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## TECHNICAL SPECIFICATION

**Doc No: DSF-SPC-CIV-017**

**Rev. 1**

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### HIGH PRESSURE (HP) TRANSMISSION SYSTEMS

### F.O. (FIBRE OPTIC) CONDUIT INSTALLATION

**JUNE 2021**

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## REVISION HISTORICAL SHEET

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## 1. SCOPE AND OBJECTIVES

This specification covers the requirements for the construction and installation of HDPE conduit which will accommodate the fiber optic cable system.


## 2. REFERENCES

### 2.1 References Documents

- Tech. Spec. No. DSF-SPC-QAC-005 [Shop Inspection of Equipment and Materials for NGT Project]
- Tech. Spec. No. DSF-SPC-QAC-006[Inspection and Test Instructions]
- Tech. Spec. No DSF-SPC-CIV-005[Backfilling]
- Tech. Spec. No DSF-SPC-CIV-018[Construction Installation of Pipeline HDD]
- Tech. Spec. No DSF-SPC-CIV-019[High Density Polyethylene(H.D.P.E.) Piped]

### 2.2 Reference Drawings

- STD-1-41-18[Typical Pipeline Construction Details - RAVINE Crossing - Bed Erosion Protection with RIP-RAP, Alternative "1"]
- STD-1-41-04 [Erosion Protection Ditch Breaker with Sand Bags for Pipelines]
- STD-1-41-06[Erosion Protection Ditch Breaker with concrete for Pipelines]
- STD-1-41-09[River Bank Protection with gabions]
- STD-0-41-11[River, Stream/Torrent Bed Protection with gabion Boxes for Pipelines]
- STD-1-43-22[F.O. Conduit Cable - Manhole and Handhole]
- STD-4-41-17[Fiber Optic (F.O.) Cable Conduit Installation]

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## 2.3 Reference Codes and Standards

- ELOT EN 1555-1[Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) - Part 1: General]
- ELOT EN 1555-2[Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) - Part 2: Pipes]
- DIN 16874[Pipes of High-Density Polyethylene (Pe-Hd) For Buried Telecommunication - Dimensions and Technical Delivery Conditions]

## 3. ACRONYMS

DN	Nominal Diameter
HDD	Horizontal Directional Drilling
HDPE	High Density Polyethylene

## 4. CONDUIT MATERIAL REQUIREMENTS

The conduit cable and fittings shall comply with codes and standards referenced in Material Requisition “HDPE Pipe for FOC”. HDPE material properties are described in Technical Specification DSF-SPC-CIV-019 “High Density Polyethylene (H.D.P.E.) Pipe”.

Also, special material precautions that have to be taken for transportation and storage of HDPE Pipes, are described in the above mentioned Specification.

## 5. CONDUIT INSTALLATION

### 5.1 General

The conduit shall follow the route of the pipeline and be installed level and with minimum bending of the conduit. Where the conduit requires bending, only elastic bending shall be permitted with a minimum distance between bends of 60m and a radius of 10m. In

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exceptional circumstances where it is not possible to achieve a bending radius of 10m, a bend radius of 4m may be applied to the conduit as an absolute minimum.

Only personnel trained and competent in the handling, laying, jointing and testing of HDPE conduit piping for use with fibre optic cable installation shall be employed in this technique.

Under normal laying conditions conduit joints shall be made at minimum distance of 1km intervals. Reduction of this interval shall only be carried out with the authorisation of the Supervisor.

Prior to joint construction, the CONTRACTOR shall ensure that the spigot ends of both pipes and the coupling are free from all contamination and damage.

Jointing shall comply strictly with the manufacturer's instructions and shall ensure no internal burrs, edges or deformations. Joints/ connection fittings shall be capable of removal after construction and shall have end load ability to prevent pull-out due to expansion or contraction of adjacent conduit piping. Connection fittings shall be rated to the same design pressure as the conduit.

End plugs/ caps shall be fitted to seal the ends of empty ducts immediately following installation to prevent entry of any unwanted elements such as dirt, water, moisture, insects/ rodents etc. prior to installation of FO cable.

Cable sealing plugs shall be provided with the conduit for use in holding the cable and preventing entry of any unwanted elements, as specified above.

## 5.2 Conduit Individual Route in Pipeline Trench

Backfilling up to first backfill level shall be carried out according to Tech. Spec. No. DSF-SPC-CIV-004, as shown on Std Dwg. No. STD-4-41-17, figure 1.

The material shall be compacted properly to prevent it from subsiding.

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After laying the conduit in the backfilling layer a plastic warning mesh shall be laid down in a position of 160 mm above the conduit.

### **5.3 Conduits Fastened to Concrete Encased Pipeline**

The conduits can be fastened by means of suitable plastic ties preventing slipping, as shown on STD Dwg. No. STD-4-41-17, figure 2, alternative 1.

Preferably and according to Supervision instructions the conduits shall be embedded in concrete as per alternative 2 shown in figure 3.

It shall be assured by Contractor that the conduit shall not be deformed by the plastic ties. Backfilling shall be carried out properly without causing any damage to the cable conduit.

Conduits shall be fastened to the pipeline at a spanning of 5 m maximum.

Conduit shall be protected by partial backfill with sand and lightweight concrete tiles, approximately 300mmx 600mmx 25mm.

### **5.4 Conduits Installed in The Pipeline Concrete Encasement**

The conduits shall be installed before concreting the pipeline encasement as shown on STD Dwg. No. STD-4-41-17, figure 3.

### **5.5 Conduits Fastened into Concrete Saddles**

The conduits shall be fastened on concrete saddles by means of suitable plastic lugs as shown on STD Dwg. No. STD-4-41-17, figure 4.

For supplementary requirements see Section 5.3 herein above.


### **5.6 Conduits Fastened into The Pipeline Casing Pipe**

The conduits shall be fastened by means of suitable plastic ties as shown on STD DWG. No. STD-4-41-17, figure 5.

The fixing point shall be placed between two insulating spacers. The distance between spacers must not exceed 2.5 m and the distance between fixing points must not exceed 5m.

### **5.7 Conduits in HDD**

The conduit can be mounted to and pulled together with the steel pipe string. However, possible twisting of the steel pipe section may result in failure of this process.

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If the HDPE conduit is damaged (e.g buckling) while being pulled back with the steel pipe section, separate punch holes have to be pierced alongside the intake pipe section and the HDD line is pulled back to the new position.

## 6. TESTS

### 6.1 Calibration Test

The CONTRACTOR shall carry out a gauging diameter deviation test or calibration test. The test shall be carried out on completion of backfilling and the calibration pig (attach. Appendix 1 Pigging Device) shall pass freely through the conduit with no excess pressure required. The Supervisor shall witness each calibration test and shall consequently be informed in advance of each test.

The calibration pig shall be fitted with a tracking signaller that will allow location should it become lodged in the conduit. The tracking signaller may also be supplied as a separate tool.

In case there is a severe distortion and the pig stops, the distortion point shall be detected by means of a second pig with a light string attached to it and by measuring the length of string.

The pipe at the location of the defect shall be cut out and repaired using new pipe and HDPE couplings following the pipe Manufacturer's recommendations.

The pipe section at the repair area shall be retested at Contractor's expenses.

### 6.2 Pressure Test

All pressure testing shall be carried out using air at a pressure of 5 bar introduced into the conduit at a maximum rate of 2bar/min. The CONTRACTOR shall ensure that all necessary safety measures have been implemented and site personnel are made aware of the site restrictions during the test.





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The pressure test shall be performed after the pipe sections have been laid in the ditches and the trench is backfilled up to a height of at least 0,4 m on top of the HDPE pipe.

After a stabilization period of 1 hour, the test shall be monitored for 3 hours. The test shall be considered acceptable if the pressure drop is less than 0.1bar over the 3hr period. A pressure recorder shall be used to record the test data and the resultant data shall form a part of the test results, which shall be subject to authorization by the Contractor Representative.

For this test only certified Manometers shall be used with scale 0-10 bars, class 1.5 and error  $\pm 0.01$  bar. In case of a pressure drop greater than 0.1 bar, indicating a rupture or leaking in the duct, the test shall be repeated, for the whole pipe section after the rupture is identified, using the H2 Method, and it shall be repaired at Contractor's expenses.

By using the H2 method, a low concentration of hydrogen gas, for example 5% to 10% of hydrogen in nitrogen, is injected into the leaking pipe section.

Hydrogen penetrates easily leaks of the pipes as well as the backfilling material.

The identification of the leak point will be done with a gas detector which is especially designed to detect only hydrogen, even when the concentration of the hydrogen in the air is less than 0,0001%.

## **7. QUALITY ASSURANCE**

It is Contractor's responsibility to properly complete quality forms, which are applicable for the execution of said works, in accordance with the specifications and applicable standards.

After completion of works, the relevant quality forms and certificates shall be submitted to the Client's Representative for approval and acceptance of the works.

Client's representatives shall have the right to review all the relevant documentation and audit the relevant quality procedures, as considered necessary, in order to ensure that the quality system is functioning satisfactorily.



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### Appendix 1: Typical Example of Pigging Device For HDPE Conduit Testing



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### ALUMINUM ROD

HOLE FOR ATTACHING LIGHT STRING

