

Quality Requirement

Hydraulic & Pneumatic Assembly - General Requirements

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| RIG/PLANT | | |
| ADDITIONAL CODE | SDRL CODE | TOTAL PGS 7 |
| REMARKS | | |
| MAIN TAG NUMBER | DISCIPLINE | |
| CLIENT PO NUMBER | | |
| CLIENT DOCUMENT NUMBER | | |

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|---|---|---|
| REFERENCE TM01169 | REFERENCE DESCRIPTION Quality Clause | |
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| DATA CLASSIFICATION Public | | |
| DOCUMENT NUMBER 103189060 | REV 1 | |

REVISION HISTORY

| Rev | Date | Reason for issue | Prepared | Checked | Approved |
|-----|-------------|------------------|----------|---------|----------|
| 1 | 17-Jan-2023 | For Information | TKL | TBO | TRM |
| 0 | 19-Feb-2020 | Approved for Use | JÃO | HAH | LUMO |

CHANGE DESCRIPTION

| Revision | Change description |
|----------|--------------------|
| 1 | |
| 0 | Initial release |

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1 PIPE AND TUBE ASSEMBLY

1.1 General

Piping and Tubing assembly shall be performed in a clean and suitable working environment, separated from Steel work (welding grinding activities). All hydraulic components shall be carefully inspected before assembly on equipment.

Critical components such as proportional valves, servo valves, manifolds, and cylinders are delivered clean according to manufacturer's procedure and shall be stored sealed until installation.

All Installation/Assembly to be according to standards listed below and notes:

(Note: the beginning of all paragraphs are rewrites of the current standard to which reference is made. The current revision of the standard always applies)

1.2 Piping assembly

Piping assembly shall be done in accordance with ASME B31.3 Process Piping, chapter V

1.3 Hydraulic Tube Assembly

Follow these paragraphs in ISO 4413 (latest edition)

Hydraulic fluid power - General rules and safety requirements for systems and their components (ISO 4413:2010)

- **5.2.1 Selection of components and piping**
 - 5.2.1.1 All components ...
 - 5.2.1.2 Components and piping ...
 - 5.2.1.3 It is recommended ...
- **5.3.2.1 Replacement**
- **5.3.2.2. Maintenance requirements**
- **5.3.2.4. Installation**
- **5.3.2.5 Use of standard parts**
 - 5.3.2.5.1 Commercially available parts ...
 - 5.3.2.5.2 **Except** "...All port connections should be in accordance with ISO 6149-1, ISO 6149-2 and ISO 6149-3 for threaded port connections," ...
SAE J1926-1, SAE J514(only applicable for North America)
- **5.3.4.1 Identification of piping**
- **5.3.4.2 Packaging**
- **5.3.4.3 Sealing and protection of openings**
- **5.4.4.3 Manifolds**
 - **5.4.4.3.1 Surface finish and flatness**
 - **5.4.4.3.2 Distortion**
 - **5.4.4.3.3 Mounting**
- **5.4.5.1 Fluids**
 - 5.4.5.1.1.1 Fluids should be ...
Note: For FAT only!
NOV require DIN 51524, part 3 HVLP, ISO VG 32 or ISO VG 46 for hydraulic oil, ISO 12922 (latest edition), Type HFC, for glycol systems.
 - 5.4.5.1.1.2 When selecting ...

- **5.4.5.1.2 Compatibility**
- **5.4.5.1.3 Cleanliness level of fluids**
- **5.4.6.1.2 Use of connections**
- **5.4.6.1.3 Piping layout**
 - 5.4.6.1.3.1 Tubes ...
 - 5.4.6.1.3.2 Piping should ...
 - 5.4.6.1.3.3 Piping shall ...
 - 5.4.6.1.3.4 Every connection ...
- **5.4.6.1.4 Piping mounting and identification**
- **5.4.6.1.5 Connector sealing**

Note: Only NBR/HNBR for fluid according to ISO 12922 (HFC), glycol systems
- **5.4.6.1.6 Pressure rating of connectors**
- **5.4.6.3 Support of tubes**
 - 5.4.6.3.1 Tubes ...
 - 5.4.6.3.2 Supports ...
 - 5.4.6.3.3 Pressure, ...
 - 5.4.6.3.4 Recommended approximate spacing ...
- **5.4.6.4 Foreign matter**

1.4 Bolt- or tube fittings torque settings

ISO 6162-1 (latest edition)

Hydraulic fluid power — Flange connections with split or one-piece flange clamps and metric or inch screws — Part 1: Flange connectors, ports and mounting surfaces for use at pressures of 3,5 MPa (35 bar) to 35 MPa (350 bar), DN 13 to DN 127

Note: If brand specific flanges are used, manufacturers assembly procedure shall be followed.
Equivalent standard: SAE J518, Code 61, Standard pressure series

ISO 6162-2 (Latest edition)

Hydraulic fluid power — Flange connections with split or one-piece flange clamps and metric or inch screws — Part 2: Flange connectors, ports and mounting surfaces for use at a pressure of 42 MPa (420 bar), DN 13 to DN 76

Note: If brand specific flanges are used, manufacturers assembly procedure shall be followed.
Equivalent standard: SAE J518, Code 62, High pressure series

ISO 6164 (Latest edition)

Hydraulic fluid power — Four-screw, one-piece square flange connections for use at pressures of 42 MPa, DN 25 to 80

Note: If brand specific flanges are used, manufacturers assembly procedure shall be followed.

ASME B31.3 latest edition)

Process Piping

- **309 Bolting**

API 6A (Latest edition)

Specification for Wellhead and Tree Equipment

- **Annex H Recommended Assembly of Closure Bolting**
 - H.1 Lubrication
 - H.2 Bolt Tightening Pattern
 - H.3 Recommended make-up Torque

Note: If brand specific flanges are used, manufacturers assembly procedure shall be followed.

1.4.1 Flushing of hydraulic tubing systems

1.4.1.1 General

The supplier is responsible for the hydraulic system being cleaned to current requirements. This means that flushing equipment, components, and flushing fluids are the responsibilities of the supplier.

Flushing fluids to be compatible with the system fluid.

Unless otherwise agreed, flushing of the assembled system shall be in accordance with:
ISO 23309 (latest edition)

*Hydraulic fluid power systems — Assembled systems — Methods of cleaning lines by flushing
For North America:*

ASTM D4174 Standard Practice for Cleaning, Flushing, and Purification of Petroleum Fluid Hydraulic Systems

1.4.1.2 Cleanliness requirement

NOV cleanliness requirement for all hydraulic systems: Class 17/15/12, ISO 4406

1.5 Pneumatic Tube Assembly

Follow the same paragraphs as in Chapter 1.3 “Hydraulic Tube Assembly”, except item 5.4.5.1, 5.4.5.1.2 and 5.4.5.3.1

1.5.1 Flushing of pneumatic tubing systems

1.5.1.1 General

The supplier is responsible for the pneumatic system being cleaned to current requirements. This means that flushing equipment and components are the responsibilities of the supplier.

Flushing fluid shall be water with a salt content below 250 PPM.

Drainage and drying of system shall be performed with dry air with dew point < -7 degree and air cleanliness according to ISO 8573-1, class 3-3-3.

Unless otherwise agreed, flushing of the assembled system shall be in accordance with
ISO 23309 (latest edition)

Hydraulic fluid power systems — Assembled systems — Methods of cleaning lines by flushing

1.5.1.2 Cleanliness requirement

NOV cleanliness requirement for #Flushing fluid water” samples shall be Class 17/15/12, ISO 4406

2 HOSES

2.1 General

Hose assembly shall be performed in a clean and suitable working environment.

Only NOV approved hose suppliers to be used.

SAE J1273, (only applicable for North America)

2.2 Hose Assembly

Follow these paragraphs in ISO 17165-2 (latest edition)

Practices for hydraulic hose assemblies

- **5.17 Hose cover protection**
- **5.18 External physical abuse**
- **5.2.1 Slings and clamps**
- **5-22 Minimum bend radius**
- **5.23 Elbows and connectors**

- **5.24 Lengths**
 - 5.24.1 General
 - 5.24.2 Motion absorption
 - 5.24.3 Tolerances and machine motion
 - 5.24.4 Change in hose length due to changes in pressure
- **5.25 Hose movement and bending**
- **6 Hose assembly fabrication**
 - Note: NOV require documented individual pressure test 1.5 x WP of hose assembly before installation
- **7 Hose installation and replacement**
- **9 Hose storage**

2.3 Cleaning of hose before assemblies

The cleanliness requirements of the system other than hose assemblies can determine the cleanliness requirements of the application. Hose assemblies vary in cleanliness levels; therefore, hose assemblies with adequate cleanliness for the system shall be specified.