079, *Rubber hoses and hose assemblies — Textile-reinforced hydraulic types for oil-based or water-based fluids — Specification*

ISO 5598, *Fluid power systems and components — Vocabulary*

ISO 8330, *Rubber and plastics hoses and hose assemblies — Vocabulary*

ISO 8331, *Rubber and plastics hoses and hose assemblies — Guidelines for selection, storage, use and maintenance*

ISO 11237, *Rubber hoses and hose assemblies — Compact wire-braid-reinforced hydraulic types for oil-based or water-based fluids — Specification*

ISO 12151-1, *Connections for hydraulic fluid power and general use — Hose fittings — Part 1: Hose fittings with ISO 8434-3 O-ring face seal ends*

ISO 12151-2, *Connections for hydraulic fluid power and general use — Hose fittings — Part 2: Hose fittings with ISO 8434-1 and ISO 8434-4 24 degree cone connector ends with O-rings*

ISO 12151-3, *Connections for hydraulic fluid power and general use — Hose fittings — Part 3: Hose fittings with ISO 6162-1 or ISO 6162-2 flange ends*

ISO 12151-4, *Connections for hydraulic fluid power and general use — Hose fittings — Part 4: Hose fittings with ISO 6149 metric stud ends*

ISO 12151-5, *Connections for hydraulic fluid power and general use — Hose fittings — Part 5: Hose fittings with ISO 8434-2 37 degree flared ends*

ISO 12151-6, *Connections for hydraulic fluid power and general use — Hose fittings — Part 6: Hose fittings with ISO 8434-6 60 degree cone ends*

ISO 17165-1, *Hydraulic fluid power — Hose assemblies — Part 1: Dimensions and requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5598, ISO 8330 and the following apply.

3.1
manufacturing date of the hose assembly
date when hose and hose fittings were assembled into a hose assembly

4 Safety considerations

4.1 General

The list of potential conditions and situations that can lead to personal injury or property damage described in 4.2 through 4.8 is not necessarily all-inclusive. Reasonable and feasible means, including those described in this clause, shall be taken into consideration, to reduce the risk of personal injury, property damage or both. Training, including the information in this document, for operators, maintenance personnel, and other individuals working with hose assemblies under pressure is encouraged.

4.2 Fluid injections

Fine streams of escaping pressurized fluid can penetrate skin and enter a human body. These fluid injections can cause severe tissue damage and loss of limb. Various means shall be taken into consideration to reduce the risk of fluid injections, particularly in areas normally occupied by operators. Such means include: careful routing of hose, adjacent components, warnings, guards, shields and training programs. Pressure shall be relieved before disconnecting hydraulic or other lines. All connections shall be tightened before applying pressure. Contact with escaping fluids shall be avoided. All leaks shall be treated as if they were pressurized and hot enough to burn skin. No part of the human body shall be used to check a hose for leaks. If a fluid-injection accident occurs, medical treatment by a doctor shall be sought immediately.

WARNING — Fluid-injection injuries shall be treated without delay and shall not be treated as a simple cut.

Any fluid injected into the skin shall be surgically removed *within a few hours*, or gangrene can result. Doctors unfamiliar with this type of injury should consult a knowledgeable medical source.

4.3 Whipping hoses

If a pressurized hose assembly blows apart, the hose fittings can be thrown off at high speed, and the loose hose can flail or whip with great force. This is particularly true in systems that use compressible fluids. When this risk exists, consider guards and restraints to protect against injury.

4.4 Burns from conveyed fluids

Fluid power media (hydraulic fluid) can 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.

4.5 Fire and explosions from conveyed fluids

Most fluid power media (hydraulic fluid), including fire-resistant hydraulic fluids, can burn under certain conditions. Fluids that escape from pressurized systems can form a mist or fine spray that can flash or explode upon contact with an ignition source. Consider selecting, guarding, and routing hose to minimize the risk of combustion (see Clause 5 and ISO 3457).

4.6 Fire and explosions from static-electric discharge

Fluid passing through hose can generate static electricity, resulting in static-electric discharge. This can create sparks that can ignite fluids in the systems or gases in the surrounding atmosphere. When this potential exists, hose specifically designed to carry the static-electric charge to ground shall be selected.

4.7 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. This shall be kept in mind when routing or using hose near electrical sources. When this cannot be avoided, appropriate hose shall be selected, and nonconductive hoses should be considered. Hoses that comply with ISO 3949 with orange covers marked "Nonconductive" are available for applications requiring nonconductive hose.

4.8 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 can fall, or vehicles or machines can lose their brakes or steering. If mechanisms are controlled by fluid power, safe modes of failure that minimize risks of injury or damage shall be considered.

5 Hose selection and routing

5.1 General

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 ISO 1436, ISO 3862, ISO 4079, ISO 11237, ISO 3949 and ISO 12151-1 to ISO 12151-6, or other relevant design standards, performance of hose assemblies should be determined by appropriate testing. Each system shall be carefully analysed, and then routings shall be designed and hose and related components shall be selected to meet the system performance and hose-service-life requirements and to minimize the risks of personal injury, property damage or both. The factors covered in 5.2 through 5.25 shall be considered.

5.2 System pressures

Excessive pressure can accelerate hose assembly failure. Steady-state pressures and the frequency and amplitude of pressure surges, such as pulses and spikes, shall be analysed. These are rapid and transient rises in pressure which many common pressure gauges do not indicate and can be identified best on high-frequency-response electronic measuring instruments. For maximum hose assembly service life,

selection of the hose and hose fittings should be based on a system pressure, including surges, that is less than the maximum working pressure of the hose assembly.

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

5.3 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.

5.4 External pressure

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

5.5 Temperature

Temperature outside of the hose's ratings can significantly reduce hose life. Select hose so the fluid and ambient temperatures, both static and transient, fall within the hose's 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 to meet these requirements, and route or shield hose to avoid hose damage from external heat sources.

5.6 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, especially of gaseous fluids, when selecting hose. Consult the hose and fluid manufacturers for permeability information.

5.7 Compatibility between hose materials and system 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) duration of exposure

Because of permeation (see 5.6), compatibility of system fluids with the hose, tube, cover, reinforcement, and hose fittings shall be considered. 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' catalogues show ratings based on fluids at 21 °C (i.e. room temperature). These ratings can be different at other temperatures. The notes on the compatibility tables should be read carefully and the manufacturer consulted if there is any doubt.

5.8 Environment

Environmental conditions can cause hose and hose fitting degradation. Conditions that shall be evaluated include, but are not limited to:

a) ultraviolet light

b) salt water

c) air pollutants

d) temperature

e) ozone

f) chemicals

g) electricity

h) abrasion

i) paint.

If necessary, the hose manufacturer shall be consulted for more information about the effect of these and other environmental conditions.

5.9 Static-electric discharge

Fluid passing through hose can generate static electricity, resulting in static electric discharge. This can create sparks that can puncture hose. If this potential exists, hose with sufficient conductivity to carry the static-electric charge to ground shall be selected.

5.10 Sizing

The power transmitted by pressurized fluid varies with pressure and flow rate. Hose with adequate size to minimize pressure loss and to avoid hose damage from heat generation or excessive flow rates shall be selected. Conduct calculations or consult the hose manufacturer for sizing at relevant flow rates.

5.11 Unintended uses

Hose assemblies are designed for the internal forces of fluids conducted. Hose assemblies shall not be pulled or used for purposes that can apply external forces for which the hose or hose fittings were not designed.

5.12 Specifications and standards

When selecting hose and hose fittings for specific applications, applicable government, industry, and manufacturer's specifications and standards shall be referred to.

5.13 Unusual applications

For applications that are not addressed by the manufacturer or by industry standards, special testing can be necessary before the proper hose can be selected.

5.14 Hose assembly cleanliness

The cleanliness requirements of components other than hose assemblies can determine the cleanliness requirements of the application. The component manufacturers' cleanliness information for all components in the system shall be consulted. Hose assemblies vary in cleanliness levels; therefore, hose assemblies with adequate cleanliness for the system shall be specified.

5.15 Hose fittings

Selection of the proper hose fittings for the hose and application is essential for proper operation and safe use of hose and related assembly equipment. Hose fittings are qualified with the hose. Therefore, only hose fittings compatible with the hose for the applications shall be selected. Improper selection