E & P	3/8" & 1/2” ID HYDRAULIC HOSES

INDEX OF REVISIONS

REV	DESCRIPTION AND/OR AFFECTED SHEETS
0	ORIGINAL

	ORIGINAL	REV. A	REV. B	REV. C	REV. D	REV. E	REV. F	REV. G	REV. H
DATE	AUG/10								
MADE BY	FBA								
CHECKED	AAG								
APPROVAL	CASP								

INDEX

NOTE

This Technical Specification replaces former I-ET-3500.00-1500-290-PAZ-003 REV. A issued MAY/08 which was been improved since OCT/99, from 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

1.0 - PURPOSE

The purpose of this Technical Specification (ET) is to define the basic characteristics of the hoses to be used as a component of completed umbilicals (umbilicals and IPUs) for hydraulic control in offshore applications.

As a general requirement, hoses shall comply with ISO 13628-5, Second edition, 2009. However, additional requirements herein specified, which modify or complement the provisions of this Specification shall be adopted.

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, 7,500 psi and 10,000 psi. For a specific hose, the pressure rating is defined in the related Material Requisition (RM).

2.0 - BASIC CHARACTERISTICS OF 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 the phases of manufacturing, handling, storage, installation, and operation during their specified service life.

2.1- HOSES CONSTRUCTION

Hoses are composed of 3 layers: liner that shall guarantee the hose leakproofness; reinforcement, that shall guarantee inner pressure resistance; and sheath that shall guarantee external protection to the hose. This item presents the material specification that is currently being used by Petrobras for each of these layers. Alternative materials may be accepted, providing the flexible manufacturer provides Petrobras documentation - approved by a Third Party pointed out by Petrobras in advance - demonstrating that such materials were successfully qualified on tests for the hose's specified service life.

2.1.1 - Liner

This layer is made of a poliamide 11 material which is compatible with the specified internal fluids (Petrobras suggests Rilsan Besno P40 TLO). Any other poliamide 11 material shall not contaminate the conveyed fluid with oligomers or other products of chemical reaction.

2.1.2 - Reinforcement
The inner tube is covered with an aramid fiber pressure reinforcement.

2.1.3 – Sheath
A polyether based polyurethane or polyamide 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. For 3/8 inch nominal bore, thread 9/16 inch thread type – 18 UNF; For 1/2 inch nominal bore, 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

The main functional requirements are the following:

- Application: Hydraulic Control.
- Test Pressure ratios as per ISO 13628-5, Second edition, 2009, Section 7.3.4.1.
- Dimensions and tolerances: As per ISO 13628-5, Second edition, 2009, Section 7.3.2.
- 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 temperature: 4° C.
- Inner Fluid: Water based hydraulic fluid, as per related I-RM;
- Minimum number of proof tests @ 1.5 WP without loss of properties(after the umbilical's FAT): 6
- Volumetric expansion test limits:

3/8" ID HOSES

Pressure (psi / bar)	Maximum Allowable Expansion (cc/m – cc/ft)
3,000 - 204	5.67 - 1.72
5,000 - 340	7.56 – 2.30
7,500 - 510	9.66 - 2.94
10,000 - 680	11.76 - 3.58

Note: Volumetric expansion shall be informed at every 1,000 psi step, only for characterization. Values informed on the above table shall be considered as acceptance criteria.

1/2" ID HOSES

Pressure (psi / bar)	Maximum Allowable Expansion (cc/m – cc/ft)
3,000 - 204	10.03 - 3.06
5,000 - 340	13.45 - 4.10
7,500 - 510	17.16 - 5.23
10,000 - 680	20.90 - 6.37

Note: Volumetric expansion shall be informed at every 1,000 psi step, only for characterization. Values informed on the above table shall considered as acceptance criteria.

* Note: Pressure steps above indicated shall be considered up to the DWP of the specified hose.

3.0 – MINIMUM DATA SHEET CONTENT

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 Pressure;
- Max 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;
- Collapse 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)

4.0 - SERVICE LIFE

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

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);
- Collapse Test according to ISO 13628-5, Second edition, 2009 Section 7.3.7.9, and technical spec of qualification tests for umbilicals to be performed on 4 hose samples(2 samples bent to its MBR and 2 straight samples), as characterization only.
- Impulse test according to ISO 13628-5, Second edition, 2009 Section 7.3.7.7 (the test may be conducted with the test fluid at ambient temperature);
- Volumetric Expansion, according ISO 13628-5, Second edition, 2009, Annex D. Test samples shall not be less than 3 meters in lenght between end fittings. (one 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;
- 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 MWP of the hoses without loss of properties, hose samples 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 Tests:
  Suppliers shall present in the proposal a scope of tests in order to adress 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;
  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

Process control and records shall comply with ISO 13628-5, Second edition, 2009. Manufacturer shall also assure the traceability of the hoses which shall include certificates of all materials, manufacturing, tests, and inspections records. Manufacturing data book shall be provided on request.

7.1 – FACTORY ACCEPTANCE TESTS

Each batch of the manufactured hoses (i.e., manufactured continuous length, specially for the brading process) to be used in the construction of the completed umbilicals shall be tested as per ISO 13628-5, Second edition, 2009, Section 7.3.8. Additional requirements mentioned below shall also be considered:

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

- 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.

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.