SASO IEC 61196-1

COAXIAL COMMUNICATION CABLES –
Part 1: Generic specification –
General, definitions and requirements

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INTRODUCTION

The Saudi Standards and Quality Organization (SASO) has adopted the International Standard IEC 61196-1/2005 Ed 2.0 "COAXIAL COMMUNICATION CABLES – Part 1: Generic specification – General, definitions and requirements " issued by the International Electrotechnical Commission (IEC). It has been adopted without any technical modifications with a view to its approval as a Saudi standard.
COAXIAL COMMUNICATION CABLES –
Part 1: Generic specification –
General, definitions and requirements

1 Scope

This part of IEC 61196 specifies the general requirements, the definitions and the requirements for the design and test methods of coaxial communication cables.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60028:1925, International standard of resistance for copper
IEC 60332 (all parts), Tests on electric and optical fibre cables under fire conditions
IEC 60754-1: 1994, Test on gases evolved during combustion of materials from cables – Part 1: Determination of the amount of halogen acid gas
IEC 60754-2:1991, Test on gases evolved during combustion of electric cables – Part 2: Determination of degree of acidity of gases evolved during the combustion of materials taken from electric cables by measuring pH and conductivity
IEC 60811-1-1, Common test methods for insulating and sheathing materials of electric cables – Part 1-1: Methods for general application – Measurement of thickness and overall dimensions – Tests for determining the mechanical properties
IEC 60811-4-1, Insulating and sheathing materials of electric and optical cables – Common test methods – Part 4-1: Methods specific to polyethylene and polypropylene compounds – Resistance to environmental stress cracking – Measurement of the melt flow index – Carbon black and/or mineral filler content measurement in polyethylene by direct combustion – Measurement of carbon black content by thermogravimetric analysis (TGA) – Assessment of carbon black dispersion in polyethylene using a microscope
IEC 61196-1(all parts), Coaxial communication cables
IEC 62153 (all parts), Metallic communication cable test methods
3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 Dielectric types

3.1.1 airspaced dielectric cables
cables in which the dielectric is air, except for a portion occupied by insulating spacers assembled on the inner conductor at regular intervals, or helically applied tapes and/or threads. It is characteristic of this type of cable that outside the spacers, it is possible to pass from the inner conductor to the outer conductor without passing through a layer of solid plastic dielectric

3.1.2 semi-airspaced dielectric cables
cables in which the dielectric is a plastics/air construction comprised of either a cellular polymer or an insulating tube at the centre of which the inner conductor is supported by discs or another plastic construction. It is characteristic of this type of cable that it is not possible to pass from the inner conductor to the outer conductor without passing through a layer of plastic dielectric

3.1.3 solid dielectric cables
cables in which the space between the inner conductor and outer conductor is filled by solid plastic dielectric. The dielectric may be homogeneous or composite, the latter comprising two or more concentric layers which may have different properties

3.2 braiding

Braiding variables used in the formulae are given in Table 1.

Table 1 – Braiding formulae variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$d$</td>
<td>Diameter of braid wire or thickness of braid tape</td>
</tr>
<tr>
<td>$D_m$</td>
<td>Mean diameter of braid i.e. diameter over dielectric plus 2.25$d$</td>
</tr>
<tr>
<td>$L$</td>
<td>Lay length of braid</td>
</tr>
<tr>
<td>$N$</td>
<td>Number of ends of wire per spindle</td>
</tr>
<tr>
<td>$W$</td>
<td>Width of tape for tape braids or $N \times d$ for wire braids</td>
</tr>
<tr>
<td>$m$</td>
<td>Total number of spindles</td>
</tr>
</tbody>
</table>

3.2.1 braid angle

$\beta$

angle between the longitudinal axis of the cable and the tangent to the helix described by a wire (ends) of the braid

$$\beta = \arctan \frac{\pi D_m}{L}$$
3.2.2 lay factor

\( K_L \)

ratio of the helical length of a wire (ends) to the length of braided cable

\[
K_L = \sqrt{1 + \pi^2 \left( \frac{D_m}{L} \right)^2} = \frac{1}{\cos \beta}
\]

3.2.3 filling factor

\( q \)

factor defined as:

\[
q = \frac{m W}{2 \pi D_m} \sqrt{1 + \pi^2 \left( \frac{D_m}{L} \right)^2}
\]

which may also be expressed as:

\[
q = \frac{m W}{2 L \sin \beta}
\]

3.2.4 coverage factor

\( K_C \)

factor related to the filling factor, so that

\[
K_C = 2q - q^2
\]

3.3 eccentricity of dielectric

variation in dielectric radial thickness of a dielectric cross-section \( (D_x) \), and is defined as the ratio of the maximum difference between the two radial dielectric thicknesses \( (T_{\text{max}} - T_{\text{min}}) \) on diameter \( (D_x) \), divided by that outer dielectric diameter \( (D_x) \), expressed as a percentage

\[
E = \left( \frac{T_{\text{max}} - T_{\text{min}}}{D_x} \right) \times 100 \%
\]

3.4 ovality of dielectric or cable

ratio of the maximum difference between two orthogonal diameters of the cross-section of a dielectric or a cable \( (D_{\text{max}} - D_{\text{min}}) \), divided by the mean of these diameters \( (D_{\text{max}} + D_{\text{min}})/2 \), and expressed as a percentage

\[
O = \left( \frac{2(D_{\text{max}} - D_{\text{min}})}{D_{\text{max}} + D_{\text{min}}} \right) \times 100 \%
\]
3.5
impedance

3.5.1
characteristic impedance
ratio of voltage to current waves travelling in the same direction on a transmission line
3.5.2
mean characteristic impedance
$Z_\infty$
asymptotic value at which the characteristic impedance approaches at sufficiently high frequencies ($\approx 200$ MHz) such that it is a positive real number

NOTE At sufficiently low frequencies ($\approx 10$ MHz), the characteristic impedance may be described by a complex number with negative phase angle.

3.5.3
impedance irregularities
3.5.3.1
random impedance irregularities
impedance irregularities which have no repetitive character or for which the function of repetitive correlation has not been found

NOTE In cables of normal manufacturing regularity, these irregularities have statistical properties. The irregularities affect the broadband performance of transmission.

3.5.3.2
periodic impedance irregularities
impedance irregularities which arise from equidistant physical distortions in the cable, due to variations in manufacture or cable structure

NOTE Even if the irregularities are small, at discrete frequencies they affect the transmission performance or considerably increase the input noise in the detection of digital signals.

3.5.3.3
local impedance irregularities
impedance irregularities due to differences in end (input) impedance of cables connected together, or from imperfections in the joints, or at points of local cable damage

3.6
velocity ratio (relative propagation velocity)
ratio of the velocity of propagation of a signal in a cable to the velocity of the same signal in free space

3.7
power rating
input power at any specified frequency and ambient temperature which may be handled continuously, without either the maximum permissible operating voltage, or maximum inner conductor temperature being exceeded. During these conditions, the cable is terminated by its characteristic impedance

3.8 screening effectiveness
3.8.1
transfer impedance
$Z_t$
quotient of the longitudinal voltage $U_2$ of an electrically short uniform cable, induced in the outer circuit (environment) to the current $I_1$ in the inner circuit (cable) or vice versa, related to unit length

$$Z_T = \frac{U_2}{I_1 \times L}$$
where $L$ is the coupling length
3.8.2 capacitive coupling

\[ Y_c = \frac{I_1}{U_2 \times L} = j \omega C_T \]

where

- \( C_T \) is the through capacitance
- \( L \) is the coupling length

3.8.3 screening attenuation

\[ a_s = 10 \log_{10} \left( \frac{P_{feed}}{P_{rad,max}} \right) \]

For electrically long cables – in a frequency range where the transfer impedance of the cable screen is proportional to frequency – the screening attenuation is length and frequency independent

3.9 messengered cable

cable (usually outdoor) having an independent support member

3.10 aerial cable

cable (usually outdoor) suspended in the air on poles or other support structures for cables

3.11 messenger

metallic or other suitable cable support member

4 Materials and cable construction

4.1 General

Unless otherwise specified, all physical measurements shall be carried out under standard atmospheric conditions for testing, in accordance with Clause 5 of IEC 60068-1.
4.2 Visual examination

Visual inspection shall be carried out to ensure that there are no observable defects in the cable. The examination shall be carried out with normal or corrected vision, without magnification.

4.3 Measurement of dimensions

The measurement of thickness and diameter shall be carried out in accordance with Clause 8 of IEC 60811-1-1.

4.4 Cable construction – Inner conductor

4.4.1 Conductor material

For solid copper conductors, the conductor shall consist of annealed or hard drawn copper, uniform in quality, and free from defects. The properties of the copper shall be in accordance with IEC 60028.

Alternatively, the conductor may consist of copper-clad steel. The layer of copper coating shall be continuous and shall adhere to the steel; the cross-section shall be circular, such that the maximum resistance of the coated conductor shall not exceed that given for a copper conductor, in accordance with IEC 60028, by more than a factor 4.8, 3.5 and 2.8, respectively, for 21 %, 30 % and 40 % nominal conductivity grade copper-clad steel. The percentage elongation at break, when tested in accordance with the test methods given in IEC 61196-1-308 shall be not less than 1 %. The minimum tensile strength shall be 827 N/mm², 792 N/mm² and 760 N/mm² for 21 %, 30 % and 40 % conductivity, respectively.

Alternatively, the conductor may consist of copper-clad aluminium. The layer of copper coating shall be continuous and shall adhere to an aluminium conductor circular in cross-section, such that the maximum resistance of the coated conductor shall not exceed that given for a copper conductor, in accordance with IEC 60028, by more than a factor of 1.8. The percentage elongation at break, when tensile tested in accordance with the test methods given in IEC 61196-1-308, shall be not less than 1 % unless otherwise specified in the relevant sectional or detail specification.

Other conductor material and metallic coating (if applicable) shall be specified in the relevant sectional or the detail specification.

4.4.2 Inner conductor metallic coating

The conductor metallic coating (if applicable) shall be specified in the relevant sectional or detail specification.

4.4.3 Thickness of conductor coatings

Thickness of conductor coatings (if applicable) shall be specified in the relevant sectional or detail specification.

4.4.4 Inner conductor construction

The construction and material of the inner conductor shall be specified in the relevant sectional or detail specification.

Where the inner conductor consists of a single strand or tube, there shall be no joint made subsequent to the last drawing operation.
Joints in individual strands of a stranded copper inner conductor shall be cold pressure welded, brazed, or silver soldered, using a non-acid flux so that the strand diameter shall not be increased and there shall be no lumps or sharp projections.
No joint in an individual strand shall be within 0.3 m of a joint in any other individual strand.

Samples of copper strand or tube removed from the finished cable shall show no substantial discoloration. If conductors are tinned, they shall be free from flux and cleaning material.

4.4.5 Solderability

The ease with which conductors permit easy soldering (if applicable) shall be checked by the solder bath method specified in 4.6 of IEC 60068-2-20. Non-activated flux shall be used.

4.5 Dielectric

4.5.1 Type

The type of dielectric required for each cable shall be specified in the relevant sectional or detail specification. The diameter over dielectric, the ovality, and the eccentricity shall be given in the sectional or the detail specification.

4.5.2 Tensile strength and the elongation at break

The tensile strength and the elongation at break of the solid dielectric material, when specified in the relevant sectional or detail specification, shall be tested in accordance with IEC 60811-1-1.

Thermal ageing, when specified in the relevant sectional or detail specification, shall be carried out in accordance with IEC 60811-1-2.

4.5.3 Eccentricity

The eccentricity of the dielectric shall be determined from a measurement of the cross-section of cable dielectric.

The measurement shall be made in accordance with test methods given in IEC 61196-1-3021.

The maximum value of eccentricity shall not exceed the value specified in the relevant sectional or detail specification.

4.5.4 Ovality

The ovality of the dielectric shall be determined from a measurement of the cross-section of cable dielectric.

The determination shall be made in accordance with test methods IEC 61196-1-301.

The maximum value of ovality shall not exceed the value specified in the relevant sectional or detail specification.

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1 Under consideration.
4.6 Outer conductor or screen

4.6.1 General

The construction and material of the outer conductor or screen shall be specified in the relevant sectional or detail specification.

The outer conductor or screen may be one, or any combination, of the following.

a) A braid of plain or coated wire or tape. Joints in the braiding wires or tapes shall be soldered, twisted, or woven in, and there shall be no joint in the complete braid. The braid shall be applied evenly. The braid angle and the filling factor or coverage factor shall be specified in the relevant sectional or detail specification.

b) Plain or coated wires or tape(s) wrapped around the core as a continuous and closed screen, with or without a metallic binder.

c) A tube of suitable conducting material (i.e. extruded, welded smooth or corrugated).

d) A layer of metal, or metallized film, applied longitudinally, with a sufficient overlap as specified in the relevant sectional or detail specification.

e) Combinations of the above, with loss-conducting or magnetic intersheath.

f) A combination of two layers of metallized tapes or films with a layer of aluminium, copper or tinned copper wires between them, and in contact with the metallized coatings. The two tapes or films may be applied longitudinally or helically over the coaxial cable dielectric.

g) A layer of metal or metallized film longitudinally formed with sufficient overlap around the dielectric and covered with a braid. An additional longitudinal layer of metal or metallized film formed with sufficient overlap and covered with braid may be utilized.

4.6.2 Intersheath/intermediate layers

Where an intersheath is required between the outer conductor and screen, it shall be of plastic material, with requirements given in the relevant sectional or detail specification.

The construction of the intersheath shall be specified in the relevant sectional or detail specification.

The intersheath shall be free from pinholes, cracks, blisters, and other defects, and shall have an even finish.

4.6.3 Semiconducting layers

Semiconducting layers, if applicable, shall be as specified in the relevant sectional or detail specification.

4.7 Jacket or sheath

4.7.1 General

Where required, the outer sheath of the cable shall be of plastic material, unless otherwise specified in the relevant sectional or detail specification.
Carbon black content, if applicable, shall be as specified in the relevant sectional or detail specification and shall be tested in accordance with IEC 60811-4-1.

UV-stability of the sheath, when specified, shall be tested in accordance with IEC 61196-1-301.

The tensile strength and the elongation at break of the sheath material, when specified in the relevant sectional or detail specification, shall be tested in accordance with IEC 60811-1-1.

Thermal ageing, when specified in the relevant sectional or detail specification, shall be carried out in accordance with IEC 60811-1-2.

4.7.2 Sheath thickness and overall dimensions

Sheath thickness and overall dimensions shall be as specified in the relevant sectional or detail specification.

The measurement of sheath thickness and overall dimensions shall be carried out in accordance with Clause 8 of IEC 60811-1-1.

4.7.3 Moisture barrier

A moisture barrier, if applicable, shall be as specified in the relevant sectional or detail specification.

4.7.4 Ovality

The ovality shall be determined from measurement of the cross-section of a cable sample.

The determination shall be made in accordance with IEC 61196-1-301.

The ovality shall not exceed the value specified in the relevant sectional or detail specification.

4.7.5 Flammability

Unless otherwise specified, the flammability shall be determined in accordance with the applicable clause of the IEC 60332 series.

4.7.6 Corrosive products of combustion

When applicable, the amount of halogen acid gas evolved during a combustion shall be determined using IEC 60754-1. When required, determination of degree of acidity of gases by measuring pH and conductivity shall be performed according to the IEC 60754-2.

4.8 Armouring

When applicable, armouring shall be specified in the relevant sectional or detail specification.

The constructional and dimensional details of armouring should be specified for each individual case, according to the hazard to be expected. Table 2 gives typical examples of construction to suit some selected hazards.
Table 2 – Armouring against hazards

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Typical examples of suitable cable construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasion, rough handling</td>
<td>Braid, made of steel or aluminium alloy</td>
</tr>
<tr>
<td>Tensile stress</td>
<td>Helical covering of round or flat steel wires, non-metallic strength members</td>
</tr>
<tr>
<td>Compressive stress</td>
<td>Wrapping of two steel tapes</td>
</tr>
<tr>
<td>Rodent attack</td>
<td>Wrapping of one steel tape</td>
</tr>
<tr>
<td>Termite attack/Marine attack</td>
<td>Wrapping of one layer of thin bronze tape</td>
</tr>
<tr>
<td>All hazards except tensile</td>
<td>Alternately, chrome plated corrugated steel</td>
</tr>
<tr>
<td>stress</td>
<td></td>
</tr>
</tbody>
</table>

4.9 Messenger wire

The messenger type shall be specified in the relevant sectional or detail specification.

5 Ratings and characteristics

The ratings and characteristics applicable to each cable shall be stated in the relevant sectional or detail specification.

6 Identification, marking and labelling

6.1 Cable identification

Cable identification shall be as given in 6.1.1 or as specified in the sectional or detail specification.

6.1.1 Cable marking

When required the marking shall be as given in 6.2 and/or the manufacturer’s designated markings as specified in the relevant sectional or detail specification.

Cable marking abrasion resistance shall be specified in the relevant sectional or detail specification.

6.2 IEC marking

When marking with an IEC cable type number is specified in the relevant sectional or detail specification the number shall be made up of the following elements.

a) A number giving the nominal characteristic impedance of the cable in ohms, for example, "75".

b) A number that corresponds to the nominal diameter measured over the dielectric, in millimetres.

c) The number of the IEC specification, for example, "IEC 61196-5-x".

Example 75 12,4 IEC 61196-1-2
6.3 Labelling

Unless otherwise specified in the relevant sectional or detail specification, reels, coils or packages shall be provided with a label with durable print giving the following minimum information.

a) Manufacturer’s or supplier’s designation of the cable.
b) Length of cable.
c) Name of manufacturer or supplier.
d) Length of cable, in metres.

7 Tests and test methods

Tests and their requirements shall be specified in the relevant sectional or detail specification.

Test methods shall be chosen from the IEC 61196-1-xx series (different parts of the IEC 61196-1-xx are in preparation) or from the IEC 62153 series if applicable and if not otherwise specified in this part or the relevant sectional or detail specification.

8 Quality

When specified in the sectional or detail specifications, quality procedures shall be in accordance with IEC 61196-1-1.

9 Delivery and storage

Delivery of cables shall be made on reels, coils or in boxes, with suitable protection.

The ends of the finished cable shall be adequately sealed to prevent the ingress of moisture. Sealing shall be carried out immediately after the inspection and acceptance tests.