



Quality Clause

Clause 08

Hydraulic & Pneumatic Assembly

General Requirements

RIG/PLANT		
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REMARKS		
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1 HYDRAULIC/PNEUMATIC ASSEMBLY

1.1 Hydraulic Assembly

Hydraulic 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.

Hydraulic components shall be sealed when stored.

1.2 Final System cleanliness requirement

Drilling equipment / Ring Line system: ISO 4406 (latest edition), class 17/15/12, (NAS 6)

Crane(s) with integrated HPU: ISO 4406 (latest edition), class 19/17/14 (NAS 8)

1.3 Restrictions

The supplier shall not mix hoses from different manufacturer on any individual equipment. Thread tape, Loctite and similar products shall not be used in hydraulic systems

Fittings and hose couplings shall be Cr(VI)-free plated unless otherwise specified

Flanges shall be Hot Dip Galvanized unless otherwise specified

Pipes/Tube including functional nut, shall be Stainless steel AISI 316L unless otherwise specified

For Air/water system, Stainless steel AISI 316 shall always be used unless otherwise specified.

Hoses shall not be purchased more than twelve (12) months before installation and each hydraulic hose shall be marked in accordance with a relevant hose-list for the equipment.

Hydraulic hoses shall be marked for traceability with manufacturer and batch number.

2 HYDRAULIC SYSTEMS

2.1 Assembly of hydraulic Systems

Manufacturing of various hydraulic lines require the following equipment: Certified Bending-, hose building and prefab machines. All necessary machines and equipment shall be the responsibility of the Supplier.

Specific flushing specifications and requirements may apply in addition as specified I the PO documentation package.

2.2 Marking of Hydraulic hoses

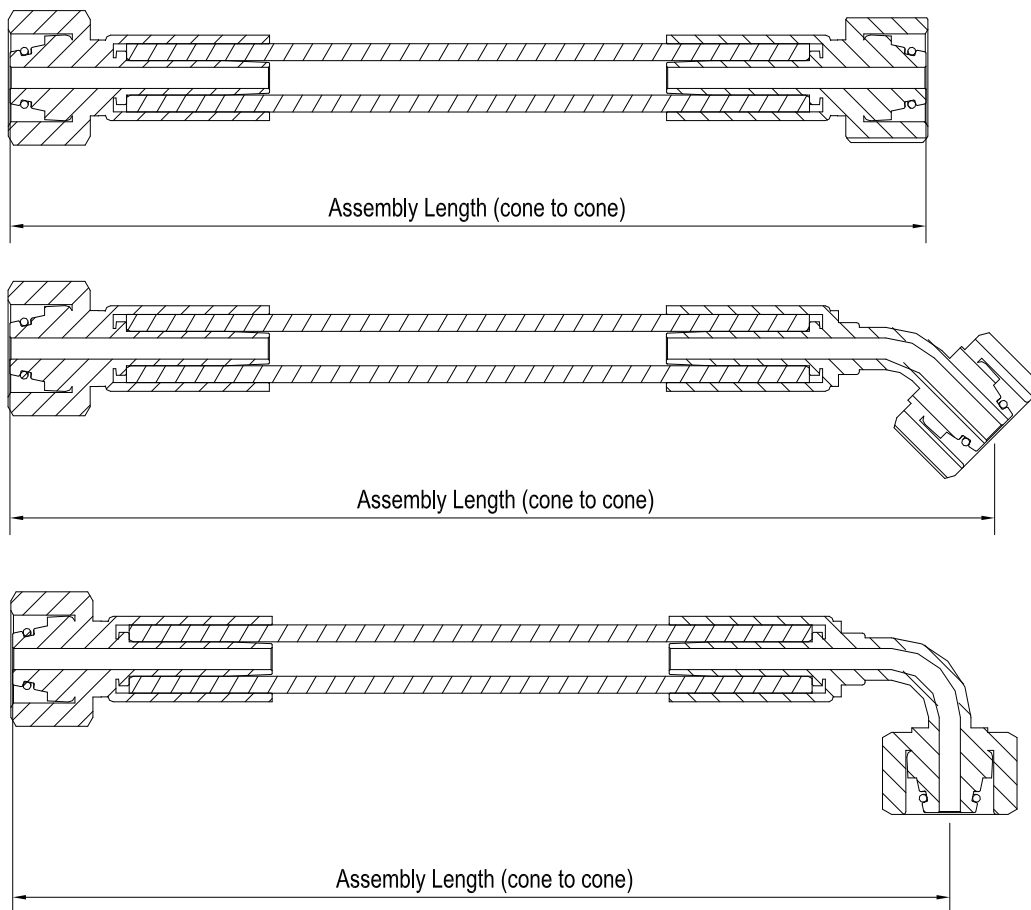
Each hydraulic hose is to be marked (in both ends if above 3m / 10 feet) with a permanent marking system in accordance with the relevant "hose-list" for the equipment.

Plastic wrapping to be used on hoses where the hose is crossing sharp corners.

The hose couplings of the hose assembly are to be as follows unless otherwise specified in the drawings or specifications of the PO documentation package:

- Coupling 1 to be a straight (0°) connection.
- o Coupling 2 to be a straight (0°), 45°, or 90° connection.
- o Only female couplings shall be used.

Hose lengths shall be measured, and records shall be created as showed in the images below:



2.3 Marking of Hydraulic components

Stainless steel coins shall be fastened by use of stainless-steel wire. Plastic/stainless steel tags/plates to be fastened by use of adhesive compound. All position tags to be fastened beside the actual component if possible.

All pressure setting valves to be checked and tagged according to above procedure.

3 MANUFACTURING OF HYDRAULIC PIPING, TUBING, HOSES WITH DOCUMENTATION

All personnel fabricating piping/tubing and hoses for NOV's equipment shall be documented certified/trained as per applicable standards or training requirements.

Certificates/ documentation for this training should be maintained by the Supplier or Sub-Supplier and available for NOV or 3rd party review.

All stainless steel (piping, support) which has been contaminated at Supplier's premises shall be properly cleaned prior to delivery as specified in section 1.

3.1 Supports

Piping and tubing shall not be forced to fit with support location in such manner that additional stress is introduced. Pipes / tubing shall normally not be supported by other pipes / tubing i.e. Individual supporting is required according to NOV's requirements. Where hoses are routed vertical, "Chinese fingers" or similar shall be used to reduce weight on hose couplings. Hoses and Cables in drag chain are to be mounted according to NOV instructions.

3.2 Flushing and cleanliness requirements

The supplier shall have designated area for clean mounting of hydraulic systems.

Hoses, pipes or components shall have plugged ends or sealed openings when purchased or delivered from supplier sub-suppliers.

"Jet-Cleaning" of tubes and hoses

"Jet-Cleaning" system is based on the principle that projectiles are pushed through a tube or hose by the use of pressurized air to remove contamination from prefabrication. The method provides for a satisfactory mechanical cleaning up to 2" pipes and hoses.

Pipes and Hoses above 2" Hot oil flushing is required:

The supplier shall obtain the cleanliness requirement by using mineral oil and "Reynold number" ≥ 30000

Hot oil flushing shall be performed in accordance with the references noted and as a minimum to satisfy:

ISO 4406; latest edition or equivalent

Water content less than 250 ppm.

Oil flow minimum: 3 m/s.

Equipment required for “hot oil” flushing

- Flushing unit, use HPU with sufficient capacity.
- Thermometer
- Particle counter
- As required oil heater, various hoses with couplings, caps and tools.

Stainless steel pipes above 2”

Hot Water High Pressure Washing (HWHPW)

HWHPW shall be performed by use of a rotating pipe cleaner nozzle prior to bending, as well as after final fabrication.

After final fabrication and drying of the pipe it must be preserved inside to avoid corrosion. The complete pipe shall be sprayed with suitable preservation oil and immediately well sealed.

The preserved and sealed pipe shall be tagged with date and signature.

Technical data	Minimum Requirements
Minimum hot water flow	10 liter/min
Minimum hot water pressure	160 bar
Minimum water temperature	80°C
Rotating pipe cleaning nozzle size	Adapted to actual water flow and pipe size.

Additional cleanliness requirements may apply as specified in the PO documentation package. If not specified otherwise, the following shall apply:

- Drilling equipment/Ring Line system: ISO 4406 (latest edition), class 17/15/12 (NAS6)
- Crane(s) with integrated HPU: ISO 4406 (latest edition), class 19/17/14 (NAS 8)
- ≤ 250 PPM (water content)

3.3 Flushing and cleanliness requirements

The obtained cleanliness level shall be documented before a flushing / cleaning operation may be considered as final.

4 PNEUMATIC ASSEMBLY

Pneumatic assembly shall be carried out according to good workmanship standard by-use of skilled and qualified personnel that follow established instruction/procedure applicable for the Supplier and Sub-Suppliers.

4.1 Compressed Air System minimum requirements

- Air with quality Class 3-3-3, ref. ISO 8573-1 or equivalent standard
- All fittings material shall be of AISI 316. Flanges shall be "Hot Dip Galvanized".
- Large blocks and adapters can be steel with Cr(VI) free coating.
- Gasket material for flanges in NBR / HNBR.
- These specifications are valid for out- and indoor systems.