

**UMBILICALS FOR SUBSEA APPLICATIONS
1/2"ID HOSES FOR CHEMICAL INJECTION**

INDEX

1.0 - PURPOSE

2.0 - BASIC CHARACTERISTICS OF HCR HOSES AND FITTINGS

2.1 - HCR HOSES CONSTRUCTION

2.1.1 - Metallic Carcass

2.1.2 - Liner

2.1.3 - Reinforcement

2.1.4 - Sheath

2.2 - TERMINATIONS

2.3 - FUNCTIONAL REQUIREMENTS

3.0 - MINIMUM DATA SHEET CONTENT

4.0 - SERVICE LIFE

5.0 - QUALIFICATION TESTS

6.0 - IDENTIFICATION

7.0 - MANUFACTURING REQUIREMENTS

7.1 - FACTORY ACCEPTANCE TESTS

NOTE

This Technical Specification replaces former-ET-3500.00-1500-290-PAZ-004 REV. A issued MAY/08 which was been improved since OCT/99, from former previous Technical Specifications. Comments to these Specs along time were issued by Marcos Carpigiani, João Manoel, Fernando Buscacio, André Athayde, Marco Dias and William Albuquerque

**UMBILICALS FOR SUBSEA APPLICATIONS
1/2"ID HOSES FOR CHEMICAL INJECTION**

1.0 - PURPOSE

The purpose of this Technical Specification (ET) is to define basic characteristics for High Collapse Resistant (HCR) hoses to be used as components of completed umbilicals and IPUs for chemical injection in offshore applications.

As a general requirement such hoses shall comply with ISO 13628-5, Second edition, 2009, and also with additional requirements herein specified which modify or complement the standard provisions.

HCR hoses shall be previously qualified by Petrobras before any submittal of proposal for any supply of umbilicals.

This technical specification covers hoses with pressure ratings of 5,000 psi and 7,500 psi and. For a specific hose, the pressure rating is defined in the related Material Requisition (RM).

2.0 - BASIC CHARACTERISTICS OF HCR HOSES AND FITTINGS

Constructive materials to be used for hoses and fittings shall withstand all applicable types of degradation arising from exposure to operating environment and service fluids. It includes, among others, the following agents:

- Sea water and marine growth, considering that hoses can be exposed to such agents at the connection to the subsea equipment, due to tearing of the outer sheath;
- UV radiation, as hose extremities can be exposed to sunlight before installation, during storage, handling and transportation, and also after installation on offshore platforms, where connection points shall be located at surface or splash zone;
- Conveyed fluids ;

Hose assemblies shall withstand all loads transmitted by adjacent flexible layers, considering phases of manufacturing, handling, storage, installation, and operation during their specified service life.

2.1- HCR HOSES CONSTRUCTION

HCR hoses are composed of 4 layers: metallic carcass, the innermost structural layer, which provides the hose resistance to the external pressure; liner, a polymeric layer which provides the hose seal for the conveyed internal fluid; reinforcement, that shall guarantee inner pressure resistance; and sheath, that shall guarantee external protection. This item introduces material specifications currently in use by Petrobras for each of these layers. Alternative materials may be accepted, when umbilical manufacturer provide Petrobras with documentation - approved by a Third Party pointed out by Petrobras in advance - demonstrating that such materials were successfully qualified on tests for the HCR's specified service life.

**UMBILICALS FOR SUBSEA APPLICATIONS
1/2"ID HOSES FOR CHEMICAL INJECTION**

2.1.1 - Metallic Carcass

The carcass material must resist to corrosion and chemical degradation caused by conveyed fluids and, as applicable, due to the contact of these fluids with hose terminations.

2.1.2 - Liner

This layer is made of a poliamide 11 material which shall be compatible with specified internal fluids. If confirmed by the supplier its compatibility, Petrobras suggests Rilsan Besno P40 TLO. Any other poliamide 11 material must not contaminate the conveyed fluid with oligomers or other products of chemical reaction.

2.1.3 - Reinforcement

The polymeric leakproof layer is covered with an aramid fiber internal pressure reinforcement.

2.1.4 - Sheath

A polyether based polyurethane or poliamide 11 sheath is applied over the reinforcement .It shall be resistant to UV radiation.

2.2 - TERMINATIONS

Hoses shall be supplied with swaged fittings terminated with female 37° flared JIC swivel nuts, 3/4 inch thread type – 16 UNF. Fitting construction material shall present corrosion properties equal or better than AISI 316L.

Couplings to join two hose lengths within an umbilical are not allowed. All fittings to be supplied shall have its traceability stamped.

2.3 - FUNCTIONAL REQUIREMENTS

Main functional requirements are as follows:

- Application: Chemical Injection.
- DWP: 5000 and 7500 psi.
- Test Pressure ratios as per ISO 13628-5, Second edition, 2009, Section 7.3.4.1.
- Minimum external collapse pressure (P_C): $P_C = (WD \times \gamma_{SW} \times 9.81) \times S_f$ (Pa), being the internal pressure equal to the atmospheric pressure, where :
 - WD = Maximum Water Depth (m);
 - γ_{SW} = Specific weight of the sea water = 1.025 kgf/m³;
 - S_f = Safety factor = 1.5.
- Dimensions and tolerances:
 - Inside diameter: Carcass bore ID = 12.7 mm (-0.0 / + 1.0 mm)
 - Outside diameter: Compatible with end fitting termination.

**UMBILICALS FOR SUBSEA APPLICATIONS
1/2"ID HOSES FOR CHEMICAL INJECTION**

- Maximum change in length at DWP: As per ISO 13628-5, Second edition, 2009, Section 7.3.4.3
- Maximum temperature of the inner fluid (storage): 60° C.
- Minimum number of proof tests @ 1.5 WP without loss of properties(after the umbilical's FAT): 6
- Inner Fluids: Chemicals - Paraffin Inhibitor, Demulsifier, Asphaltene Inhibitor, Scale Inhibitor, Corrosion Inhibitor, Sulfidric Acid Scavenger and Ethanol Anhydrous (Hydrate Inhibitor), as presented in the following tables. It shall be note that Paraffin Inhibitor and Demulsifier are injected through the same line but not at the same time.

Paraffin Inhibitor and Demulsifier

Feature	<i>Paraffin Inhibitor</i>	<i>Demulsifier</i>
Active Component	olefine polymer or polyacrilate	oxy-propylene condensate and oxy-ethylene
Solvent	Aromatical (xylene, toluene)	Aromatical (xylene, toluene)
Active Component Contents	15 to 20 %	40 to 50 %
Injection Routine	continuous	continuous
SpGr@ 20° C	892 kg/m ³	873,1 kg/m ³

Asphaltene Inhibitor and Scale Inhibitor

Feature	<i>Asphaltene Inhibitor</i>	<i>Scale Inhibitor</i>
Active Component	amine polymer	aspartic acid and amine-phosphates
Solvent	xylene, toluene or kerosene	MEG
Active Component Contents	50 to 70 %	78 to 82 %
Injection Routine	continuous	continuous
SpGr@ 20° C	932 kg/m ³	1231 kg/m ³

Corrosion Inhibitor and Sulfidric Acid Scavenger

Feature	<i>Corrosion Inhibitor</i>	<i>Sulfidric Acid Scavenger</i>
Active Component	quaternary ammonium compound	amine
Solvent	methanol or ethanol	water or alcohol
Active Component Contents	15 to 40 %	2%
Injection Routine	continuous	continuous
SpGr@ 20° C	838 kg/m ³	1026 kg/m ³

**UMBILICALS FOR SUBSEA APPLICATIONS
1/2"ID HOSES FOR CHEMICAL INJECTION**
Ethanol Anhydrous

<i>Characteristics</i>	<i>Limit Values</i>	<i>Standard</i>
SpGr@ 20° C	791,5 kg/m ³ , max	MB 1533
Alcohol content	95,0 grau INPM, min	MB 1533
Non volatile matter @ 105 °C	30 mg/l, max	MB 2123
pH	7 ± 1	-

- Minimum flow rate: 0.8 m³/hour for a 5,000-m long hose with a maximum pressure drop of 5,000 psi.
- Minimum bending radius (MBR): 0.5 m

3.0 – MINIMUM DATA SHEET CONTENT

The hose data sheet shall present as a minimum the following technical information:

- Hose identification code, (manufacturer's part number);
- Cross Sectional Drawing showing all layers and its materials and diameters;
- Application;
- Internal and external diameter with manufacturing tolerances;
- Nominal weights in air and seawater, full and empty;
- Weight for all hose components;
- Design Working Pressure;
- Maximum and minimum inner temperature;
- Hose Pressure FAT / Umbilical Pressure FAT;
- Burst Pressure;
- Volumetric Expansion Data;
- Maximum linear expansion under working pressure;
- MBR;
- Collapse Pressure in straight and MBR;
- Burst Pressure of the liner;
- Characteristic Flow Rate Curve Water Based - P (psi) x Q (m³/h);
- Thermal Exchange Coefficient at 20 ° C.
- Maximum number of proof tests @ 1.5 WP without loss of properties(after the umbilical's FAT): 6

4.0 - SERVICE LIFE

The required service life for all hoses and fittings herein specified is 30 years of operation as a component of completed umbilicals.

**UMBILICALS FOR SUBSEA APPLICATIONS
1/2"ID HOSES FOR CHEMICAL INJECTION**

5.0 – QUALIFICATION/VERIFICATION TESTS

At least, the tests listed below - for a hose sample set - shall be carried out on *unaged* samples of each specified hydraulic hose, as per ISO 13628-5, Second edition, 2009 - Table B3, considering, however, the requirements herein mentioned.

- Visual and Dimensional Test (all hose samples of the set);
- Change in Length Test (2 hose samples+ fittings assemblies);
- Leakage test (2 hose samples+ fittings assemblies);
- Burst Test (6 hose samples + fittings assemblies, 3 from each end of the manufactured hose);
- Impulse test according to ISO 13628-5, Second edition, 2009 Section 7.3.7.7 (this test may be conducted with the test fluid at ambient temperature);
- Volumetric Expansion, according to ISO 13628-5, Second edition, 2009, Annex D. Test samples shall not be less than 3 meters in length between end fittings. (1 hose sample, different from that to be used in the burst test);
- Permeability Tests and theoretical behavior considering the liner's material versus inner fluids. Tests according to ISO 13628-5, Second edition, 2009, Section 7.3.7.13, to be carried over at least five samples;
- Collapse Test according to ISO 13628-5, Second edition, 2009 Section 7.3.7.9 and technical spec of qualification tests for umbilicals(6 hose samples + fittings assemblies, 2 from each end of the manufactured hose and two further samples with a minimum of one splice in the carcass). Along test, hoses shall be maintained under the predicted pressure for the specified maximum water depth over a minimum period of 60 minutes, before raising the pressure up to the collapse of the hose.

Additionally, the following tests, according to ISO 13628-5, Second edition, 2009, shall be performed:

- Flow Test (Flow x Pressure Drop curve shall be obtained).
- Proof Test Characterization Test:
In order to find the allowable number of proof tests @ 1.5 the DWP of the hoses without loss of properties, hose samples, from the same batch, shall be subjected to a series of proof tests and subsequent burst tests. Tests shall be performed as many times as needed to lead the values of burst pressure to 70% of its nominal value. In the first test step samples will be subjected to one proof test over a period of one hour followed by a burst test. In the second step, two proof tests over one hour followed by a burst will be performed, and so on, up to a burst of 70% of the nominal burst pressure of the hose.
- Ageing Characterization Test:
Suppliers shall present in the proposal a scope of tests in order to address the following areas of concern (as an alternative, data from previous tests or verification plans may be accepted):
 - Time dependency of mechanical properties;
 - Ageing characteristics to temperature;
 - Ageing characteristics to bending;
 - Environmental stress cracking resistance;

**UMBILICALS FOR SUBSEA APPLICATIONS
1/2"ID HOSES FOR CHEMICAL INJECTION**

Ageing in water and alcohols.

Test acceptance criteria shall comply with the statements of this technical specification. When not mentioned, test criteria shall be according to ISO 13628-5, Second edition, 2009.

Above tests shall be performed according to manufacturer's written specification / procedures, which shall be presented in advance for Petrobras' comments and approval.

6.0 - IDENTIFICATION

Hoses shall be marked lengthwise, according to ISO 13628-5, Second edition, 2009, Section 7.3.3.5.

7.0 - MANUFACTURING REQUIREMENTS

Manufacturing requirements as per ISO 13628-5, Second edition, 2009 and API SPEC 17J (metallic carcass), as applicable. Manufacturer shall also assure the traceability of the product, which shall include certificates of all materials, manufacturing, tests, and inspection records. Manufacturing data book shall be provided on request.

7.1 - FACTORY ACCEPTANCE TESTS

Each batch of manufactured hoses (i.e., manufactured continuous length, especially regarding the braiding process) to be used in the construction of the completed umbilicals shall be tested as per ISO 13628-5, Second edition, 2009. Additional requirements mentioned below shall also be considered:

At least one sample taken from each end of each batch shall be tested:

- Collapse Test, according to ISO 13628-5, Second edition, 2009 Section 7.3.7.9 and technical spec of qualification tests for umbilicals. During test, hoses shall be maintained under the predicted pressure for the specified maximum water depth over a minimum period of 60 minutes, before raising the pressure up to the collapse of the hose.
- The whole HCR produced length shall be cleaned to NAS 1638 class 10 (or equivalent SAE AS4059) before the delivery to Petrobras, as well as before bundling (laying-up for the umbilical construction) under a qualified procedure, submitted in advance for Petrobras approval.

In general, test acceptance criteria shall comply with item 2.3 above. When not mentioned in that item, test criteria shall be according to ISO 13628-5, Second edition, 2009.