TECHNICAL REPORT

ISO/TR 17165-2

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Hydraulic fluid power — Hose assemblies —

Part 2: Recommended practices for hydraulic hose assemblies

Transmissions hydrauliques — Flexibles de raccordement — Partie 2: Pratiques recommandées pour les flexibles de raccordement hydrauliques

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Contents

Page

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TR 17165-2 was prepared by Technical Committee ISO/TC 131, *Fluid power systems*, Subcommittee SC 4, *Connectors and similar products and components*.

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

— *Part 1: Dimensions and requirements*

— *Part 2: Recommended practices for hydraulic hose assemblies* (Technical Report)

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:
Recommended 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 1436-1, ISO 1436-2, ISO 3862-1, ISO 3862-2, ISO 3949, ISO 4079-1, ISO 4079-2, ISO 11237-1 and ISO 11237–2, and hose connectors conforming to ISO 12151-1 through ISO 12151-6.

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

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

2 Normative references

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

ISO 1436-1, *Rubber hoses and hose assemblies — Wire-braid-reinforced hydraulic types — Specification — Part 1: Oil-based fluid applications*

ISO 1436-2, *Rubber hoses and hose assemblies — Wire-braid-reinforced hydraulic types — Specification — Part 2: Water-based fluid applications*

ISO 2230, *Rubber products — Guidelines for storage*

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

ISO 3862-1, *Rubber hoses and hose assemblies — Rubber-covered spiral-wire-reinforced hydraulic types — Specification — Part 1: Oil-based fluid applications*

ISO 3862-2, *Rubber hoses and hose assemblies — Rubber-covered spiral-wire-reinforced hydraulic types — Specification — Part 2: Water-based fluid applications*

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

ISO 4079-1, *Rubber hoses and hose assemblies — Textile-reinforced hydraulic types — Specification — Part 1: Oil-based fluid applications*

ISO 4079-2, *Rubber hoses and hose assemblies — Textile-reinforced hydraulic types — Specification — Part 2: Water-based fluid applications*

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

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

ISO 8331[1)], *Rubber and plastics hoses and hose assemblies — Guidelines for selection, storage, use and maintenance*

ISO 11237-1, *Rubber hoses and hose assemblies — Wire-braid-reinforced compact types for hydraulic applications — Specification — Part 1: Oil-based fluid applications*

ISO 11237-2 *Rubber hoses and hose assemblies — Wire-braid-reinforced compact types for hydraulic applications — Specification — Part 2: Water-based fluid applications*

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 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 flange ends*

ISO 12151-4[2)], *Connections for hydraulic fluid power and general use — Hose fittings — Part 4: Hose fittings with ISO 6149 metric stud ends*

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

ISO 12151-6[2)], *Connections for hydraulic fluid power and general use — Hose fittings — Part 6: Hose fittings with ISO 8434-6 60° cone ends*

ISO 17165-1[2)], *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 and ISO 8330 and the following apply.

3.1
manufacturing date of the hose assembly
date when the hose and connectors 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 and/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 injuries and/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.

1) To be published. (Revision of ISO 8331:1991)

2) To be published.

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, 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 can 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 1436-1, ISO 1436-2, ISO 3862, ISO 4079, ISO 11237, ISO 3949 and ISO 12151-1 through ISO 12151-6, or other relevant design standards, performance of hose assemblies should be determined by appropriate testing. Each system shall be carefully analyzed, 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 and/or property damage. 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 analyzed. These are rapid and transient rises in pressure which might not be indicated on many common pressure gauges and can be identified best on high-frequency-response electronic measuring instruments. For maximum hose 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 pressures of the hose and hose fitting.

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,

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.

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 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.