

المواصفات الفنية الخاصة بالمناقصة العامة

رقم المناقصة : (٢٠١١/٤٣)

الخاصة بشراء وتوريد (٨٠) كم كابلات هوائية مختلفة

السعات

المؤسسة العامة للاتصالات السلوكية واللاسلكية

الإدارة العامة للمشتريات والمخازن

إدارة المشتريات - قسم العقود والمناقصات

REPUBLIC OF YEMEN

*Ministry of Telecommunication
& Information Technology*

Public Telecommunication Corporation

**Technical Specifications
& Schedule Of Quantities
(AERIAL CABLES)**

CABLE AERIL POLYETHYLENE INSULATED AND SHEATHED

CONTENTS

- 1) General Notes
- 2) Associated Documents
- 3) Definitions
- 4) Temperature and Environment
- 5) Construction of cable
- 6) Electrical Requirements at 20 °C.
- 7) Mechanical Requirements
- 8) Compliance
- 9) Supply experience
- 10) Samples.
- 11) Delivery Lengths.
- 12) Inspection.
- 13) Packing and Marking.
- 14) Data sheet
- 15) Schedule of quantities

1. GENERAL NOTES:

- (a) This specification cover the construction, properties, testing and packing of polyethylene insulated and sheathed, paired, self supporting local cable.
- (b) The cables shall be provided with a screen , refer to point 5.7

2. ASSOCIATED DOCUMENTS:

- (a) Where international standards are not available, standards in accordance with ASTM (American Society for Testing and Materials), IP (Institute of Petroleum) and BS (British Standards Institute) have been specified. The latest issues shall be apply and deemed to be integral parts of the specification.
- (b) The following standards are referred to in this specification:

ASTM B3	Conductor, Quality of Copper.
ISO R402	Conductor, Tensile Strength and Elongation.
ASTM D 1248	Insulation and Sheath, Quality of Polyethylene material
IBC 189-2	Colour Code for Conductor Insulation and group markers .
IEC 304	Standard for colours.
ASTM D 792	Insulation and Sheath, Density
ISO R 292	Insulation and Sheath, Melt Flow Index.
ISO R 527	Insulation and Sheath, Tensile Strength and Elongation
ASTMD 1603	Sheath, Carbon Black Content.
ASTMD 1693	Sheath, Environmental Stress Cracking.
BS 6007	Sheath, Spark Test.
ISO R S9	Steel Wire, Tensile Strength
ASTM A90	Steel Wire, Thickness of Zinc Coat
ASTM A239	Relevant Publications
MAT-061	Inspection and Testing
MAT-062	Packing and Marking



3. DEFINITIONS:

(a) **Conductor**

A solid continuous copper wire, circular in section.

(b) **Conductor Insulation**

The insulation material immediately surrounding a conductor

(c) **Pair**

Two identical (except for colours) insulated conductors twisted together.

(d) **Group**

Ten pairs stranded together with an identification binder applied over it.

(e) **Unit**

Five groups stranded together with an identification binder applied over it.

(f) **Core Center**

The inner unit(s) of a cable symmetrically arranged around the axis of the cable.

(g) **Core**

The stranded group(s) or unit(s) laid up and wrapped, before the addition of a screen or a sheath.

(h) **Lay**

The axial length of one complete turn of the helix formed around an imaginary line between the center of the conductors of a pair or around an imaginary longitudinal line at the center of a unit, group, or core, (whipping, lapping, screening or armouring as applicable).

4. TEMPERATURE AND ENVIRONMENT:

- (a) The cable shall retain the mechanical and electrical characteristics, within specified limits detailed in this specification, over a working temperature range of -10 C° to $+60\text{ C}^\circ$.
- (b) The cable shall suffer no deterioration from corrosive elements found naturally in the ground.

5. CONSTRUCTION OF CABLE:

5.1 Conductor:

- (a) Each conductor shall consist of a solid wire of commercially pure copper annealed, circular in section, uniform in quality and free defects. Conductors shall meet the requirements of ASTM B3 with the exception of the dimension and permissible variation.
- (b) The nominal conductor diameters shall be 0.5 mm.
- (c) The conductor diameter shall be within such limits of the specified nominal diameter as to meet the resistance limits given in Table 8.

5.2 Conductor Insulation:

- (a) Each conductor shall be insulated with solid high density polyethylene conforming to ASTM D1248.
- (b) The average radial thickness at any cross shall not be less than 95% of the nominal thickness and the minimum spot thickness shall not be less than 70% of the nominal thickness.
- (c) The minimum thickness of the insulation shall be such that the electrical requirements of this specification are met and shown in the following Table.

Table 1

Conductor dia. (mm)	Minimum Thickness of Insulation (mm)
0.5 ± 0.01	0.28

- (d) The insulation shall be coloured in accordance with IEC 198-2 as shown in Table 2. The colors shall be readily identifiable and durable. Colours shall correspond reasonably with the standard colours shown in the IEC Publication IEC-304.

Table 2

Number of Pairs	Conductor (A)	Conductor (B)
1	White	Blue
2	White	Orange
3	White	Green
4	White	Brown
5	White	Gray
6	Red	Blue
7	Red	Orange
8	Red	Green
9	Red	Brown
10	Red	Gray

5.3 Twinning:

Two insulated conductors shall be uniformly twisted together to form a pair. The lay shall be different for each pair in a group and shall not be less than 30mm nor greater than 150mm and the group lay not less than 500mm, The unit lay shall be not less than 150mm .

5.4 Stranding:

- (a) Ten pairs, coloured as in Table 2, shall be stranded together to form a group.
- (b) An open lapping of plastic tape(s) or textile threads, durably coloured, shall be applied over each group as shown in Table 3, Colours shall be correspond to reasonably with the standard colours shown in IEC Publication IEC 304.
The groups shall be stranded together.

Table 3

Group Number	Color Code
1	Blue
2	Orange
3	Green
4	Brown
5	Gray
6	Red
7	White
8	Black
9	Yellow
10	Violet

- (c) Cable with 10 pairs or more shall have spare pairs as shown in table 4,5 .The spare pairs shall be stranded to from a separate unit whipped an open helix of durable coloured tape(s).
- (d) Cable up to and including 100pairs shall be formed by stranding group together and laid as shown in (Table 4).
- (e) The counting of group shall be start in the center layer

Table 4

Number of pairs	10 - pair group number		No. of Spare Pairs
	Center	Layer 1	
10	1	-	0
20	1,2	-	0
30		-	0
50	1	2 - 5	1
70	1	2-7	1
100	1,2(3)	(3) 4 - 10	1

- (f) Cables in excess of 100 pair shall be formed by stranding together units as shown in table 5. The units shall be compassed of five 10 pairs group as shown in table 4.

Table 5

Number of pairs	Number of pairs in the unit	Core Center	Number of spare pairs
150	50	1 - 3	3
200	50	1 - 4	4

- (g) An open lapping of durably tape (s), or threads shall be applied over each unit or subunit. The binder shall be of same colour for all units except for the first unit, which shall be different colour.
- (h) The length of lay of the binders shall not be exceed 100 millimeters when laid in the same rotation as the pairs. When laid in the opposite rotation the length of lay shall not be exceed 150 millimeters.
- (i) The spare pairs shall be placed in the interstices of the outer layer. The electrical and physical characteristics of each spare pair shall be meet all pertinent requirements for the standard pairs.

5.5 Core wrapping:

- (a) The stranded units shall be wrapped with a continuous layer of no hygroscopic dielectric material forming a compact and circular core. The wrapping shall having an overlap of 30% for the wrapping but not less than 5mm. If required for manufacturing reasons, the center core may be similarly wrapped better polyester tape 40 μ m.
- (b) The wrapping shall not be adhere to the insulation or to the screen sheath.

5.6 Identification:

An identification tape, durably marked with R.Y.P.T.C the Manufacturer's name and the year of manufacture of the cable, shall be placed longitudinally, straight or in spiral, under or over the wrapping. Alternatively these details may be printed on the outer wrapping. This information shall be repeated at intervals of maximum 300 millimeters.

5.7 Screen:

- (a) Cable with 0.5mm conductors shall be provided with a screen 0.2mm aluminum tape coated on both sides with protective plastic. coating the thickness of the coating on each side shall be minimum 0.05mm
- (b) The screen shall be applied longitudinally with a minimum overlap of 6 millimeters.
- (c) Two tinned copper wires of 0.5mm diameter shall be applied helically of longitudinally under the aluminum alloy foil.

5.8 Suspension Strand:

- (a) The suspension strand shall be consist of 7 zinc coated steel wires in after drawn condition performed with a left hand lay ad shown in the table (6). The length of lay shall be approximately 20 times the diameter of the strand.
- (b) The steel wire from a fabricated strand shall be, when tested according to ISO R 89.
- (c) The wire shall be coated with zinc technical grade. The radial thickness of the zinc coat shall be equivalent to a weight of minimum 70g/m² when tested according to ASTM A90. standard method
- (d) The uniformity and covering properties of the zinc coating shall be checked by dip test according to ASTM A 239 with the exceptions that the solution shall be consist of one part CU SO₄ · 5 H₂O + 1 g Cu(OH)² and shall not be withstand two dips .
- (e) When the performed strand is cut the individual wires shall not be spring open.
- (f) The size of the suspension wire shall be as shown in table 6.

Handwritten signatures and stamps are present at the bottom of the page, including a blue ink signature, a black ink signature, and a circular stamp with a signature inside.

Table 6

Number of pairs	0.5mm	
	Minimum diameter of each steel wire (mm)	Minimum breaking load of each strand (KN)
10	1.2	12
20	1.2	12
30	1.2	12
50	1.2	12
70	1.6	22
100	1.6	22
150	1.6	22
200	1.6	22

5.9 Outer sheath:

- (a) The sheath shall be consist of high density polyethylene compound in accordance with ASTM D 1248 containing adequate amount of recognized sunlight deterioration inhibitors stabilizers. Anti-oxidation agent and other additives to retain the properties of the sheath when subjected to high temperatures. Intensive sunlight and sulphur polluted air. The sheath shall be extruded over the suspension strand forming a "figure 8" cross section.
- (b) The nominal thickness of the outer sheath over the cable core and over the suspension strand as given in table 7.
- (c) The average thickness at any cross section shall not minimum be less than 95% of the specified thickness.
- (d) The sheath shall be free from pinholes, joints, repairs and their defects.
- (e) The web jointing the suspension strand and the cable core shall be well centered. The thickness as well as the height of the web shall be (HXW = 4X4mm)

Table 7

Number of Pairs	Thick of Screen		Nominal thickness of the polyethylene sheath in mm						
			Over cable core			Over the suspension strand			
	Screen	Polymer	0.5				0.5		
10	0.2mm	0.05mm	1.4				1.5		
20	0.2mm	0.05mm	1.4				1.5		
30	0.2mm	0.05mm	1.5				1.6		
50	0.2mm	0.05mm	1.5				1.6		
70	0.2mm	0.05mm	1.8				2.0		
100	0.2mm	0.05mm	1.8				2.0		
150	0.2mm	0.05mm	2.2				2.4		
200	0.2mm	0.05mm	2.2				2.4		

5.10 Length Marking:

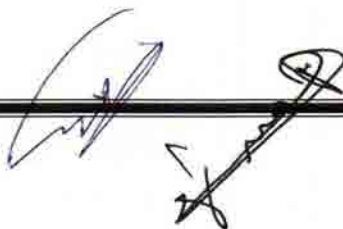
Sequentially numbered length markers should be placed at regular intervals of 1m longitudinally on the outside sheath. Continuous sequential numbering should be employed for any single length .The number shall not be less than 3mm in height and spaced to produced Good legibility. The numbers shall be of clear distinguishable contrast marking.

The accuracy of the length marking shall be within ± 1%.

An occasional illegible is permissible if there is a legible marking on either side of it.

5.11 Identification Marking:

Each length of cables shall be identified with the manufacturers name, and with the Ministry of Telecommunications & Information Technology, Republic of Yemen and PTC so as to have the type of cable. The number of pairs and gauge of conductor marked on the outer surface of the polyethylene sheath .The interval of the marking shall be approximately two meters. Marking shall be indented to give permanency.



5.12 Cable Size:

The cable size shall be as specified in schedule of quantities

6. ELECTRICAL REQUIREMENTS AT 20°C:

6.1 Conductor Resistance:-

For any length of cable the conductor resistance shall not be exceed the values given in table 8. The resistance temperature coefficient for cooper conductors used in the cable should be specified.

Table 8

Conductor diameter (mm)	Maximum average resistance for all pair (Ohm/Km)	Maximum resistance one pair (Ohm/Km)
0.5	92	96

6.2 Resistance Unbalance:

The resistance unbalance between the two conductors of a pair shall not be exceed the values shown in the following table.

Table 9

Conductor (mm)	Max average (%)	Max individual (%)
0.5	0.75	2.0

6.3 Mutual Capacitance:

The mutual capacitance shall be measured with 800Hz or 1000Hz .The average mutual capacitance shall be $44 \pm 6 \text{ nF/Km}$ for average and individual values of $(46 \text{ nf} \pm 8 \text{ nf}) / \text{Km}$ respectively may apply.

6.4 Capacitance Unbalance:

- The capacitance unbalances shall be measured with 800HZ or 1000HZ and shall be corrected to a500m. Length cable. The correction factor shall be $500/L$ for RMS values and 500m for maximum values (L- length of the cable in meters).
- The maximum pair-to-pair capacitance unbalance within a group shall be $22 \text{ Pf}/500\text{m}$ RMS and $150 \text{ pf} / 500\text{m}$ for individual values.
- The maximum pair-to-pair capacitance unbalance between adjacent groups or units shall be $20 \text{ pF}/500\text{m}$ for RMS values and $50 \text{ pf} / 500\text{m}$ for individual values.
- The pair - to - screen unbalances shall be measured at 800Hz or 1000Hz .The maximum pair to screen capacitance unbalances shall be $400 \text{ pF}/\text{Km}$ for RMS values and $1500 \text{ pF}/\text{Km}$ for individual values.

6.5 Insulation Resistance:

Each insulated conductor in the completed cable shall be tested with a potential of 500 volts DC, applied for one minute. Each insulated conductor shall have a minimum insulation resistance of 10000 megohm for 1000m.

Throughout the test all insulated conductors other than those under measurement the screen and the suspension wire shall be earthed. Several pairs may be tested at the same time.

6.6 Dielectric Strength:

- In each length of completed cable the insulation shall be capable of withstanding DC potential for three seconds as the following table.

Table 10

Conductor Dia. (mm)	Test Potential (Volts)	
	Conductor to Conductor	Conductor to Screen
0.5	5000	10000

6.7 Spark Test of Sheath:

The sheath shall be spark tested in accordance with BS 6007 at the voltage shown in Table 11. The test may be made during sheath extrusion process.

Table 11

Radial thickness of sheath (mm)	Test voltage (Volts) DC
1.4	6,000
1.5	8,000
2.0	10,000
2.5-3.0	12,000

6.8 Attenuation:

Nominal attenuation shown in the following table 12.

Table 12

Conductor Dia. (mm)	Nominal Attenuation (dB/Km)
0.5	1.45

7. MECHANICAL REQUIREMENTS

All tests shall be performed as specified in inspection and test of PTC's specification.

7.1 Conductor:

The tensile strength shall be minimum 200N/mm². The percentage permanent elongation after completed test shall be not less than shown in table 13.

Table 13

Nominal Diameter (mm)	Permanent elongation
0.5mm	14 %

7.2 Insulation:

The maximum melt flow index shall be 0.5.

The tensile strength shall not be less than 10N/mm² and the ultimate elongation not less than 300%.

7.3 Screen:

The minimum force required to peel the screen from the cable sheath shall be not less than 6.5N for a width of 26mm.

7.4 Sheath:

- The maximum melt flow index shall be 0.5.
- The tensile strength shall not be less than 12.5N/mm² and the ultimate elongation not less than 400%.
- Resistance to environmental stress cracking shall not be allow more than 2 failures from 10 tested specimens.
- The carbon block content shall be 2.5 percent (weight).

8. COMPLIANCE

The Tenderer shall be state their compliance with specification in figures and detailed statements any deviation suggested by manufacture, shall be fully documented and may be presented the word (comply) is not sufficient for this purpose.

9. SUPPLY EXPERIENCE

The tender shall be submit document of supply experience.

10. SAMPLES

- The sample must be corresponding to submitted offer with length not less 40cm, clearly showing all the cable layers.
- The sample must be stamped by Manufacture Company.

11. DELIVERY LENGTH:

The cables shall be delivered on drums in standard length or as specified by order.

12. INSPECTION:

- (a) Manufacturer shall keep suitable summary records for a period not less than five years of all electrical and physical tests required in such a form that test data, for a particular drum may readily be available to the ministry upon request and in an easily readable form.
- (b) Following test results should be supplied with each cable drum:-
- Continuity
 - Conductor resistance.
 - Resistance unbalance.
 - Mutual Capacitance.
 - Capacitance unbalance.
 - Insulation resistance.
 - Dielectric strength.
- (c) PTC shall have a right to depute a representative to inspect at the factory during the manufacture of the cable at the cost of the tenderer.

13. PACKING AND MARKING:

- (a) Packing and marking shall be performed according to PTS's specification MAT-062.
- (b) The cable shall be coiled on strong wooden drums. The ends shall be firmly secured in order to withstand all transportation conditions.
- (c) When viewed from ends of the cable the direction of the rotation of the colour scheme of pairs shall be indicated by making the clockwise and anti-clockwise ends with red and green bands respectively.
- (d) Unless otherwise specified, the lengths shall be so drummed that the rotation of the colour scheme at the running end is clockwise. Cables normally need not be so drummed if, for some unforeseen manufacturing reason, this direction is reversed.
- (e) The cable shall be tested after being coiled on drums and if found satisfactory by the engineer, or his representative, the drum shall be lagged with stout closely fitting battens to prevent damage to the cable during storage or transportation.
- (f) All cable ends shall be sealed against the ingress of dirt and moisture. Cable shall not be stored or transported without the ends being sealed.
- (g) Drum Axle diameter shall be (110 mm).
- (h) A distinguishing number and the following information shall be plainly marked on the outside of each drum:-
- Manufacturer's name and Country of origin.
 - Contract Number
 - M.T.I.T.R.Y.P.T.C
 - Tender number
 - Year of manufacture
- (i) Description of cable in short, stating the type, the number of pairs and conductor size: -
- Length in meters
 - Net and gross weights
- (j) An arrow shall be painted on the drum to show direction of rolling (i.e. in the opposite direction to that in which the outer end of the cable points) and the words 'ROLL THIS WAY' shall be lettered on the drums. Drums shall be lettered 'HANDLE WITH CARE' and 'SLING THROUGH CENTRE HOLE ONLY' in English language and also in Arabic.
- (k) All cables shall be protected against damage by insects, vermin's, termites and other similar creatures.

Information to be submitted with the Tender: -

Tenderers shall be give details of the Construction of cable, electrical characteristics and mechanical characteristics relating to the concerned tender in the form given in the table below:-

<i>Characteristics</i>	<i>10P</i>	<i>20P</i>	<i>30P</i>	<i>50P</i>	<i>70P</i>	<i>100P</i>	<i>150P</i>	<i>200P</i>
1- Construction of cable: -								
1.1 Conductor. Min, Max & Nom diameter and material								
1.2 Conductor insulation Material and Min thickness(mm)								
1.3 Colour code for - Conductor insulation - Binders								
1.4 No. Of pairs in a group								
1.5 Number and location of spare pairs in the cable								
1.6 Average lay of cable - lay of single pair (mm) - lay of unit (mm) - lay of group								
1.7 Core wrapping - Material and thickness (mm)								
1.8 Screen - Material & thickness (mm) - Min thickness of Polymer coating								
1.9 Outer sheath - Material and Min. Thickness (mm)								
1.10 Suspension - Material & Min. diameter of each steel wire (mm)								
1.11 Outer suspension diameter (mm)								
1.12 Outer diameter of messenger (mm)								
1.13 Suspension web - high & width								
1.14 Outer diameter of cable (mm)								
1.15 Overall high of the cable (mm)								
1.16 Cable Core diameter								
1.17 Carbon content of cable %								
1.18 Weight of copper per km of conductor								
1.19 Weight of copper per km of cable								
1.20 Weight of copper per km of cable with spares.								
1.21 Weight of cable per Km.								
1.22 Drawing for cable construction								
1.23 Standard length (m)								
1.24Dram axle dia. (spindle hole =110mm)								
2. Electrical characteristics at 20 °C:								
.2.1 Conductors Resistance. - Max average resistance for all pairs - Max resistance of any single pair								
2.2 average resistance unbalance between two conductors								
2.3 Mutual capacitance per Km at1 KHz - Average mutual capacitance - Maximum individual values								

<i>Characteristics</i>	<i>10P</i>	<i>20P</i>	<i>30P</i>	<i>50P</i>	<i>70P</i>	<i>100P</i>	<i>150P</i>	<i>200P</i>
2.4 Capacitance unbalance - Max pair to pair unbalance within 10 pairs group – r.m.s./Indi. (for500m) - Max pair to screen capacitance unbalance r.m.s /Indi. Per Km								
2.5 Min. insulation resistance of conductors per Km with 500v meggar in Gega ohm								
2.6 Dielectric strength for 3 sec test. - wire – wire								
- wire – shield								
2.7 Spark test of sheath for 1 minute test.								
2.8 Nominal characteristic impedance								
2.9 Nominal Attenuation per Km at 1 KHz								
2.10 Cross Talk Loss per Km at 150KHz - Far – end cross talk - Near – end cross talk								
3- Mechanical characteristics								
3.1 Tensile strength and elongation of conductor								
3.2 Tensile strength and elongation of conductor insulation.								
3.3 Tensile strength and elongation of sheath.								
3.4 Tensile strength and elongation of suspension								
3.5 Operating temperature & relative humidity								
3.6 Appearance of cable ends in the drum								

*** END OF SPECIFICATION ***

المعايير الأساسية لمواصفات الكابلات: الهوائية

م	1. تركيب الكابل	الحد الأدنى لمواصفات المؤسسة
1	قطر الموصل (مم)	0.5 mm+0.01
2	مادة عازل الموصل	Solid HDPE
3	سمك العازل (مم)	Min. 0.28mm
4	معدل التفاف الخط الواحد (مم)	30 -150mm
5	مادة التاريز وسماعته (مم)	Aluminum tape /min 0.2m m*2layers
6	مادة وسماعة الخبطة	zinc coated steel wires (1.2-1.6 * 7)
7	الغلاف الخارجي	HDPE

م	2. المتطلبات الكهربائية عند 20 م	الحد الأدنى لمواصفات المؤسسة
1	مقاومة الموصل	max.96ohm /km
2	السعة التبادلية عند 1 كيلوهيرتز	Avr. 44 +-6 nf/km Ind. 46 +-8 nf/km
3	السعة الغير متزنة لـ : خط مع خط في نفس المجموعة	Rms. 22pf/500m Ind. 150pf/500m
	السعة الغير متزنة لـ : خط مع التاريز	Rms. 400pf/km Ind. 1500pf/km
4	مقاومة العازلية عند 500 فولت	10GΩ/km
5	قوة العزل الكهربائي خلال 3 ثواني..	wire - wire : 5KVDC wire - shield : 10KVDC
6	الاضمحلال للإشارة	1.45 dB/km

م	3. المتطلبات الميكانيكية	الحد الأدنى لمواصفات المؤسسة
1	قوة الشد والتمدد للموصل	Min200N/mm ² ,/elong. 14%
2	قوة الشد والتمدد للعازل	Min.10N/mm ² ,/elong. 300%
3	قوة الشد والتمدد للغلاف	Min.12.5N/mm ² ,/elong. 400%

Handwritten signatures and stamps at the bottom of the page.

Schedule to tender No. 43/2011
For the supply of
Aerial Cables

No.	Item descriptions	Quantity (Km)	Drum Length (m)
1.	Aerial cable 200 pairs/0.5mm	10	1000
2.	Aerial cable 150 pairs/0.5mm	10	1000
3.	Aerial cable 100 pairs/0.5mm	10	1000
4.	Aerial cable 30 pairs/0.5mm	10	1000
5.	Aerial cable 20 pairs/0.5mm	10	1000
6.	Aerial cable 10 pairs/0.5mm	30	1000
TOTAL		80	

NOTES: -

The tenderers must reply to the following points, otherwise this offer will be rejected: -

1. Statement of complete form manufacturing company regarding the compliance with PTC specifications.
2. Respond to and comply with PTC Technical schedules.
3. Catalogs and documents, containing instructions on how to install Cables.
4. Manufacturer's brand name must be embossed on samples, which must be which must be applicable to the submitted offer, as per PTC specifications.
5. Manufacturer must submit company profile and experience.

ملاحظات:-

يجب الإجابة على هذه الأسئلة الموضحة أدناه وسوف لا ينظر إلى أي عطاء ما لم يكون مستوفي هذه الشروط:-

- ١ - الإجابة العملية من الشركة المصنعة على كل مواصفات المؤسسة (عروض الاستجابة).
- ٢ - الإجابة على المواصفات الفنية الموضحة في الجداول الفنية.
- ٣ - الكاتالوجات والوثائق التي توضح تركيب الكابلات المطلوبة.
- ٤ - العينات المقدمة يجب أن تكون مطابقة للعرض المقدم وأن يكون محدد عليها بحفر اسم الشركة المصنعة.
- ٥ - الخبرة التزويدية للمصنع.