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NS: 344 : 2052

दोस्रो पुनरिक्षण: २०७४/१०/०९



नेपाल गुणस्तर
NEPAL STANDARD

**PVC insulated cable for fixed wiring with copper
conductor**

नेपाल सरकार
उद्योग मन्त्रालय
नेपाल गुणस्तर तथा नापतौल विभाग
बालाजु, काठमाडौं

NBSM

काठमाण्डौ, नेपाल ।

नेपाल गुणस्तर परिषद्

Nepal Council for Standardization (NCS)

ने.गुण.३४४-२०७४

**PVC insulated cable for fixed wiring with copper
conductor**

दोस्रो पुनरिक्षण

अध्यक्ष

माननिय सुनिल बहादुर थापा, उद्योग मन्त्री

उपाध्यक्ष

श्री याम कुमारी खतिवडा, सचिव, उद्योग मन्त्रालय

सदस्यहरु

<u>सि.नं.</u>	<u>नाम</u>	<u>पद</u>	<u>संस्था</u>
१.	श्री रिषिराज कोईराला	सह-सचिव	उद्योग मन्त्रालय
२.	सह-सचिव	वाणिज्य मन्त्रालय
३.	श्री सुरेन्द्र पसाद सुवेदी	सह-सचिव	विज्ञान तथा प्रविधि मन्त्रालय
४.	सह-सचिव	खाद्य प्रविधि तथा गुणनियन्त्रण वि.
५.	सह-सचिव	भौतिक पूर्वाधार तथा यातायात मन्त्रालय
६.	श्री डिल्लीराज घिमिरे	सह-सचिव	कानून तथा संसदीय व्यवस्था मन्त्रालय
७.	श्री सुमनलाल श्रेष्ठ	सह-प्राध्यापक	त्रिभुवन विश्वविद्यालय
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९.	श्री ज्ञानेन्द्रलाल प्रधान		नेपाल उद्योग वाणिज्य महासंघ
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सदस्य सचिव

श्री विश्वबाबु पुडासैनी, महानिर्देशक, ने.गु. तथा ना.तौ.वि.

प्राविधिक समितिको बैठकका पदाधिकारी हरु (२०७४/०९/१३)

ने.गुण.३४४-२०७४

**PVC insulated cable for fixed wiring with copper
conductor**

- श्री विश्वबाबु पुडासैनी, महानिर्देशक, नेपाल गुणस्तर तथा नापतौल विभाग
 श्री रोमी मान्न्धर, उप-महानिर्देशक, नेपाल गुणस्तर तथा नापतौल विभाग
 श्री दीनानाथ मिश्र, उप-महानिर्देशक, नेपाल गुणस्तर तथा नापतौल विभाग
 श्री प्रमोदा प्रधान, उप-महानिर्देशक, नेपाल गुणस्तर तथा नापतौल विभाग
 श्री माधब प्र. आर्चाय, सिटिजन नेपाल प्रा.लि.
 श्री गणेश प्र. पाठक, नेपाल गुणस्तर तथा नापतौल विभाग
 श्री अनिल शाक्य, नेपाल गुणस्तर तथा नापतौल विभाग
 श्री दिपेन्द्र कु. झा, नेपाल गुणस्तर तथा नापतौल विभाग
 श्री चन्द्र दत्त कंडेल, काठमाडौं विधुतिय व्यावसायी संघ
 श्री भिमलाल श्रेष्ठ, नेपाल ईलेक्ट्रीसियन संघ, भोटेवहाल
 श्री प्रभाकर शमशेर राणा, हिम ईलेक्ट्रनिक्स
 श्री होमनाथ पोखरेल, नेपाल ईलेक्ट्रीसियन संघ, भोटेवहाल
 श्री आशिष सिग्देल, नेपाल ईलेक्ट्रिकल एण्ड ईलेक्ट्रोनिक्स म्या. ए.
 श्री उपेन्द्र बडाल, सोसाईटि अफ ईलेक्ट्रिकल्स ईन्जिनियर्स नेपाल
 श्री राजेन्द्र प्र. कुशवाहा, शहरी विकास तथा भवन निर्माण विभाग
 श्री नरहरी भण्डारी ई.ई., नेपाल गुणस्तर तथा नापतौल विभाग
 श्री युवराज भण्डारी ई.ई., नेपाल गुणस्तर तथा नापतौल विभाग
 श्री सुबोध खनाल, नेपाल ईलेक्ट्रिकल एण्ड ईलेक्ट्रोनिक्स म्या. ए.

नेपाल गुणस्तर

०. प्रस्तावना

१. नेपाल गुणस्तर (प्रमाण चिन्ह) ऐन २०३७ ले प्रदत्त अधिकार प्रयोग गरी नेपाल गुणस्तर परिषदबाट गुणस्तर निर्धारण गर्न यस विभागलाई भएको निर्देशन र नीति अनुसार राष्ट्रिय स्तरमा गुणस्तर प्रलेख हरू, तयार पार्ने सिलसिलामा आवश्यक तरिका र ढाँचामा यो गुणस्तर प्रलेख तर्जुमा गरी प्रस्तुत गरिएको छ । यसले नेपाल गुणस्तर संग सम्बन्धित सबै पक्षका निमित्त आवश्यक निर्देशिकाको कार्य गर्ने छ ।

२. यो प्रलेख तयार पार्दा गुणस्तर निर्धारणका प्रलेख सम्बन्धका अन्य देशहरुले र अन्तराष्ट्रिय संगठनहरु ले अपनाएका प्रणाली, चलन, तरिका र ढाँचालाई यथोचित ध्यानमा राखिएको छ । यसले तर्जुमाको लागि विशेष गरी देहायको विदेशी तथा अन्तराष्ट्रिय संघ संस्थाको प्रलेख तथा अन्य साधानहरु को सहयोग लिइएको छ ।

(क) आई.एस.ओ. – इन्टरनेशनल अर्गनाइजेशन फर स्टान्डर्डइजेशन

(ख) वि.एस.आई. – ब्रिटिश स्ट्याण्डर्ड इन्स्टिट्यूसन

(ग) वि.आई.एस. – ब्यूरो अफ इन्डियन स्टान्डर्ड

३. प्रलेख तयार पार्दा खास ध्यानमा राखिएका बुँदाहरु

३.१ गुणस्तर प्रलेखको तर्जुमा गर्दा अन्य प्रलेखको कुनै पनि परिच्छेदको उलंघन हुन नजाओस भनि यथासक्य होसियारी राखिएको छ । असावधानीबाट केही उलंघन हुन गएको ज्ञात हुन आएमा यसमा चाहिने संशोधनको लागि यथाशिघ्र कदम उठाईने छ ।

३.२ देशको ऐन नियम अन्तरगत परेको सबै बुँदाहरुलाई यथोचित मान्यता दिई यसको कुनै दफा तथा परिच्छेदको उलंघन नहुने गरी यो गुणस्तर प्रलेख तयार पार्ने कोशिस गरिएको छ । कथंकदाचित गुणस्तर प्रलेखको कुनै भागमा उल्लेखित कुराहरु हाल प्रचलनमा भएका तथा भविष्यमा आउने ऐन नियम संग बाझिन गएमा त्यस्ता (प्रलेख) का कुराहरु स्वतः निस्कृय हुनेछ ।

३.३ नापतौल ईकाइ तथा तिनीहरूको, पान्तर गर्दा स्टान्डर्ड नापतौल ऐन अन्तरगत जे जति नियमहरु छन् सबैलाई यथोचित मान्यता दिई यिनीहरूको प्रयोग गरिएको छ

३.४ यस प्रलेखको तर्जुमा ने.गु. तथा आई.एस.आई. र त्यस्तै अन्य अन्तराष्ट्रिय संघ संस्थाहरु का सम्बन्धित विषयमा निर्देशिका पुस्तीका तथा गुणस्तर निर्धारण र गुण नियन्त्रण सम्बन्धी अन्य कार्यहरुको प्रतिवेदन ईत्यादिबाट सामाग्रिहरु यथासम्भव प्राप्त गरी तिनीहरु को सिफरिस अनुरूप सामान्जस्य ल्याउन खोजिएको छ ।

३.५ यस प्रलेखको तर्जुमा गर्दा नापनतौल इत्यादि विभिन्न ईकाईहरुको लागि अन्तराष्ट्रिय क्षेत्रमा चलि रहेको बहुमान्य ईकाई तथा आईयस।ओ ले समेत सिफरिस गरेको एस।आई ईकाई प्रणालीलाई यथासम्भव प्रयोगमा ल्याएको छ ।

५. यस गुणस्तर प्रलेख २०५२ सालमा पहिलो चोटी प्रकाशन भएको थियो । सो प्रलेखमा भएका बिन्नि त्रुटिहरु हटाउन र उत्पादकहरु / खरीदकर्ताहरु] आवश्यकता हरूलाई पूर्ति गर्नु यस पहिलो संशोधित प्रलेखको आवश्यकता हुन आएको हो । उत्पादकहरु र खरीदकर्ताको सुझावहरु लिई यस प्रलेखलाई पहिलो संशोधन गरिएको हो ।
७. यस गुणस्तर प्रलेखमा **PVC insulated cable for fixed wiring with copper conductor** विवरण सम्बन्धि प्राविधिक पक्षलाई मात्र समावेश गरिएको छ । कारोबार सम्बन्धि कुराहरु यस प्रलेखको क्षेत्र भित्र पर्दैनन् ।

PVC INSULATED CABLE FOR FIXED WIRING WITH COPPER CONDUCTOR

1 SCOPE

This standard covers the requirements, sampling plan, criteria for conformity, marking and packing for the following types of unarmored PVC insulated cables with copper conductor for electric power and lightning for voltage up to and including 750V to be used for fixed wiring purposes:

- a) Single core(Unsheathed)
- b) Single core (Sheathed)
- c) Circular twin, three and four core (Sheathed)
- d) Flat twin with or without earth continuity conductor (Sheathed)
- e) Flat three core(Sheathed)

2. NORMATIVE REFERENCES

The standards given below are necessary adjuncts to this standard.

NS no.	Title
NS 340	PVC vocabulary (cables, conductors, and accessories)
NS 342	Copper conductor for insulated cable
NS 285 Part (1 - 8)	Test method, PVC insulated cable
NS ^{1*}	
NS ^{2*}	
NS ^{3*}	
NS ^{4*}	
NS ^{5*}	

3 TERMINOLOGY

3.1 For the purpose of this standard, definitions given in NS 340 shall apply in addition to the following –

3.2 Type Test - Test carried out to prove conformity with the specification, these are intended to prove the general quality and design of a given type of cable.

3.3 Acceptance Test - Test carried out on samples taken from a lot for the purpose of acceptance of the lot.

3.4 Routine Test - Test carried on each cable to check the requirements which are likely to vary during production.

3.5 Optional Test - Special tests to be carried out when required by agreement between the purchaser and supplier.

3.6 Earth Continuity Conductor (ECC) –It is a part of earthing system which joints or bonds together all the metal parts of an installation. It is connected to earthing lead at connecting points.

3.7 PVC Compound – Combination of materials suitably selected, proportioned and tested, of which the characteristic constituent is a plastomer polyvinyl chloride or one of its copolymers. The same term also designates compounds containing both polyvinyl chloride and certain of its polymers.

3.8 Cable Code: The following code shall be used for designating the cable:

Constituent	Code Letter
PVC insulation	Y
PVC sheath	Y
Suitable for outdoor use	OU
PVC with flame retardant (FR) properties	FR
PVC with flame retardant low smoke and halogen properties	FR-LSH

Notes:

1. No code letter is required when the conductor material is copper.
2. In case of copper single core unsheathed PVC cable with FR or FR – LSH properties, the abbreviation FR or FR-LSH to be used after the complete cable code that is for example, Y (FR) or Y (FR-LSH).
3. In case of copper multicore PVC insulated and sheathed cable with FR or FR-LSH properties, the abbreviation FR or FR-LSH to be used after the cable code, that is for example YY(FR) or YY(FR-LSH).

4 PHYSICAL CONSTANT FOR COPPER

4.1 Physical constant of copper conductor shall be as per the values given in clause 3 of NS 342-2052.

5 REQUIREMENTS

5.1 General requirements of copper conductor shall be as per Table 1.

5.2 Construction of conductor: The construction of cable shall be as given in Table 2 and Table 4.

5.2.1 In case of stranded compacted circular and shaped conductors, the ratio of larger to smaller diameters of two wires before stranding in the same conductor shall not exceed 2.

5.3 Dimensions, weight, and resistance of circular copper wire shall be as per the values given in table 1.

5.4 Dimensions, wire number and resistance of stranded conductor shall be as per the values given in table 2.

5.5 During annealing test of copper conductor minimum percentage elongation shall be as per the values given in table 3.

5.6 Nominal thickness of insulation and overall maximum diameter of single core PVC insulated (unsheathed) cables shall be as per the values given in table 4.

5.7 Nominal thickness of insulation, nominal thickness of sheath and overall maximum dimensions of PVC insulated and sheathed cables shall be as per the values given in table 5.

5.8 The insulation and sheath shall consists of a compound based on any one of the following materials, which have been suitably compounded and processed to meet the requirements of this standard:

- a) Polyvinyl Chloride (PVC)
- b) Suitable Co-polymer of which the major constituent shall be vinyl chloride.

c) Mixture of polyvinyl chloride and Co polymer.

5.9 Application of insulation : The insulation shall be applied by extrusion process so that it fits closely on the conductor and it shall be possible to remove easily without damaging the conductor.

5.10 Tolerance on the insulation thickness: Measured value of thickness shall not be less than by $(0.1+0.1 t_1)$ of values given in table 4 and 5.

5.11 Minimum tensile strength and minimum percentage elongation at break of insulation shall be 12.5 N/mm^2 and 150% respectively.

5.12 Core identification:

Cores shall be identified by different coloring of PVC insulation. Following color scheme shall be adopted.

1 Core - Red, black, yellow, blue, white, green, or grey

2 Core - Red and black

3 Core - Red, yellow, blue

4 Core - Red, yellow, blue and black

5.13 Laying up of cores:

5.13.1 Flat twin and 3 cores cables (without ECC) - 2 or 3 cores shall be laid side by side.

5.13.2 Flat twin (with ECC) cables : Two cores with a bare ECC shall be laid side by side in the same plain, ECC occupying the central position.

5.13.3 Circular twin, 3 and 4 core cables : 2,3 or 4 core shall be laid together with a suitable right hand lay. The interstices between the cores may be filled with vulcanized rubber, thermoplastic materials but should not be harder than PVC. A binder tape of plastic material or proofed cotton may be applied over the laid up cores or the laid up cores shall be provided with inner sheath applied either by extrusion or wrapping.

5.14 Sheathing:

5.14.1 The sheath where applicable shall be applied by extrusion. It shall be applied

a) Over insulation in case of single core cables.

b) Over the laid up cores in other cases.

5.14.2 The sheath shall be so applied that it fits closely on the laid up cores and it shall be possible to remove it without damage to the insulation.

5.14.3 Thickness of sheath : Thickness of sheathing shall be as per the values given in table 5.

5.14.4 Tolerance on thickness of sheath - Measured thickness (ts) on the table 5 shall not be less than by $(0.2 t_s + 0.2)$ mm.

5.14.5 Sheath color - The color of sheath shall be mostly black or white or grey.

5.15 During flammability test, the period of burning after removal of flames shall not exceed 60 seconds and charred portion from the lower edge of the top clamp shall be at least 50 mm (for test method, refer to NS 285 part 5).

5.16 During high voltage test at room temperature, the cable shall withstand an AC voltage of 3 KV (rms) at the frequency of 40-60 Hz or a DC voltage of 7.2 KV between conductor and ECC (if any). The connection and test period shall be as per the table 6.

NOTE: For single core cables having nominal area of conductor 50 mm^2 and below, this test is not necessary.

5.17 During spark test, cables shall not fail while applying test voltage corresponding to table 7.

NOTE: Spark test is done as an alternate to high voltage test on single core unsheathed cables.

5.18 Insulation resistance constant: Minimum insulation resistance constant shall be as follows:

At 27°C: 36.7 M ohm km

At 70°C: 0.037 M ohm km

5.19 PVC multi strand cable: It shall be constructed as given in Table 2 and Table 4.

5.20 Test requirements for PVC insulation shall be as per the values given in table 9.

5.21 Test requirements for PVC sheath shall be as per the values given in table 10.

6 SAMPLING AND TESTING

6.1 Sampling from Lot : Cables with similar annealed high conductivity copper conductors and the same cross sectional area and similar configuration, having the same insulation and sheathing (if any), manufactured under the identical condition and submitted for a test at a time shall constitute a lot.

Required number of samples shall be collected randomly as given in Table 8.

6.2 Types of tests:

6.2.1 Routine tests:

- Resistance test of conductor
- High voltage test / Spark test

6.2.2 Acceptance Tests: – Test shall be carried out as per NS 285.

- Annealing test of conductor
- Resistance test of conductor
- Thickness and overall dimensions of insulation and sheath
- Tensile strength and percentage elongation of insulation and sheathing.
- Insulation resistance test
- High voltage / Spark test
- Flammability test

6.2.2.1 For each test under general requirements (clause 5.1) and Acceptance Tests (Clause 6.2.2) samples shall be selected as per the table 8.

6.2.3 Type Tests:

a) Test on conductor:

- Annealing test of conductor
- Resistance test of conductor

b) Test for overall dimensions and thickness of insulation and sheath

c) Physical test for insulation:

- Tensile strength and percentage elongation at break
- Loss of mass test

- Ageing in air oven
- Shrinkage test
- Heat shock test
- Hot deformation

d) Physical test for sheath:

- Tensile strength and percentage elongation at break
- Loss of mass test
- Ageing in air oven
- Shrinkage test
- Heat shock test
- Hot deformation

e) Test on completed cable:

- High voltage test (water immersion test)
- High voltage test/Spark test
- Insulation resistance
- Flammability test
- High voltage test

6.2.3.1 For each characteristics mentioned under 6.2.3 (Type test) appropriate samples shall be taken and tested. If the sample (s) fails in any one of the test, one more sample shall be subjected for retest, which should pass.

7 CRITERIA FOR CONFORMITY

7.1 The lot shall be considered acceptable if the samples selected as per the column 2 of the table 8 satisfy each and every requirements under the clause 4 not exceeding the defectives as per column 3 of table 8.

8 MARKING AND LABELLING

8.1 The cable shall be either wound on drums, reels or coils, properly packed.

8.2 The cable shall carry the following information either stenciled on the reels or drums or contained in a label attached to it:

- a) Industry's name and trade name and / or trade mark, brand name.
- b) Nominal cross sectional area
- c) Configuration (i.e. Number of wires, cores etc.)
- d) Batch number
- e) Length of cable and number (if more than one)
- f) Approximate gross weight (if in drum)
- g) Country of manufacture
- h) Year of manufacture
- i) Voltage rating

- j) Color of core (in case of single core cables)
- k) Cable code (Provision for cable code is given in clause 3.8)
- l) Direction of rotation of drum (by means of arrow)
- m) Type of cable and material of conductor

8.3 Every meter of each cable shall contain following information's:

- a) Diameter of strand
- b) Number of strand
- c) Nominal cross sectional area
- d) Sequential running meter
- e) Batch number (optional for cable having nominal cross sectional area above 25 mm²)
- f) Industry's name and trade name and / or trade mark, brand name

9 PACKAGING

9.1 Following information's must be included:

- a) Total length of the wire
- b) Diameter of strand
- c) Number of strand
- d) Nominal cross sectional area
- e) Industry's name and trade name and / or trade mark, brand name

Table 1: Circular wire

Diameter		Calculated area (mm^2)	Nominal weight(kg/km)	Resistance per km.at 20°C (ohm)		
Standard (mm) (1)	Tolerance (mm) (2)			Standard (5)	Maximum for plain wire (6)	Maximum tinned wire (7) for
0.2000	± 0.0050	0.0314	0.2800	548.7300	565.1900	576.1700
0.3000	± 0.0070	0.0707	0.6300	243.9000	251.2200	256.1000
0.4000	±0.0090	0.1257	1.1200	137.1600	141.2700	144.0200
0.4500	± 0.0090	0.1590	1.4000	108.4300	111.6800	113.8500
0.5000	±0.0090	0.1963	1.7500	87.8300	90.4600	92.2200
0.5200	±0.0090	0.2124	1.8900	81.1700	83.6100	85.23500
0.5500	±0.0090	0.2376	2.1100	72.5600	74.7400	76.1900
0.6000	±0.0100	0.2827	2.5100	60.9900	62.8200	64.0400
0.6100	±0.0100	0.2922	2.6000	59.0000	60.7700	61.9500
0.6500	±0.0100	0.3318	2.9500	51.9600	53.5200	54.5600
0.6750	±0.0100	0.3575	3.1800	48.2300	49.6700	50.6400
0.7120	± 0.0100	0.3980	3.5400	43.3000	44.6000	45.4700
0.7500	± 0.0120	0.4420	3.9300	39.0300	40.2000	40.9800
0.8130	± 0.0120	0.5190	4.6200	33.2100	34.2100	34.8700
0.8500	± 0.0120	0.5680	5.0400	30.3800	31.2900	31.9000
0.9140	± 0.0140	0.6560	5.8300	26.2700	27.0600	27.5800
1.0160	±0.0160	0.8110	7.2100	21.2600	21.9000	22.3200
1.0200	±0.0160	0.8171	7.2100	21.1000	21.7200	22.1400
1.0600	± 0.0160	0.8830	7.8500	19.5200	20.1000	20.4900
1.1200	± 0.0160	0.9850	8.7600	17.5000	18.0300	18.2000
1.2200	± 0.0160	1.1690	10.3900	14.7500	15.1900	15.3300
1.4000	± 0.0160	1.5390	13.6800	11.2000	11.5400	11.6500
1.6300	± 0.0200	2.0870	18.5600	8.2600	8.5100	8.5900
1.7000	± 0.0200	2.2700	20.1800	7.6000	7.8300	7.9000
1.8000	± 0.0250	2.5450	22.6200	6.7800	6.9800	7.0400
2.0600	± 0.0250	3.3300	29.6300	5.1700	5.3300	5.3800
2.1400	± 0.0250	3.5980	31.9700	4.7900	4.9300	4.9800
2.2400	± 0.0250	3.9410	35.0700	4.3800	4.5100	4.5600
2.3400	± 0.0280	4.3010	38.2400	4.0100	4.1300	4.1700
2.5000	± 0.0300	4.9090	43.6400	3.5100	3.6200	3.6500
2.8000	± 0.0300	6.1580	54.7400	2.8000	2.8800	2.9100
3.0000	± 0.0300	7.0690	62.8400	2.4400	2.5100	2.5400

Note:

- 1 .Resistivity of cu is taken as 0.017241 micro ohms. (mm^2)/mtr
2. The values given in column 6 are based on +3% to the values given in column 5; the values given in column 7 are based on +5% up to 1.12 mm and +4% above 1.12 mm to the values given in column 5.
3. The values given in nominal weight column is only for guidance.

Table 2: Stranded conductors for single core and multi core cables

1	2	3	4	5	
Nominal cross sectional area mm ²	Minimum number of wire in the conductor			Maximum resistance of conductor at 20° C	
	Circular conductor	Circular compacted conductor	Shaped conductor	Annealed copper conductor	
	Cu	Cu	Cu	Plain wires Ohm/km	Tinned wires Ohm/km
0.50	7	-	-	36.0	36.7
0.75	7	-	-	24.5	24.8
1.00	7	-	-	18.1	18.2
1.50	7	6	-	12.1	12.2
2.50	7	6	-	7.41	7.56
4.00	7	6	-	4.61	4.70
6.00	7	6	-	3.08	3.11
10.00	7	6	-	1.83	1.84
16.00	7	6	-	1.15	1.16
25.00	7	6	6	0.727	0.734
35.00	7	6	6	0.524	0.529
50.00	19	6	6	0.387	0.391
70.00	19	12	12	0.268	0.270
95.00	19	15	15	0.193	0.195
120.00	37	18	18	0.153	0.154
150.00	37	18	18	0.124	0.126
185.00	37	30	30	0.0991	0.100
240.00	61	34	34	0.0754	0.0762
300.00	61	34	34	0.0601	0.0607
400.00	61	53	53	0.0470	0.0475
500.00	61	53	53	0.0366	0.0369
630.00	91	53	53	0.0283	0.0286

Note: The diameter and tolerance of individual strand shall comply with any one of the suitable diameter and tolerance of wires stated in table 1 of this standard.

Table 3: Annealing test

Wire Diameter (1)	Minimum Elongation (%) (2)
Up to and including 0.14 mm	5.5
Above 0.14 mm up to and including 0.20 mm	9.0
Above 0.20mm up to and including 0.45 mm	13.5
Above 0.45 mm up to and including 1.12 mm	18.0
Above 1.12 mm	22.5

Note: Minimum percentage elongation is applicable for the wires having joint(s) also.

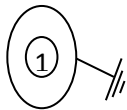
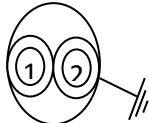
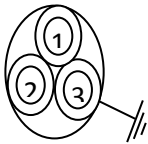
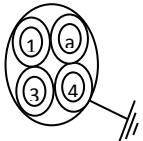
Table 4: Single core PVC insulated (unsheathed)

Nominal cross sectional area of conductor mm^2 (1)	Thickness of insulation (t1) mm (2)	Maximum overall diameter mm (3)
0.50	0.6	2.3
0.75	0.6	2.5
1.00	0.7	3.2
1.5	0.7	3.4
2	0.7	3.6
2.5	0.8	4.2
4	0.8	4.8
4.5	0.8	5.2
6	0.8	5.6
8	0.9	6.2
10	1.0	7.0
15	1.0	7.8
16	1.0	8.2
25	1.2	10.0
35	1.2	11.5
50	1.4	13.0
70	1.4	15.0
95	1.6	17.5
120	1.6	19.0
150	1.8	21.0
185	2.0	23.5
240	2.2	26.5
300	2.4	29.5
400	2.6	33.5
500	2.8	37.5
630	2.8	42.0

Table 5: PVC insulated and sheathed cables

Nominal area of conductor mm ² (1)	Nominal thickness of insulation t _l (mm) (2)	Nominal thickness of sheath (ts)				Nominal area of ECC (mm) (7)	Maximum overall dimensions						
		Single core (mm) (3)	Two core (mm) (4)	Three core (mm) (5)	Four core (mm) (6)		Single core (mm) (8)	Twin core (mm) (9)	Three core (mm) (10)	Four core (mm) (11)	Flat twin without ECC (mm) (12)	Flat twin with ECC (mm) (13)	Flat three without ECC (mm) (14)
1.0	0.6	0.8	0.9	0.9	0.9	1.0	4.7	8.2	8.6	9.2	7.8*5.0	9.2*5.0	10.5*3.0
1.5	0.6	0.8	0.9	0.9	0.9	1.5	5.0	8.8	9.2	10.0	8.4*5.4	10.2*5.4	11.5*5.4
2.5	0.7	0.8	1.0	1.0	1.0	1.5	5.8	10.5	11.0	12.0	10.0*6.4	12.0*6.4	14.0*6.4
4.0	0.8	0.9	1.0	1.1	1.1	1.5	6.8	12.0	13.0	14.0	11.5*7.2	13.5*7.2	16.5*7.4
6.0	0.8	0.9	1.1	1.1	1.2	2.5	7.8	13.5	14.5	15.5	13.0*8.0	15.5*8.0	18.0*8.0
10.0	1.0	0.9	1.2	1.2	1.3	4.0	8.8	16.5	17.5	19.5	16.0*9.6	19.0*9.6	22.5*9.6
16.0	1.0	1.0	1.3	1.3	1.4	6.0	10.5	19.0	20.0	22.5	18.5*11.0	22.0*11.0	26.5*11.0
25.0	1.2	1.1	1.4	1.5	1.6	-	12.5	23.0	24.5	27.5	22.5*13.0	-	32.5*18.5
35.0	1.2	1.1	1.5	1.6	1.7	-	13.5	25.5	27.5	30.5	25.5*14.5	-	36.0*15.0
50.0	1.4	1.2	1.6	1.7	1.8	-	15.5	29.5	31.5	35.0	29.0*16.5	-	41.5*17.0

Table 6: High voltage test - connections and test period

Type of cable	Connection diagram	Test connection	Test period (minute)
Single core		1 against E	5
Two core		1 against 2 + E 2 against 1 + E	5 5 Total =10
Three core		1 against 2+3+ E 2 against 3+1 +E 3 against 1 + 2+E	5 5 5 Total =15
Four core		1 +2 against 3+4 +E 1+3 against 2+4 +E 1 + 4 against 2+3 +E	5 5 5 Total =15

Note 1: E –Earth

Note 2: For multi core cables, voltage test shall be done between the conductor and free core bunched together and earthed as shown above.

Note 3: For single core cables, voltage test shall be done between the conductor and the tank with the cable under water.

Note 4: During high voltage test, one pole of power source shall be earthed.

Table 7: Spark test

Insulation thickness	Test voltage KV (rms)
Up to and including 1 mm	6
Above 1 mm and up to including 1.5 mm	10
Above 1.5 mm and up to including 2.0 mm	15
Above 2.0 mm and up to including 2.5 mm	20
Above 2.5 mm	25

Table 8: Sampling of cables

Number of drum/reel/coil in a lot	Number of drum/reel/coil to be taken as sample	Number of permissible defectives
Up to 25	3	0
26 – 50	5	0
51 – 100	8	0
101 – 300	13	1
Above 300	20	1

Table 9: Test requirements for PVC insulation

S.N.	Test	Unit	Type of insulation (A)	Methods of tests
1	Insulation resistance constant, Min a) at 27°C	M ohm km	36.7	Refer NS 285 Part 1
	b) at maximum rated temperature	M ohm km	0.037	
2	Without ageing a) Tensile strength, Min	N/mm ²	12.5	Refer NS ^{1*}
	b) Elongation at break, Min	Percent	150	
3	After ageing in in air oven a) Treatment - Temperature (tolerance $\pm 2^\circ\text{C}$)	$^\circ\text{C}$	80	Refer NS ^{2*}
	- Duration	Days	7	
	b) Tensile strength - Value after ageing, Min - Variation, Max	N/mm ² Percent	12.5 ± 20	
	c) Elongation at break - Value after ageing, Min - Variation, Max	Percent Percent	150 ± 20	
4	Loss of mass in air oven Treatment - Temperature (tolerance $\pm 2^\circ\text{C}$)	$^\circ\text{C}$	80	Refer NS ^{3*}
	- Duration	Days	7	
5	Hot deformation test (pressure at high temperature) a) Test temperature (tolerance $\pm 2^\circ\text{C}$)	$^\circ\text{C}$	80	Refer NS 285 part 4

	b)Time under load -first case -second case c)Depth of indentation, Max	Hours Hours Percent	4 6 50	
6	Heat shock test a)Treatment -Temperature(tolerance $\pm 2^{\circ}\text{C}$) - Duration b)Visual examination	$^{\circ}\text{C}$ Hours -	150 1 -	Refer NS ^{4*}
7	Shrinkage test a)Treatment- -Temperature(tolerance $\pm 2^{\circ}\text{C}$) - Duration b)Shrinkage, Max	$^{\circ}\text{C}$ Minutes Percent	150 15 4	Refer NS ^{5*}

Note:

The type of PVC compounds covered by this standard is given below:

1. Type A – General purpose insulation for maximum rated conductor temperature 70°C intended for cables with rated voltages U_0/U up to and including 3.3/3.3KV.
2. Type ST1 – General purpose sheath intended for use in cables operating at a maximum rated conductor temperature 70°C .

Table 10: Test requirements for PVC sheath

S.N.	Test	Unit	Type of sheath(ST1)	Methods of tests
1	Without ageing a) Tensile strength, Min b) Elongation at break, Min	N/mm ² Percent	12.5 150	Refer NS ^{1*}
2	After ageing in air oven a) Treatment - Temperature (tolerance $\pm 2^{\circ}\text{C}$) - Duration b) Tensile strength - Value after ageing, Min - Variation, Max c) Elongation at break - Value after ageing, Min - Variation, Max	$^{\circ}\text{C}$ Days N/mm ² Percent Percent Percent	80 7 12.5 ± 20 150 ± 20	Refer NS ^{2*}
3	Loss of mass in air oven a) Treatment - Temperature (tolerance $\pm 2^{\circ}\text{C}$) - Duration b) Loss of mass, Max	$^{\circ}\text{C}$ Days Mg/cm ²	80 7 2	Refer NS ^{3*}
4	Hot deformation test (pressure at high temperature) a) Test temperature (tolerance $\pm 2^{\circ}\text{C}$) b) Time under load First case Second case c) Depth of indentation, Max	$^{\circ}\text{C}$ Hours Hours Percent	80 4 6 50	Refer NS 285 part 4
5	Heat shock test a) Treatment - temperature (tolerance $\pm 2^{\circ}\text{C}$) - Duration b) Visual examination	$^{\circ}\text{C}$ Hours -	150 1 -	Refer NS ^{4*}

6	Shrinkage test			
	a) Treatment			
	- temperature (tolerance $\pm 2^{\circ}\text{C}$)	$^{\circ}\text{C}$	150	Refer
	- Duration	Minutes	15	NS ^{5*}
	b) Shrinkage, Max	Percent	4	

Note:

NS^{1*} –Until the relevant Nepal Standard will be developed for both insulation and sheath testing, refer IS 10810, part 7.

NS^{2*} - Until the relevant Nepal Standard will be developed for both insulation and sheath testing, refer IS 10810, part 11.

NS^{3*} - Until the relevant Nepal Standard will be developed for both insulation and sheath testing, refer IS 10810, part 10.

NS^{4*}-Until the relevant Nepal Standard will be developed for both insulation and sheath testing, refer IS 10810, part 14.

NS^{5*} -Until the relevant Nepal Standard will be developed for both insulation and sheath testing, refer IS 10810, part 12.