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1 st edition

TELECOMMUNICATION NETWORK – METALLIC CABLES FOR LOCAL TELEPHONE NETWORKS

(This translation is for reference only)

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Foreword

TCVN 8238:2009 was prepared on the basis of converting branch standard TCN 68-132: 1998 "Multipair metallic telephone cables for local networks – Technical requirement” of the General Post Office (now the Ministry of Information and Communication).

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Telecommunication network - Metallic cables for local telephone networks

1. Scope

This standard covers basic specifications for metallic communication cables with copper core, insulated by specialized plastic, on the basis of polyethylene material.

This standard applies to cables in local telephone network, including trunk cable and subscriber cable. Standard applying Standard applied cable is duct insulation cable, cable inserted in plastic tube and self-supporting cable, including moisture resistant non jelly filled and jelly filled cable.

2. Terms and definitions

The following terms and definitions shall be used in this standard:

2.1

Solid Colour Coded Polyethylene insulated cables (CCP cable)

Metallic communication cable with solid copper core, insulated by solid polyethylene, coded by color.

2.2

Foam-Skin Polyethylene insulated cables (FSP cable)

Communication cable with solid copper core, insulated by two-layer combined dielectric. The inner layer is plastic foam (PE foam), the outer layer is polyethylene, coded by color.

2.3

Jelly Filled cables (JF cable)

Cables in which all the interstices between insulated wires, between sub-bundles as well as between bundles are filled with a type of petroleum used for preventing moisture, water from diffusing into or spreading along cable core. Moisture resistant petroleum is a homogeneous compound, in capable of ensuring insulation during use, has no impact on the properties of the insulating material and the transmission characteristics of the cable, is not harmful to the skin, is transparent enough to not affect the colour distinguishing of the wire pairs.

2.4

Self-Supporting cables (SS cable)

Cable are equipped with galvanized steel supporting wires consisting of one or several strands twisted together, having is sheath linked in the same assembly with the cable sheath, forming a 8-shaped cross section. Steel wires are used for supporting and enhancing mechanical strength in case of outdoor cable installation.

2.5

Duct insulation cables

Cables that go without supporting wires, are in capable of resisting water, are installed in cable pipes or ducts.

2.6

Binder tape

Plastic material (typically polyolefin) with appropriate size and regulated color, and is used for binding and distinguishing cable groups.

2.7

Core wrapping tape

Heat resistant tape that is often made from natural or colorless polymer material, electrical resistant and moisture repellent, is of appropriate size, used for wrapping and round forming the cable structure, enhancing moisture resistant ability, restraining mechanical and thermal impacts to the insulation during manufacturing and installation processes.

2.8

Internal screen

The screen is a part of the cable structure, is composed of a thin metal layer, adjacent to the plastic sheath, in capable of reducing noise level.

2.9

Resistance

Pure resistance of a core of 1 km length measured at 20 °C, or the value measured shall be converted to that of 20 °C.

2.10

Resistance unbalance

The difference in resistance values between two cores of a pair of wire at 20°C, calculated as a percentage.

2.11

Mutual capacitance

Capacitance that is measured between the two cores of a pair of wire, provided the remaining pairs are connected to the internal screen (if any) and grounded.

2.12

Capacitance unbalance Pair-to-Ground

The difference in capacitance between two conductors and ground.

2.13

Capacitance unbalance Pair-to-Pair

The difference in capacitance between two wire pairs in the same group.

2.14

Transmission attenuation (loss)

The reduction of measured electrical signal when transmitted over 1 km long core. This value depends on the frequency of the signal transmitted.

2.15

Crosstalk

Penetration of the signal between the wire pairs.

2.16

Power Sum Equal Level Far End Crosstalk Loss (P.S.ELFEXT)

Total signal power loss of all wire pairs that cause far end crosstalk in comparison with the pair that is under examination.

2.17

Power Sum Near End Crosstalk Loss - P S. NEXT

The total signal power loss of all wire pairs causing near end crosstalk in comparison with the pair that is under examination.

2.18

Resistance Electricity

Ability of not being destroyed of sheath and insulation at high voltages.

2.19

Asymmetrical Digital Subscriber Line

Subscriber line pair used for transfering datas with downstream and upstream speeds of diferrent values, the downstream speed can be up to 8 Mbit/s.

2.20

High Speed Digital Subscriber Line (HDSL)

Subscriber Line offers 2-way data speed of up to 3 Mbit/s, by using 03 local cable pairs.

3. Specification

3.1 Physico-mechanical requirements

3.1.1 Core

3.1.1.1 General requirements

Core must be made from pure copper with high purity (solid), soft annealed and smoothly strained, have circular cross-section, be of uneven quality and free from flaw. The core must be ensured to meet all requirements on dimensions. Maximum resistance measured on conductor of $1\,mm^2$ cross section and 1km length, at 20 °C must not exceed 17.24 Ω.

3.1.1.2 Standard diameters

Standard diameters of cores are specified in Table 1.

Table 1-Standard diameters of cores

No.	Standard diameter, mm	Permissible tolerance, mm
1	0.32	± 0.01
2	0.40	± 0.01
3	0.50	± 0.01
4	0.65	± 0.02
5	0.90	± 0.02

Measuring method:

Length measurer such as PALMER shall be used for measuring the dimensions.

3.1.1.3 Tensile breaking force and elongation at break of core

Tensile breaking force and elongation at break of conductive core with different standard diameters must be greater than or equal to the values specified in Table 2.

Table 2 - Tensile breaking force and elongation at break of core

No.	Standard diameter, mm	Elongation at break, %	Tensile breaking force, kg/mm^2
1	0.32	10	20
2	0.40	12	20
3	0.50	15	20
4	0.65	20	20
5	0.90	22	20

Measuring method:

Core (without sheath) of 30mm length shal be kept at a temperature of 23°C± 5°C for at least 3 hours. Mark at points that are 2.5 cm away from each end. The length of the sample shall be 25 cm. The sample then shall be put into tensile test machine with pulling speed of 100 ± 20 mm/min, at temperature of 23°C.

The value of tensile breaking force is the maximum tensile stress recored during the process of pulling the sample at the point of breaking.

Elongation at break of the core shall be calculated using the formula:

$$E (\%) = 100 \times (L - 25) / 25 \qquad (3.1)$$

Where, L is the total length of the marked part after being rejoined from break (cm).

3.1.2 Insulation

3.1.2.1 General requirements

Core insulation must be PE plastic or two-layer combined dielectric. The insulation must be continuous and of standard thickness.

The uniformity of the core insulation thickness is defined by concentricity (Ec,%), or the ratio of the minimum radial thickness and maximum radial thickness (d/D) in any cross section of conductor insulation sheath as follows:

$$Ec (\%) = [1 - (D - d) / (D + d)] \times 100 \qquad (3.2)$$

Where:

D: maximum radial thickness;

d: minimum radial thickness in the same section;

Requirements:

$d/D \geq 0.75$ or $Ec \leq 43\%$.

3.1.2.2 Tensile breaking force and elongation at break of core insulation

Tensile breaking force and elongation at break of core insulation must be greater than or equal to the values specified in Table 3.

Table 3 - Tensile breaking force and elongation at break of core insulation

No.	Parameter	Value	
		CCP cable	FSP cable
1	Tensile breaking force , kg/mm^2	1.05	1.05
2	Elongation at break , %	400	300

Measuring method:

The sample is a insulated wire of 15cm length, core pulled out. Mark 2.5 cm from each end. Sample length is 10 cm.

The sample then shall be put into tensile test machine with pulling speed of 250 ± 50 mm/min, at temperature of 23°C. Use appropriate measurer to carry out continuous measurement for the length between the two marked points during the pulling process until the sample breaks.

The measured value is at least equal to the values in Table 3.

Elongation at break of core insulation shall be determined in accordance with the following formula:

$$E (\%) = 100 \times (L - 10) / 10 \qquad (3.3)$$

Where, L is the length between two marked points at break, cm.

3.1.3 Cable sheath

3.1.3.1 General requirements

Cable sheath must be made from PE plastic, free from surface defect (bulging, crack, lumpiness, hole), flexible, touch, smooth, able to withstand light and ambient temperature. Thickness of cable sheath must be in accordance with the size of the core. The permissible ovality of the cable (O,%) must be less than or equal to 10% and shall be determined by the following formula:

$$O (\%) = 100 \times (D - d) / d \qquad (3.4)$$

Where, D: Maximum outer diameter of the cable;

D: Minimum outer diameter of the cable.

3.1.3.2 Standard avaerage thickness

Standard average thickness of cable sheath depends on the size of cable core and is specified in Table 4.

The minimum average thickness of cable sheath must not be less than 90% of the standard average thickness .

Measuring method:

Length measurer such as PALMER shall be used for measuring the dimensions

Table 4 – Standard average thickness of cable sheath

No.	Diameter of cable core, mm	Standard average thickness, mm	No.	Diameter of cable core, mm	Standard average thickness, mm
1	≤ 15	1.5	8	45.1 to 50.0	2.5
2	15.1 to 20.0	1.8	9	50.1 to 55.0	2.7
3	20.1 to 25.0	1.9	10	55.1 to 60.0	2.8
4	25.1 to 30.0	2.0	11	60.1 to 65.0	2.9
5	30.1 to 35.0	2.1	12	65.1 to 70.0	3.0
6	35.1 to 40.0	2.3	13	70.1 to 75.0	3.1
7	40.1 to 45.0	2.4	14	≥ 75.1	3.2

3.1.3.3 Tensile breaking force and elongation at break of cable sheath

Tensile breaking force and elongation at break of tested sheathing material must be greater than or equal to the values specified in Table 5.

Table 5 - Tensile breaking force and elongation at break of cable sheath

No.	Tensile breaking force, kg/mm^2	Elongation at break , %
1	1.20	400

Measuring method:

As specified in 3.1.2.2

3.1.4 Cable supporting wire

3.1.4.1 General requirements

Supporting wire shall be galvanized steel wire, high force bearing strength, consist of 1 to 7 strands, twisted counterclockwise. Tensile strength, elongation and dimension of supporting wire must fit the cable weight.

3.1.4.2 Dimension of supporting wire

Sheath thickness and dimension of supporting wire must be in accordance with values specified in table 6.

Measuring method:

Length measurer like PALMER shall be use for measuring the dimensions.

Table 6 – Thickness of sheath and dimension of supporting wire

No.	Number of strand/ diameter of each strand, mm	Sheath thickness of supporting wire		Neck part of supporting wire	
		Standard thickness mm	Allowable limit mm	Height mm	Width mm
1	1/2.6	1.0	0.90-1.1	2.0 ± 1.0	2.0 ± 1.0
2	7/1.2	1.0	0.90-1.1	2.0 ± 1.0	2.0 ± 1.0
3	7/1.6	1.0	0.95-1.2	2.0 ± 1.0	2.0 ± 1.0
4	7/2.0	1.0	0.95-1.3	2.0 ± 1.0	2.0 ± 1.0

3.2 Electrical requirements

3.2.1 Resistance (R)

Pure resistance of a core of 1 km length measured at 20 °C, or converting the value measured to that of 20 °C, must be less than or equal to the values specified in Table 7.

For cable of 100 pairs or above, allow 1% of the pairs in the cable roll to be unsatisfactory about individual resistors.

When measuring at a temperature other than 20°C, the resistance value measured should be converted to that of 20°C according to the following formula:

$$R_t \ (\Omega \ / \ km) = R_d \ / \ [1 + 0.00393 \ (t \ / - 20)] \qquad (3.5)$$

Where:

R_d - Core resistance measured at t°C

R_t - Measured resistance converted to 20°C.

Table 7 – Pure resistance of 1km long core at 20°C

No.	Diameter of core, mm	Pure resistance of conductor, Ω/km	
		Average maximum	Individual maximum.
1	0.32	220.0	239.0
2	0.40	139.0	147.0
3	0.50	88.7	93.5
4	0.65	52.5	56.5
5	0.90	27.4	29.0

Measuring method:

Use Wheatstone resistance measuring bridge or equivalent measuring machine with accuracy of ±0.05%.

Where the two ends of the cable is far from each other, use the loop mounting method then halve the value measured.

When the cable length L is other than 1 km, the equivalent of 1 km cable length shall be calculated as follows:.

$$R\ (1\ km) = R\ (L) / L \qquad (3.6)$$

Where

R (L): the actual measured value of L m long cable.

3.2.2 Resistance unbalance

The resistance unbalance of a pair of core shall be determined as follow:

$$R_{cb}(\%) = 100 \times [(R_{\max} - R_{\min}) / (R_{\max} + R_{\min})] \qquad (3.7)$$

Where:

$R_{\max}$: maximum resistance value of 1 of the 2 wires

$R_{\min}$: minimum resistance value of 1 of the 2 wires

The resistance unbalance between two cores of any wire pair in finished cable roll, when measured at a temperature of 20°C or converted the measured resistance value to this temperature, must not exceed the values listed in Table 8.

Table 8 – The resistance unbalance

No.	Diameter of core, mm	Maximum average, %	Individual value, %
1	0.32	2.0	5.0
2	0.40	2.0	5.0
3	0.50	1.5	5.0
4	0.65	1.5	4.0
5	0.90	1.5	4.0

For cable of 100 pairs and above, 1% of the roll is allowed to mot meet the requirement on resistance unbalance.

Measuring method:

Resistance unbalance between 2 cores of any wire pair in the cable roll shall be determined by measuring the resistance of each core similar to 3.2.1, then calculate according to formula (3.7)

3.2.3 Mutual Capacitance (C)

Mutual capacitance is working capacitance between 2 cores of a wire pair, with the condition that the remaining pairs are connected to the screen and grounded. Mutual capacitance of local cable (telephone cable) measured at a frequency 1000 Hz, at a temperature of 20°C, must not exceed the values specified in Table 9.

For cable of at least 100 pairs, 1% of the pairs in the cable roll are allowed to not meet the requirements on the maximum particular capacitance value.

Table 9 - Mutual Capacitance

No.	Number of cable pair/ cable type	Maximum average, nF/km		Maximum individual;, nF/km	
		FSP	CCP	FSP	CCP
1	Under 13 pairs	52 ±2	52 ± 4	58	60
2	13 pairs and more	52 ±2	52 ± 4	57	60

Measuring method:

Connect the 2 cores of the pair to be measured with the capacitance bridge or capacitance measuring device. The remaining cores shall be connected with screen (if any) and earth. Measuring frequency is (1000 ± 100) Hz.

If the length L of the cable sample is other than 1000 m, the measured capacitance value should be converted to that of 1000 m long cable according to the following formula:

$$C\ (1\ km) = C_d\ (1000 / L) \qquad (3.8)$$

Where:

L - length of the cable test sample, m

C_d - Result of mutual capacitance measurement on cable sample of L m length.

3.2.4 Capacitance unbalance (C_{cb})

Unbalanced capacitance between 2 wire pairs and between a pair of wire cable with ground of finished cable, measured at a frequency of 1000 Hz, a temperature of 20°C must not be greater than the values specified in Table 10.

For cable of at least 100 pairs, allow the capacitance unbalance of 1% of the pairs to be nonconforming with maximum individual value.

If the length L of the cable sample is other than 1000 m, the measured capacitance value should be converted to that of 1000 m long cable according to the following formula:

$$C_{cb}(1km) = C_d \sqrt{\frac{1000}{L}} \qquad (3.9)$$

Where:

L - length of the cable test sample, m

C_d - Result of capacitance unbalance measurement on cable sample of L m length.

Table 10 – Capacitance unbalance (Imbalances in capacitance)

No.	Number of cable pair	Capacitance unbalance pair to pair, pF/km		Capacitance unbalance pair to ground, pF/km	
		Maximum individual	Maximum mean square	Maximum individual	Maximum average
1	Under 13 pairs	181	-	-_	-_
2	13 pairs and more	45.3	45.3	2 625	574

Measuring method:

Similar to 3.2.3.

3.2.5 Transmission Loss

Transmission attenuation of cable depends strongly on the frequency. Transmission attenuation value is determined by the frequency of 1 kHz, 150 kHz and 772 kHz, at a temperature of 20°C or the value shall be converted to that temperature.

Transmission attenuation value of 1000 m cable length should not exceed the standard value specified in Table 11.

Table 11 – Standard transmission attenuation value

No.	Diameter of core, mm	Maximum average transmission attenuation , dB/km		
		1 kHz	150 kHz	772 kHz
1	0.32	2.37 ± 3%	16.30	31.60
2	0.40	1.85 ±3%	12.30	23.60
3	0.50	1.44 ± 3%	8.90	19.80
4	0.65	1.13 ±3%	6.00	13.90
5	0.90	0.82 ± 3%	5.40	12.00

For cable of at least 100 pairs, 1% of the pairs are allowed to not meet the requirements on the maximum particular transmission loss. Value of the maximum particular transmission loss shall be 110% of the maximum average value as shown in Table 11.

Measuring method:

Measuring equipment shall be in capable of sending sinusoidal signal at the frequency of 1 kHz, 150 kHz and 772 kHz, with input power P_v. Equipment measuring level according to the power at the frequencies above and the level obtained P_r (output). Difference in termination resistance and characteristic impedance of the core pair should not exceed ± 1%. If the two ends of the cable are far from each other, loop connection is acceptable, in this case, the actual value shall be nearly equal to half the measured attenuation values.

Formula for determining transmission loss α :

$$\alpha \text{ (dB)} = - 10.\lg (P_r / P_v) \qquad (3.10)$$

If the measuring temperature t_d differs from 20°C, the measured value shall be converted to that of 20°C by using the following formula:

$$\alpha \text{ (t = 20)} = \alpha (t_d) / [1 + 0.0022 \text{ (t - 20)}] \qquad (3.11)$$

When the cable length is L m, other than 1000 m then:

$$\alpha \text{ (1 km)} = \alpha \text{ (measured)} / L \qquad (3.12)$$

3.2.6 Crosstalk attenuation

3.2.6.1 Far end crosstalk attenuation ($FEXT_{ji}$)

Average power-sum far-end crosstalk attenuation and individual power-sum far-end crosstalk attenuation in finished cable measured at the frequency of 150 kHz and 772 kHz shall not be less than the values listed in Table 12 (D-diameter of core, f – measuring frequency).

Table 12 - Standard values for far-end crosstalk attenuation

No.	D (mm)	Minimum average value, dB/km					Maximum individual value, dB/km				
	f (kHz)	0.90	0.65	0.50	0.40	0.32	0.90	0.65	0.50	0.40	0.32
1	150	60	58	58	56	54	54	52	52	52	52
2	772	46	44	44	42	40	40	38	38	38	38

Where the length L_0 of the sample to be measure is different from L_x = 1000 m, the value measured A_0 should be converted to the equivalent value at 1000m by using the following formula:

$$\text{ELFEXT}(A_x) = A_0 - 20.\log(F_x/F_0) - 10.\lg(L_x/L_0) \qquad (3.13)$$

Where:

A_0 - Far-end crosstalk power attenuation measured at the frequency F_0, on cable of L_0 m length;

A_x - Far-end crosstalk power attenuation measured on cable of 1000 m length.

Measuring method:

Choose 2 pairs of the same group. The nearer ends connect the transmitter to a resistive termination. The farther ends connect the receiver to the pair that is not connected to the transmitter, the other ends of the remaining wire pair connected with resistive termination. All the remaining pairs are connected to the screen and earth.

Sinusoidal signal generator frequency 150 kHz, 772 kHz. The frequency selection signal receiver. Difference in resistive termination, the characteristic impedance of the wire pairs and the measuring equipments shall not exceed 1%. Transmit at 0 dBm or -10 dBm, respectively with frequency 150 kHz and 772 kHz. Measure respectively for each wire pair, then calculate the far end crosstalk attenuation between the two wire pairs from the results of transmitting level P_{iF} and receiving level P_{jF} according to the following formula:

$$FEXT_{ji}(dB) = \left|10\lg(P_{iF}/P_{jF})\right| \qquad (3.14)$$

Where:

P_{iF}, P_{jF} - Transmitting power and receiving power on combined load;

i, j – the i^{th} and j^{th} cable pair.

3.2.6.2 Near-end crosstalk attenuation (NEXT $_{ji}$)

Attenuation of average power-sum near-end crosstalk and attenuation of individual power-sum near-end crosstalk measured in any group of finished cable at the frequencies of 150 kHz and 772 kHz shall not exceed the values specified in Table 13.

Table 13 – Standard value of near-end crosstalk attenuation

No.	Frequency, kHz	Minimum average value, dB/km	Minimum individual value, dB/km
1	150	53	53
2	772	47	42

If the sample length L_0 is different from the length L = 1000 m, the measured values N_0 shall be converted to the attenuation value N_x of 1 km by the formula:

$$N_x = N_0 - 10.\lg\{[1 - \exp(-4aL_x)]/[1 - \exp(-4aL_0)]\} \qquad (3.15)$$

Where:

a: measured attenuation of cable with length determined according to neper

e = 2.71828

a (dB) = 8.6856 a (neper).

Measuring method:

Similar to far-end crosstalk attenuation measurement, but the receiver and the transmitter is connected to a side of the two wire pairs, the other side is connected with resistive terminations.

The formula for calculating power sum near end crosstalk attenuation of the 2 wire pairs:

$$NEXT_{ji}(dB) = |10\lg(P_{iN} / P_{jN})| \qquad (3.16)$$

Where:

P_{jN} : signal power entering the pair causing crosstalk;

P_{iN} : power of output signal at the near end at the pair that is crosstalked.

Power-sum near-end crosstalk of the i^{th} wire pair is calculated by the formula:

$$IPS_i = 10\lg\left\{\sum_{i,j}^{n} 10^{-mji/10}\right\} \qquad (3.17)$$

The average value of power-sum near-end crosstalk loss of the coil is defined as follows:

$$APS(dB) = \frac{1}{n}\sum_{i=1}^{n}(IPSi) \qquad (3.18)$$

3.3 Requirements on environmental and electrical strength

3.3.1 Insulation resistance

Insulation resistance of each insulated core in comparison with all the other cores and screen of finished cable measured at 20°C for any length must not be less than 15 000 MΩ.km.

Measuring method:

Use MegaOhmet or earth resistance measurer to carried out the measurement between a core and another core or screen.

Test voltage is of 500 Vdc, test duration is 1 minute (for used cable, test voltage shall be of 350 Vdc).

Insulation resistance value measured must be greater than or equal to 15 000 MΩ.km.

3.3.2 Resistance to high voltage

Insulation among conductors and between conductors and cable screen throughout the length of finished cable must be able to withstand the DC voltage placed on it with value of greater than or equal to the voltage specified in Table 14.

Table 14 - High voltage resistance of finished cable

No.	Cable type	Test DC voltage, kV			
		Wire to wire		Wire to screen	
	Diameter of core, mm	CCP	FSP	CCP	FSP
1	0.32	2.0	1.5	5,0	5,0
2	0.40	2.8	2.4	10	10
3	0.50	4.0	3.0	10	10
4	0.65	5.0	3.6	10	10
5	0.90	7.0	4.5	10	10

Measuring method:

Use a DC source with required voltage, ripple of no more than 5% of the peak voltage value at no load state, voltage growth rate of more than 3000 V/s. Conduct test on each wire, the other wires are grounded. Test duration is 3 seconds. The cable must not be damaged after test.

3.3.3 Shrinkage of conductor insulation

Shrinkage of insulation of finished cable at 115°C ± 1°C must be less than 6.7%.

Testing method:

Place a test sample of 15cm length in heating cabinet for 4 hours, at a temperature of 115°C±1°C. Total shrinkage of both ends of the sample must be less than 10 cm.

3.3.4 Shrinkage of cable sheath

Shrinkage of the sheath of finished cable at 115°C must be less than 5%.

Testing method:

From the finished cable, prepare a sheath sample of 51mm length and 64mm width. Place the sample in heating cabinet for 4 hours, at a temperature of 115°C. After taking the sample out of the cabinet, cool it down by air. Total shrinkage of the cable sheath must not exceed 5%.

3.3.5 Adhesion of cable sheath with aluminum tape

For cable that uses aluminum tape as anti-humidity and anti-jam screen, the adhesion between cable sheath and aluminum tape when tested at $18^0C - 27^0C$ must not be less than 0.8 N/mm for every 01 cm of the sample's width.

3.3.6 Jelly leakage

Jelly filled cable must pass the jelly leakage test as follow:

Test sample is finish cable of 30cm length. At one end of the sample, remove 15 cm length of cable sheath and aluminum tape. Then remove 10 cm long heat resistant tape (P/S tape) to make the cable core exposed. Separate the cable pairs and hang the sample on heating chamber with its unsheathed end being downward. Set the test temperature at $65^0C \pm 1^0C$. After 24 hours, take the test cable out. The test is passed if there is no jelly leakage.

3.4 Additional requirement for cable used for xDSL services

Local telephone cable used for ADSL and VDSL services must meet the following additional requirements:

3.4.1 DC Loop Resistance (R_v) and information distance

DC loop resistance, including resistance of the wire pair and terminal unit, the information distance limits are specified in table 15

Measuring method:

Similar to 3.2.1

Table 15 – Correlation between DC loop resistance and information distance

No.	Service	Rv, Ω	Maximum length of the line used, km			
			0.40	0.50	0.65	0.90
1	HDSL	700	2.5	3.5	5.3	6.0
2	SHDL	530	1.9	2.6	3.9	4.3
3	ADSL (1.5 Mbit/s)	1 150	4.1	5.4	7.6	8.6
4	ADSL (6 Mbit/s)	760	2.7	3.6	5.1	5.8

3.4.2 Power-sum crosstalk loss

Power sum crosstalk loss of local cable in wide band transmission must not be less than the values specified Table 16.

Measuring method:

Similar to 3.2.6

Table 16 – Crosstalk loss

No.	Measuring frequency, kHz	Minimum NEXT PSL, dB	Minimum ELFEXT PST, dB
1	150	56	54
2	300	52	48
3	1 000	44	38

3.4.3 Longitudinal conversion loss (Ad)

Longitudinal conversion loss of subscriber line must be greater than or equal to the values specified in Table 17.

Table 17 – Unbalance rate in comparison with earth

No.	Technology	Measuring frequency, kHz	Minimum LCL, dB	Terminating impedance, Ω
1	HDSL	150	42.5 decrease 5 dB/Decade	135
2	SHDSL	200 - 300	40.0 decrease 20 dB/Decade	135
3	ADSL	25-1 104	40	100

Measuring method:

Terminating the line with suitable load. Transmitting signal to a wire and receiving reflected signal from the other wire.

3.4.4 Return loss (Ap)

Return loss of a pair of subscriber wires must satisfy the values specified in table 18

Table 18 – Standard return loss

No.	Technology	Measuring frequency , kHz	Minimum return loss, dB	Terminating impedance, Ω
1	HDSL	150	15	135
2	SHDSL	300	15	135
3	ADSL	25 1 104	10 15	100 100

Measuring method:

Similar to 3.4.3.

Annex A

(Normative)

Guide for conformance test

This standard covers specifications on mandatory quality for metallic cable used in local networks. For designing, To cater for the design, construction, maintenance, exploitation and development of broadband services, section 3.4 of this standard provides additional parameters cables used for xDSL services.

Process for testing the conformance of metallic cable with this standard shall be as follow:

A.1 Sampling

Test sample must be finished cable of the type specified on the cable sheath and must ensure the minimum length as specified in the standard.

A.2 Determination of phisico-mechanical parameters

The physical and mechanical parameters must be measured in the environmental conditions specified in the standard. The accuracy of measuring equipments must be one level higher than the allowed tolerance specified in the standard. Regulations on measuring method specified in the standard must be strictly followed.

A.3 Determination of electrical parameters

Measurement of electrical parameters must strictly follow the measuring methods specified in the standard. The accuracy of measuring equipments must be 02 level higher than the allowed tolerances. Measurements and measuring conditions specified for each parameter must be fully implemented.

A.4 Determination of environmental and electrical strength

- For high voltage resistance: must test at the limiting voltage (the lowest) then increase gradually until the cable is destroyed and take this value as the measured value.

- For other criteria: must comply with the regulations on measurement specified in the standard.

A.5 Reading the results

The results shall be rounded in accordance with the standard's regulations. The cable shall be considered to be unqualified if one of the measured criteria does not meet the requirement of the standard.

The results of the testing measurements form the technical ground for compliance certification of metallic cable used in local telephone networks.
