

المواصفات الفنية الخاصة بالمناقصة العامة

رقم المناقصة : (٢٠١١/٧٥)

الخاصة بشراء وتوريد (٦٠٨) كم كابلات ألياف ضوئية

مختلفة السعات

المؤسسة العامة للاتصالات السلوكية واللاسلكية

الإدارة العامة للمشتريات والمخازن

إدارة المشتريات - قسم العقود والمناقصات

SPECIFICATIONS OF
OPTICAL FIBERS CABLE

1. GENERAL

- 1.1. This specification covers the general requirements for (10 Fibers, 16 Fibers, 24 Fibers, 36 Fibers, 48 Fibers & 64 Fibers) Optical Fiber Telecommunications cables used for duct or direct buried installation.
- 1.2. The optical fiber shall be Single mode and high silica material (based on ITU-T Recommendation G652)
- 1.3. The type of optical Fiber cable as described in this specification is as follow:-
 - 1310/ 1550 nm SM Optical Fiber armored for duct or buried applications with (10 Fibers, 16 Fibers, 24 Fibers, 36 Fibers, 48 Fibers & 64 Fibers) and suitable for used DWDM systems.
 - The Tenderers shall submit offer for the Underground Cable of (10 Fibers, 16 Fibers, 24 Fibers, 36 Fibers, 48 Fibers & 64 Fibers)

2. OPTICAL FIBER CONSTRUCTION & TECHNICAL PARAMETERS

- 2.1. Operation wavelengths shall be 1310nm and 1550nm wavelength bands.
- 2.2. The geometric structures and optical characteristics shall be as per ITU-T Rec. G 652, as briefly indicated below. The tenderer shall give the corresponding figures for each these items for their offered cables.

Items	Specified Values
Mode field diameter	9 $\mu\text{m} \pm 1 \mu\text{m}$
Mode field concentricity error	Less than 1 μm
Cladding diameter	125 $\pm 2 \mu\text{m}$
Cladding no circularity error	Less than 2 %
Coating diameter	250 $\pm 2 \mu\text{m}$
Cut - Off wavelength (2 - m fiber) Cut - Off	1150 - 1280 nm
Wavelength for cabled fiber chromatic	< 1270 nm
Dispersion coefficient:	
- At 1295 - 1322 nm	Less than 3 ps/nm.Km
- At 1550 nm	Less than 17.5 ps/nm. Km
Zero dispersion Wavelength	1295 ~ nm 1322
Zero dispersion slope	Less than 0.095 ps/nm ² .Km
Attenuation coefficient:	
- 1310 nm	Less than 0.35 dB/km
- 1550 nm	Less than 0.21 dB/km
- PMD	< 0.1 ps/ $\sqrt{\text{Km}}$

- 2.3. Coating:
A protective dual UV cured acrylate coating shall be applied directly to the cladding surface.
The coating should be applied over the entire length without bare spots of variation in thickness. The coating should be color-coded and if possible have additional ring marking. The refractive index of the coating should be higher than that of the cladding, which means that undesirable light

lunched into the cladding, is absorbed within a few meters. The coating must be removable mechanically or chemically for jointing fibers.

2.4. Technical Properties

2.4.1. Tensile Load

All optical fibers with primary coating shall pass the proof test before cabling. The tensile load carried for duration of approximately 1 second shall not be less than 5N

(About 0.4 Gpa, 58Kpsi) and the proof strain of optical fiber shall be not less than 1%.

2.4.2. Bending Radius

The minimum bending radius of the coated fiber should be less than 30mm.

2.4.3 Color-coding

All fibers used in the cable are color-coded with undeniable color to facilitate individual fiber identification. The color-coding should be according to IEC 304

As follow:

Blue – Yellow – Green – Red – Natural Color..... etc

2.4.3. Temperature Ranges

Transportation and Storage Temperature	- 20°C to 50 °C
Installation Temperature	- 10°C to 50 °C
Operating temperature	-10°C to 50 °C

3. OPTICAL CABLE DESIGN

The basic building block of the optical cable required is a multifiber loose tubes (buffers) each tube have up to as the following table:-

Type of Cable	Fiber	Tube
10 F	2 Fiber	5
16 F	4 Fiber	4
24 F	4 Fiber	6
36 F	6 Fiber	6
48 F	8 Fiber	6
64 F	12 Fiber	6 1 TUBE FOR 4 F

For others These tubes are jelly filled and stranded (SZ standing) around a nonmetallic central strength member. The cable core is covered with inner sheath, corrugated steel tape and outer sheath. The cable construction preferred is as indicated in the following paragraphs.

The Tenderers, however, can give a suitable alternative construction rather than the specified below indicating the advantages over the specified one.

3.1.1 Central Strength Member

The central strength member shall be PE-coated Reinforced Glass Fiber, The outer diameter of the Central Strength Member shall be not less than 1.8mm (according to the size of the cable).

3.1.2 Loose Buffer Color Coded

The buffer (tube) must hold its shape, be tough, not to be susceptible to aging and be very flexible. The buffer tube should be smooth inside, causing the lowest possible resistance to movement of the fibers. It should be filled with thixotropic jelly compound. The dimension of the loose buffer (4 fibers per each) should be within the following typical values:

Outside diameters: 2-3.5 mm (according to number of fibers)

Wall thickness: approx 20 % of outer diameter

Every loose tubes used in the cable core should be color coded to facilitate individual loose tube identification.

3.1.3 Stranding

The loose buffers should be stranded around the central strength member using the reverse lay (SZ) stranding method. A suitable binder must be wound around the stranded elements.

3.1.4 Cable Core Filing

The empty interstices in the cable core should be filled with a suitable compound at very high pressure (about 15 bar). This compound must have a composition such that it is not detrimental to the properties of the other cable elements. The compound must have a negligible swelling tape on the PE sheath and a low thermal expansion coefficient. A barrier layer of petroleum resistant and relaxing thermoplastic adhesive extruded around the cable core serves as an additional barrier for the filling compound.

3.1.5 Water Blocking

The stranded core should be covered with a layer of water blocking material.

3.2 INNER PE CABLE SHEATH

The kind of cable core PE sheath should have the following features: low densities, high viscosity, break elongation, and easy workability. The inner sheath thickness of 1.0 mm (nominal) with a suitable dielectric barrier layer.

3.3 Armour

A corrugated steel tape shall be Electrolytic Chrome Steel (ECCS) tape with a polymer coating applied to both sides for rodent, termite and corrosion protection.

3.4 Outer PE Cable Sheath

The outer sheath covering both the messenger wire and cable core with inner sheath. The outer sheath consists of an extruded layer of black weather resistant polyethylene (LDPE). The average thickness should be 1.8 to 2.0 mm.

3.5 Cable Outer Diameter

The cable outer diameter should not be more than 22mm. (according to the number of fiber)

The tender may give any other suitable variants along with the detailed specification as alternative offer in addition to the cable meeting above specification.

3.6 The tender shall give a cross sectional diagrams of cables offered with the details of the structure and content of the cable.

3.7 Samples

The tender should offer 4 four samples of the offered cable and to clarify the differences between the sample and the offered cable.

3.8 Catalog must be attached and similar to the data sheath

4. LENGTH MARKING

4.1 The length number shall be marked at regular intervals of one meter along the outer sheath of the entire cable length.

4.2 The accuracy of the marking shall be held within a limit of $\pm 1\%$.

4.3 Each cable shall have the following information clearly marked between the numbers marked.

- a.) Name of manufacturer.
- b.) Year of manufacturer.
- c.) Code of cable.

4.3 The color of these marking shall be undeniable and preferably to be white color.

5. MACHANICAL CHARACTERASTICS

5.1 Tensile Strength

The allowable maximum tensile strength in Newton shall be indicated in the offer for the cable when tested as per ICE 794 - 1-E1- tensile performances with the following consideration:

-Maximum tensile strength shall be at least 2000N by the method ICE 794-1-E1 at Least 5-meter length.

- Mandrel diameter: 30 times the cable outer diameter.
- Duration of load: 5 minutes.

During the tensile test the cable elongation, the fiber elongation and the change in attenuation should be registered as a function of the tensile force and indicated in the offer technical sheet.

The tests must not affect the functioning of the optical fiber.



5.2 Crush Performance

The offered cable shall meet the impact test as per ICE 794-1-E4 impact with following consideration:-

- A point of cable in factory length shall be subjected to 10 times impacts of hammer head of 25 mm in diameter, 1Kg in weight and 1 meter in high of dropping.
- The distance of impacts 19 cm along the cable.

On the completion of test, no fiber break shall occur and the outer PE sheath of cable shall not be cracked. Maximum added loss shall not accede 0.1 dB.

5.3 Repeated Bending

The offered cable shall meet the Repeated Bending Test as per IEC 790- I-E6 Repeated Binding with the following consideration: -

- Bending diameter : 20 X the cable outer diameter.
- Applied load : 25Kg
- Bending angle : 90 degree
- Bending cycle : 25 times
- Bending speed : 1 cycle per 2 second

On completion of test no fiber break shall occur and the outer PE sheath shall not be cracked.

Maximum added loss should not accede 0.1 dB.

5.4 Torsion

The offered cable shall meet the Torsion Test as per IEC 794-1-E7 Torsion with the following consideration: -

- Test length:	2 m
- Applied load:	25Kg
- Twist angle:	+180
- Twist cycle:	Not less than 10 times

On completion of test no fiber break shall occur and the outer PE sheath shall not cracked.

Maximum added loss should not accede 0.1 dB

5.5 Water Penetration Test

One-meter specimen of the finished cable shall be supported horizontally and one-meter head of water shall be applied at one end of cable core at 23 +/-5 Deg. C for a period of 24 hours.

At the end of the test period, no water shall have leaked from the opposite end if the cable.

5.6 Temperature Performance

At least 1.000 Meter of the cable should be subjected to in temperature cycle test with great variation in environmental temperature. The attenuation should not vary more than 0.1 dB/km 1310 nm and 1550 nm for any fiber in the test.

6. Cable life

The fiber and cable shall be designed for a live expectancy for at least 30 years without serious degradation of the performance or reliability when maintained in accordance with the manufacture's recommendations and when operated in the environmental condition.

7. Tests for Geometrical, Optical & Transmission Characteristics

Tests on the finished cables shall be made to prove compliance with all requirements of this specification. The Bidder shall Submit full details of quality assurance procedures, which shall ensure that the cable fully comply with the requirements of the specification.

7.1. Geometric tests shall include the following.

- mode field diameter.
- Cladding diameter.
- Mode field concentricity.
- Cladding Non-circularity.
- Primary coating diameter. (Measuring Method: Microscope)

7.2. Optical properties test of the fiber shall include the following:

- Refractive index profile.
- Maximum theoretical numerical aperture.
- Cut of f wavelength

7.3. For each Production length, to be delivered in Yemen the following measurements shall be performed:

- attenuation at 1310nm and 1550 nm.
- Chromatic dispersion at 1310nm and 1550nm.
- Polarization mode dispersion.

7.4. The Bidder shall indicate and explain the test method at the time of submission of the Bid.

7.5. Independently certified test records of the specified materials, components of assembled cable parameters shall be submitted.

7.6. The detailed test reports for each drum of cabled shall be submitted on or before delivery of cables.

8. SHIPPING

8.1 Drum length:

The nominal drum length should be 4,000 meters (+100 meters without any additional cost)

8.2 Length of cable shall be shipped on wooden reels. The diameter of drum must not exceed 1.7 meters.

8.3 After completion of factory test, the outside end of the cable shall be sealed heat shrinkable cap.

8.4 The marking of contents on the outside of each flange of the reel shall be as follows:-

- Number of fibers.
- Direction of rotation.
- Consignee's name & address.
- Length and type of cable.
- Purchase order no. & date.
- Name of manufacturer.
- Drum number.

9. TECHNICAL DATA SHEETS (ENCLOSED)

Includes data sheath should be filled in and stamped by the concerned tenderer. Any changes in the stamped data sheet submitted to PTC which might affect the technical figures in your offer will be neglected and will lead to the total rejection of your offer.

10. The offer should give compliance to the above requirements and a full relevant technical description of the optical fiber.

11. The offer should give supply experience.



Technical Data sheet

Table 1

Cable Construction

Characteristics	Offered by the Tenderers
1.No of tubes	
2. No of fibers per tube	
3. Central Strength member -Material -Diameter	
4. Loose tubes -Material -Outer Diameter - Thickness -Type of filling compound	
5. Tube Assembly -Tube layout - Stranding type	
6. Flooding compound -Material	
7. Core Wrap -Material -Thickness	
8.Peripheral Strength Member	
9. Rip cords	
10.Inner Sheath - Material - Thickness	
11. Armouring - Material - Thickness - Coating Material and Thickness	
12. Outer Sheath - Material and Thickness	

TECHNICAL DATA SHEET
CONT'D (TABLE 1)
CABLE CONSTRUCTION

Characteristics	Offered by the Tenderers
13. Cable Outer diameter	
14. Length marking	
15. Identification	
16. Drum Length	
17. Drum flange diameter	
18. Drum core diameter	
19. Outside width	
20. Central hole diameter	
21. Cable weight (Kg/Km)	
22. Test results of Mechanical characteristics - Tensile strength - Impact - Repeated bending - Water penetration. - Operating temperature / humidity range	
- Cable Live (years)	

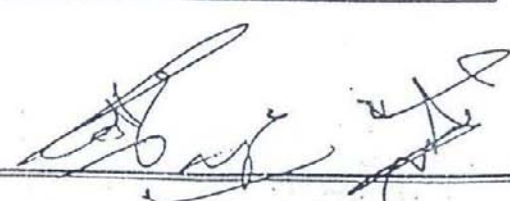
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Technical Data Sheet

(Table 2)

Fiber Data

Characteristics	Offered by the Tenderers
1-Fiber material - Core - Cladding - Coating	
2- Geometrical specification - Mode field diameter (1310 nm). - Mode field diameter (1550 nm). -Cladding diameter. -Primary coating diameter. -Mode field concentricity error. -Cladding non- circularity. -Cladding concentricity error. -Coating non-circularity.	
3-Optical and performance specification -Attenuation at 1310 nm (dB/Km). -Attenuation at 1550 nm (dB/Km). -Fiber cut- off wavelength. -Cable cut- off wavelength. -Chromatic dispersion (nm/Km) *Minimum value at 1550 -Zero dispersion wavelength. -Zero dispersion slope (ps/cnm ² .Km). -Refractive index difference. -Effective group index of refraction ❖ at 1310 nm ❖ at 1550 nm - PMD (SP/√Km)	
4-Mechanical specification -Proof test. -Coating stripping. (Mechanical stripping) -Minimum bending radius. In splice enclosure.	



Technical data sheet

(Table 3)

Sample

Characteristics	Offered by the tenderer
1- Manufacture's code for offered cable.	
2- Manufacture's code for sample submitted with tender.	
3- List of deviation -Between PTC specification and Offered cable. -Between offered cable and Sample submitted	



Technical Data Sheet
(Table 4)
Attenuation Vs. Wavelength

Attenuation vs. Wavelength		
Range (nm)	Ref (nm)	Max. Increased (dB/KM)
1285 to 1330	1310	
1525 to 1575	1550	

OPTICAL FIBERS CABLE

TECHNICAL SPECIFICATIONS

FOR

AERIAL INSTALLATION

1. GENERAL

1.1 This specification covers the general requirements for (10 fibers) optical fiber telecommunications cables used for aerial installation.

1.2 The optical fiber shall be single mode and high silica material (based on ITU-T Recommendation G.652).

1.3 The type of optical fiber cable as described in this specification is as follows:-

- 1310/1550nm SM and suitable for uses DWDM systems. Unarmored non-metallic self-supported aerial optical fiber cable. The cable preferred is a figure eight design composed of a strain-bearing element (messenger wire) and a cable core made up of buffer tubes stranded around the central strength member (FRP).

1.4 The supplier shall provide figure – 8 cable fitting according to :

- The poles are steel and of approximately 23cm diameter at the attachment point.
- 65 % of the poles will require suspension fitting and 35% of the poles require tension fitting.
- The distance between any poles and another is 40m

2. OPTICAL FIBER CONSTRUCTION & TECHNICAL PARAMETER

2.1 Operating wavelengths shall be 1310nm and 1550nm wavelength bands.

2.2 The geometric structures and optical characteristics shall be as per ITU-T Rec., G 652, as briefly indicated below. The tenderer shall give the corresponding figures for each of these items for their offered cables.

Items	Specified values
- Mode field diameter	9 $\mu\text{m} \pm \mu\text{m}$
- Mode field concentricity error	Less than 1 μm
- Cladding diameter	125 \pm 2 μm
- Cladding no circularity	Less than 2%
- Coating diameter	250 \pm 2 μm
- Cut-off wavelength (2-m fiber)	1150 – 1280nm
- Cut-off wavelength for cabled fiber	< 1270nm
- Chromatic dispersion coefficient:	
- At 1295 – 1322nm	Less than 3 ps/nm-km
- At 1550nm	Less than 18 ps/nm – km
- Zero dispersion wavelength	1295 ~ 1322nm
- Zero dispersion slope	Less than 0.095 ps/nm – km
- Attenuation coefficient:	
- 1310nm	Less than 0.35 dB/km
- 1550nm	Less than 0.21 dB/km
- PMD	< 0.1 PS/ $\sqrt{\text{Km}}$

2.3 Coating:

A protective dual UV cured acrylate coating shall be applied directly to the cladding surface.

The coating should be applied over the entire length without bare spots or variation in thickness. The coating should be color-coded and, if possible, have additional ring marking. The refractive index of the coating should be higher than that of the cladding, which means the undesirable light launched into the cladding, is absorbed within a few meters. The coating must be removable mechanically or chemically for jointing fibers.

2.4 Technical properties:

2.4.1 Tensile load:

All optical fibers with primary coating shall pass the proof test before cabling. The tensile load carried for a duration of approximately 1 second shall not be less than 5N (about 0.4Gpa, 58Kpsi) and the proof strain of optical fiber shall not be less than 1%.

2.4.2 Bending radius

The minimum bending radius of the coated fiber should be less than 30mm.

2.4.3 Color coding

All fibers used in the cable are color-coded with undeniable color to facilitate individual fiber identification. The color-coding should be according to IEC 304 as follows:-

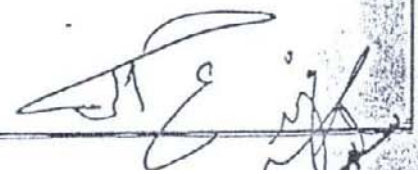
Blue-Yellow-Green-Red-Natural colors...etc.

2.4.4 Temperature ranges

Transportation and storage temperature	-20°C to 50°C
Installation temperature	-10°C to 50°C
Operating temperature	-10°C to 50°C

3. OPTICAL CABLE DESIGN

The basic building block of the Aerial optical cable required is a figure (8) design. It consists of strain-bearing element (messenger wire) and the cable's core made up of loose buffer tubes stranded (SZ standing) around central strength member. The cable construction preferred is as indicated in the following paragraphs.



The Tenderers, however, can give a suitable alternative construction rather than the specified below indicating the advantages over the specified one.

3.1 Cable Core

The cable core is composed of loose tubes each with up to (2) fibers. The loose tubes are SZ- stranded around a central strength member. The cable core consists of a central strength member, loose tube(s), filling compound, core covering tape(s).

In addition, a suitable material of water blocking tape should be applied over the Cable core.

3.1.1 Central Strength Member

central strength member shall be PE-coated Reinforced Glass Fiber, The outer diameter of the Central Strength Member shall be not less than 1.8mm (according to the size of the cable).

3.1.2 Loose Buffer Color Coded

The buffer (tube) must hold its shape, be tough, not to be susceptible to aging and be very flexible. The buffer tube should be smooth inside, causing the lowest possible resistance to movement of the fibers. It should be filled with thixotropic jelly compound. The dimension of the loose buffer (2 fibers per each) should be within the following typical values:

Outside diameters: 2 - 3.5 mm (according to number of fibers)

Wall thickness: approx 20 % of outer diameter

Every loose tubes used in the cable core should be color coded to facilitate individual loose tube identification.

3.1.3 Stranding

The loose buffers should be stranded around the central strength member using the reverse lay (SZ) stranding method. A suitable binder must be wound around the stranded elements.

3.1.4 Cable Core Filling

The empty interstices in the cable core should be filled with a suitable compound at very high pressure (about 15 bar). This compound must have a composition such that it is not detrimental to the properties of the other cable elements. The compound must have a negligible swelling tape on the PE sheath and a low thermal expansion coefficient. A barrier

ayer of petroleum resistant and relaxing thermoplastic adhesive extruded around the cable core serves as an additional barrier for the filling compound.

3.1.5 Water Blocking

The stranded core should be covered with a layer of water blocking material.

3.1.6 Strength Member

A layer of synthetic aramida yarn with high tensile strength should be applied between the cable core and the inner sheath to increase the tensile strength of the cable.

3.2 INNER PE CABLE SHEATH

The kind of cable core PE sheath should have the following features: low modulus, high viscosity, break elongation, and easy workability. The inner sheath thickness of 1.0 mm (nominal) with a suitable dielectric barrier layer.

3.3 MESSENGER WIRE

The supporting messenger is made stranded galvanized steel wires with Nominal diameter 7 x 1.57mm.

3.4 Outer PE Cable Sheath

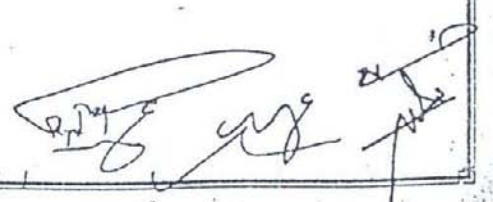
The outer sheath covering both the messenger wire and cable core with inner sheath. The outer sheath consists of an extruded layer of black weather resistant polyethylene (LDPE). The average thickness should be 1.8 to 2.0 mm.

3.5 Cable Outer Diameter

The cable outer diameter should not be more than 22mm. (according to the number of fiber)

The tender may give any other suitable variants along with the detailed specification as alternative offer in addition to the cable meeting above specification.

3.6 The tender shall give a cross sectional diagrams of cables offered with the details of the structure and content of the cable.



3.7 Samples

The tender should offer 4 four samples of the offered cable and to clarify the differences between the sample and the offered cable.

3.8 Catalog must be attached and similar to the data sheath

4. LENGTH MARKING

4.1 The length number shall be marked at regular intervals of one meter along the outer sheath of the entire cable length.

4.2 The accuracy of the marking shall be held within a limit of $\pm 1\%$.

4.3 Each cable shall have the following information clearly marked between the numbers marked.

- a.) Name of manufacturer.
- b.) Year of manufacturer.
- c.) Code of cable.

The color of these marking shall be undeniable and preferably to be white color.

5. MACHANICAL CHARACTERASTICS

5.1 Tensile Strength

The allowable maximum tensile strength in Newton shall be indicated in the offer for the cable when tested as per ICE 794-1-E1- tensile performances with the following consideration:

- Maximum tensile strength shall be at least 2000N by the method ICE 794-1-E1 at Least 5-meter length.
- Mandrel diameter: 30 times the cable outer diameter.
- Duration of load: 5 minutes.

During the tensile test the cable elongation, the fiber elongation and the change in attenuation should be registered as a function of the tensile force and indicated in the offer technical sheet.

The tests must not affect the functioning of the optical fiber.

5.2 Crush Performance

The offered cable shall meet the impact test as per ICE 794-1- E4- impact with following consideration:-

- A point of cable in factory length shall be subjected to 10 times impacts of hammer head of 25 mm in diameter, 1Kg in weight and 1 meter in high of dropping.
- The distance of impacts 10 cm along the cable.

On the completion of test, no fiber break shall occur and the outer PE sheath of cable shall not be cracked. Maximum added loss shall not exceed 0.1 dB.

5.3 Repeated Bending

The offered cable shall meet the Repeated Bending Test as per IEC 794-1-E6 Repeated Binding with the following consideration:-

- Bending diameter : 20 X the cable outer diameter.
- Applied load : 25Kg
- Bending angle : 90 degree
- Bending cycle : 25 times
- Bending speed : 1 cycle per 2 second

On completion of test no fiber break shall occur and the outer PE sheath shall not be cracked.

Maximum added loss should not exceed 0.1 dB.

5.4 Torsion

The offered cable shall meet the Torsion Test as per IEC 794-1-E7 Torsion with the following consideration:-

- Test length:	2 m
- Applied load:	25Kg
- Twist angle:	+180
- Twist cycle:	Not less than 10 times

On completion of test no fiber break shall occur and the outer PE sheath shall not be cracked.

Maximum added loss should not exceed 0.1 dB.

5.5 Water Penetration Test

One-meter specimen of the finished cable shall be supported horizontally and one-meter head of water shall be applied at one end of cable core at 23 +/- 5 Deg. C for a period of 24 hours.

At the end of the test period, no water shall have leaked from the opposite end of the cable.

5.6 TEMPERATURE PERFORMANCE

At least 1,000 meter of the cable should be subjected to one temperature cycle test with great variation in environmental temperature. The attenuation should not vary more than 0.1 dB/km at 1310 nm and 1550nm for any fiber in the test.

6. Cable life

The fiber and cable shall be designed for a live expectancy for at least 30 years without serious degradation of the performance or reliability when maintained in accordance with the manufacturer's recommendations and when operated in the environmental condition.

7. Tests for Geometrical, Optical & Transmission Characteristics

Tests on the finished cables shall be made to prove compliance with all requirements of this specification. The Bidder shall Submit full details of quality assurance procedures, which shall ensure that the cable fully comply with the requirements of the specification.

7.1 Geometric tests shall include the following.

- mode field diameter.
- Cladding diameter.
- Mode field concentricity.
- Cladding Non-circularity.
- Primary coating diameter. (Measuring Method: Microscope)

7.2. Optical properties test of the fiber shall include the following:

- Refractive index profile.
- Maximum theoretical numerical aperture.
- Cut off wavelength

7.3. For each Production length, to be delivered in Yemen the following measurements shall be performed:

- attenuation at 1310nm and 1550 nm.
- Chromatic dispersion at 1310nm and 1550nm.
- Polarization mode dispersion.

7.4. The Bidder shall indicate and explain the test method at the time of submission of the Bid.

7.5. Independently certified test records of the specified materials, components of assembled cable parameters shall be submitted.

7.6. The detailed test reports for each drum of cabled shall be submitted on or before delivery of cables.

8. SHIPPING

8.1 Drum length:

The nominal drum length should be 2,000 meters (+100 meters without any additional cost)

8.2 Length of cable shall be shipped on wooden reels. The diameter of drum must not exceed 1.7 meters.

8.3 After completion of factory test, the outside end of the cable shall be sealed heat shrinkable cap.

8.4 The marking of contents on the outside of each flange of the reel shall be as follows:-

- Number of fibers.
- Direction of rotation.
- Consignee's name & address.
- Length and type of cable.
- Purchase order no. & date.
- Name of manufacturer.
- Drum number.

9. TECHNICAL DATA SHEETS (ENCLOSED)

Includes data sheath should be filled in and stamped by the concerned tenderer. Any changes in the stamped data sheet submitted to PTC which might affect the technical figures in your offer will be neglected and will lead to the total rejection of your offer.

10. The offer should give compliance to the above requirements and a full relevant technical description of the optical fiber.

11. The offer should give supply experience.

Technical Data sheet

Table 1

Cable Construction

Characteristics	Offered by the Tenderers
1.No of tubes	
2. No of fibers per tube	
3. Central Strength member -Material -Diameter	
4. Loose tubes -Material -Outer Diameter - Thickness -Type of filling compound	
5. Tube Assembly -Tube layout - Stranding type	
6. Flooding compound -Material	
7. Core Wrap -Material -Thickness	
8. Peripheral Strength Member	
9. Rip cords	
10.Inner Sheath - Material - Thickness	
11. Messenger wire - Material - Diameter	
12. Outer Sheath - Material and Thickness	

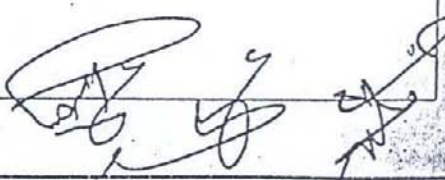
TECHNICAL DATA SHEET
CONT'D (TABLE 1)
CABLE CONSTRUCTION

Characteristics	Offered by the Tenderers
13. Cable Outer diameter	
14. Length marking	
15. Identification	
16. Drum Length	
17. Drum flange diameter	
18. Drum core diameter	
19. Outside width	
20. Central hole diameter	
21. Cable weight (Kg/Km)	
22. Test results of Mechanical characteristics - Tensile strength - Impact - Repeated bending - Water penetration - Operating temperature / humidity range	
23-Cable live (years)	

Technical Data Sheet

(Table 2)

Fiber Data

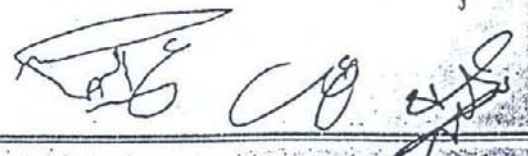
Characteristics	Offered by the Tenderers
1-Fiber material - Core - Cladding - Coating	
2- Geometrical specification - Mode field diameter (1310 nm). - Mode field diameter (1550 nm). -Cladding diameter. -Primary coating diameter. -Mode field concentricity error. -Cladding non-circularity. -Cladding concentricity error. -Coating non-circularity.	
3-Optical and performance specification -Attenuation at 1310 nm (dB/Km). -Attenuation at 1550 nm (dB/Km). -Fiber cut-off wavelength. -Cable cut-off wavelength. -Chromatic dispersion (nm/Km) *Minimum value at 1550 -Zero dispersion wavelength. -Zero dispersion slope (ps/cnm ² .Km). -Refractive index difference. -Effective group index of refraction ❖ at 1310 nm ❖ at 1550 nm - PMD (ps/√Km).	
4-Mechanical specification -Proof test. -Coating stripping. (Mechanical stripping) -Minimum bending radius. In splice enclosure.	

Technical data sheet

(Table 3)

Sample

Characteristics	Offered by the tenderer
1- Manufacture's code for offered cable.	
2- Manufacture's code for sample submitted with tender.	
3- List of deviation -Between PTC specification and Offered cable. -Between offered cable and Sample submitted	



Technical Data Sheet
(Table 4)
Attenuation Vs. Wavelength

Attenuation vs. Wavelength		
Range (nm)	Ref (nm)	Max. Increased (dB/KM)
1285 to 1330	1310	
1525 to 1575	1550	



Schedule of tender No. (75/2011)

For the supply of Optical Fiber Cables

N/S	Items Description	Qty. Km	Unit price	Total price
1.)	Optical fiber cable: SM optical fiber (10 fiber) Aerial cable.	100		
2.)	Optical fiber cable: SM optical fiber (10 fiber) Armored cable for duct & direct buried application.	120		
3.)	Optical fiber cable: SM optical fiber (24 fiber) Aerial cable.	40		
4.)	Optical fiber cable: SM optical fiber (24 fiber) Armored cable for duct & direct buried application.	100		
5.)	Optical fiber cable: SM optical fiber (36 fiber) Armored cable for duct & direct buried application.	100		
6.)	Optical fiber cable: SM optical fiber (48 fiber) Armored cable for duct & direct buried application.	48		
7.)	Optical fiber cable: SM optical fiber (64 fiber) Armored cable for duct & direct buried application.	100		
TOTAL		608		