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SPECIFICATION FOR ALUMINIUM CONDUCTORS FOR OVERHEAD TRANSMISSION PURPOSES

PART III ALUMINIUM CONDUCTORS, ALUMINIZED-STEEL REINFORCED

(Second Revision)

(Incorporating Amendment Nos. 1, 2 & 3)

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Price Group 4

Indian Standard

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(*Continued on page* 2)

(*Continued from page* 1)

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SPECIFICATION FOR ALUMINIUM CONDUCTORS FOR OVERHEAD TRANSMISSION PURPOSES

PART III ALUMINIUM CONDUCTORS, ALUMINIZED-STEEL REINFORCED

(Second Revision)

0. FOREWORD

0.1 This Indian Standard (Part III) (Second Revision) was adopted by the Indian Standards Institution on 3 June 1976, after the draft finalized by the Conductors and Power Cables Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard was originally published in 1953 and the first revision was brought out in 1961. The second revision has been undertaken with a view to effecting the following modifications:

a) To line up with the international standards;

b) To further rationalize the sizes of stranded aluminium conductors, steel reinforced aluminium conductors and to introduce a few sizes, which will have a higher aluminium/steel ratio;

c) To introduce aluminized-steel reinforced aluminium conductors; and

d) To introduce aluminium alloy stranded conductors (aluminium-magnesium-silicon type).

0.2.1 While revising this standard, it was decided to issue it in different parts covering different types of conductors. This part dealing with aluminized-steel reinforced aluminium conductors form Part III of the series. Other parts in the series are given below:

Part I Aluminium stranded conductor

Part II Aluminium conductor, galvanized-steel reinforced

Part IV Aluminium alloy stranded conductors (under preparation)

0.3 The important deviation from the standards published by the IEC is with respect to the value adopted for resistivity. Owing to difficulties in getting EC grade aluminium of a higher conductivity locally, the standard has prescribed a resistivity of 0.028 45 ohm.mm^2/m at 20°C, whereas the value prescribed in the IEC standard is 0.028 264 ohm.mm^2/m at 20°C.

0.4 In the preparation of this standard, considerable assistance has been derived from AS 1220, Part . . 'Draft Australian Standard Specification for aluminium conductors for overhead transmission purposes: Part . . Aluminized-steel reinforced (ACSR/AZ), Doc : 1898' issued by the Standards Association of Australia.

0.5 The values of modulus of elasticity and coefficient of linear expansion are given in Appendix B for information.

0.6 This edition 3.3 incorporates Amendment No. 2 (May 1983) and Amendment No. 3 (April 1985). Side bar indicates modification of the text as the result of incorporation of the amendments.

0.7 For the purpose of deciding whether a particular requirement of this standard is complied with, the final values, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off values should be the same as that of the specified values in this standard.

SECTION I GENERAL

1. SCOPE

1.1 This standard (Part III) covers the requirements and tests for aluminium conductors, aluminized-steel reinforced used for overhead power transmission purposes.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions in addition to those given in IS : 1885 (Part XXXII)-1971† shall apply.

2.1 Aluminium Conductor, Aluminized-Steel Reinforced — Conductor consisting of seven or more aluminium and aluminized steel wires built up in concentric layers. The centre wire or wires are of aluminized steel and the outer layer or layers of aluminium.

2.2 Diameter — The mean of two measurements at right angles taken at the same cross section.

2.3 Direction of Lay — The direction of lay is defined as right-hand or left-hand. With right-hand lay, the wires conform to the direction of the central part of the letter Z when the conductor is held vertically. With left-hand lay, the wires conform to the direction of the central part of the letter S when the conductor is held vertically.

2.4 Lay Ratio — Ratio of the axial length of a complete turn of the helix formed by an individual wire in a stranded conductor to the external diameter of the helix.

*Rules for rounding off numerical values (*revised*).

†Electrotechnical vocabulary: Part XXXII Cables, conductors and accessories for electricity supply.

3. PHYSICAL CONSTANTS FOR HARD-DRAWN ALUMINIUM

3.1 Resistivity — The resistivity of aluminium depends upon its purity and its physical condition. For the purpose of this standard, the maximum value permitted is 0.028 45 ohm.mm^2/m at 20°C, and this value has been used for calculation of the maximum permissible values of resistance.

NOTE — It is not intended to check the resistivity from the measured values of resistance.

3.2 Density — At a temperature of 20°C, the density of hard-drawn aluminium has been taken as 2.703 g/cm^3.

3.3 Constant-Mass Temperature Coefficient of Resistance — At a temperature of 20°C the constant-mass temperature coefficient of resistance of hard-drawn aluminium, measured between two potential points rigidly fixed to the wire, the metal being allowed to expand freely, has been taken as 0.004 per degree Celsius.

3.4 Coefficient of Linear Expansion — The coefficient of linear expansion of hard-drawn aluminium at 0°C has been taken as 23.0×10^{-6} per degree Celsius. This value holds good for all practical purposes over the range of temperature from 0°C to the highest safe operating temperature.

4. PHYSICAL CONSTANTS FOR ALUMINIZED STEEL WIRES

4.1 Density — At a temperature of 20°C, the density of aluminized steel wire has been taken as 7.80 g/cm^3.

4.2 Coefficient of Linear Expansion — In order to obtain uniformity in calculations, a value of 11.5×10^{-6}/°C has been taken as the value for the coefficient of linear expansion of aluminized steel wires used for the cores of steel reinforced aluminium conductors.

SECTION II MATERIALS

5. MATERIAL

5.1 The conductor shall be constructed of hard-drawn aluminium and aluminized steel wires which have the mechanical and electrical properties specified in Tables 1 and 2.

The coating on the aluminized steel wires may be applied by the hot process or the electrolytic process.

When specified by the purchaser, neutral grease may be applied between the layers of wires.

NOTE — Lithium soap grease corresponding to Grade II of IS : 7623-1974* is suitable for such application.

*Specification for lithium soap greases.

6. FREEDOM FROM DEFECTS

6.1 The wires shall be smooth and free from all imperfections, such as spills and splits.

SECTION III DIMENSIONS AND CONSTRUCTION

7. STANDARD SIZES

7.1 Wires

7.1.1 *Nominal Sizes* — The aluminium and aluminized steel wires for the standard constructions covered by this standard shall have the diameters specified in Tables 1 and 2. The diameters of the steel wires shall be measured over the aluminium coating.

7.1.2 *Tolerances on Nominal Sizes*

7.1.2.1 *Aluminium wires* — A tolerance of ± 1 percent shall be permitted on the nominal diameter specified in Table 1.

TABLE 1 ALUMINIUM WIRES USED IN THE CONSTRUCTION OF ALUMINIUM CONDUCTORS, ALUMINIZED-STEEL REINFORCED

(*Clauses* 5.1, 7.1.1, 7.1.2.1, 12.2.1, 12.5 *and* A-3.2)

Diameter			Cross-Sectional Area of Nominal Diameter Wire	Mass	Resistance At 20°C, *Max*	Breaking Load, *Min*	
Nom	*Min*	*Max*				Before Stranding	After Stranding
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
mm	mm	mm	mm^2	kg/km	Ω/km	kN	kN
1.50	1.48	1.52	1.767	4.78	16.54	0.32	0.30
1.96	1.94	1.98	3.017	8.16	9.625	0.54	0.51
2.11	2.09	2.13	3.497	9.45	8.293	0.63	0.60
2.59	2.56	2.62	5.269	14.24	5.527	0.89	0.85
3.00	2.97	3.03	7.069	19.11	4.107	1.17	1.11
3.18	3.15	3.21	7.942	21.47	3.651	1.29	1.23
3.35	3.32	3.38	8.814	23.82	3.286	1.43	1.36
3.50	3.46	3.54	9.621	26.01	3.026	1.55	1.47
3.53	3.49	3.57	9.787	26.45	2.974	1.57	1.49
3.80	3.76	3.84	11.34	30.65	2.562	1.80	1.71
4.09	4.05	4.13	13.14	35.51	2.208	2.08	1.98
4.13	4.09	4.17	13.40	36.21	2.165	2.13	2.02
4.72	4.67	4.77	17.50	47.30	1.661	2.78	2.64

NOTE 1 — The resistance has been calculated from the maximum value of resistivity and the cross-sectional area based on the minimum diameter.

NOTE 2 — The resistance of individual wires shall be such that the completed stranded conductor meets the requirements of the maximum resistance specified in Table 3 calculated by applying the relevant stranding constants given in Table 5.

7.1.2.2 *Aluminized steel wires* — A tolerance of ± 2 percent shall be permitted on the nominal diameter specified in Table 2.

TABLE 2 STEEL WIRES USED IN THE CONSTRUCTION OF ALUMINIUM CONDUCTORS, ALUMINIZED-STEEL REINFORCED

(*Clauses* 5.1, 7.1.1, 7.1.2.2, 12.2.1, *and* A-3.2)

Diameter			Cross-Sectional Area of Nominal Diameter Wire	Mass	Breaking Load, *Min*	
Nom	*Min*	*Max*			Before Stranding	After Stranding
(1)	(2)	(3)	(4)	(5)	(6)	(7)
mm	mm	mm	mm^2	kg/km	kN	kN
1.50	1.47	1.53	1.767	13.78	2.34	2.13
1.57	1.54	1.60	1.936	15.10	2.46	2.34
1.96	1.92	2.00	3.017	23.53	3.83	3.64
2.11	2.07	2.15	3.497	27.27	4.44	4.22
2.30	2.25	2.35	4.155	32.41	5.15	4.89
2.59	2.54	2.64	5.269	41.09	6.53	6.20
3.00	2.94	3.06	7.069	55.13	8.77	8.33
3.18	3.12	3.24	7.942	61.95	9.61	9.13
3.35	3.28	3.42	8.814	68.75	10.67	10.14
3.53	3.46	3.60	9.787	76.34	11.84	11.25
4.09	4.01	4.17	13.14	102.48	14.98	14.23

7.2 Aluminium Conductors, Aluminized-Steel Reinforced

7.2.1 The sizes of standard aluminium conductors, aluminized-steel reinforced shall be as given in Table 3.

7.2.2 The resistances shall be in accordance with Table 3. The masses (excluding the mass of grease, if applied) are given in Table 3 for information.

8. JOINTS IN WIRES

8.1 Aluminium Wires — In aluminized-steel reinforced, aluminium conductors containing any number of aluminium wires, joints in individual aluminium wires are permitted, in addition to those made in the base rod or wire before final drawing, but no two such joints shall be less than 15 m apart in the complete stranded conductor. Such joints shall be made by resistance or cold pressure butt-welding. They are not required to fulfil the mechanical requirements for unjointed wires. Joints made by resistance butt-welding shall, subsequent to welding, be annealed over a distance of at least 200 mm on each side of the joint.

TABLE 3 ALUMINIUM CONDUCTORS, ALUMINIZED-STEEL REINFORCED

(*Clauses* 7.2.1, 7.2.2 *and* A-3.2)

Nominal Aluminium Area	Stranding And Wire Diameter		Sectional Area of Aluminium	Total Sectional Area	Approximate Overall Diameter	Approximate Mass	Calculated Resistance at 20°C, *Max*	Approximate Calculated Breaking Load
	Aluminium	Steel						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
mm^2	mm	mm	mm^2	mm^2	mm	kg/km	Ω/km	kN
10	6/1.50	1/1.50	10.60	12.37	4.50	43	2.799	3.79
18	6/1.96	1/1.96	18.10	21.12	5.88	73	1.629	6.43
20	6/2.11	1/2.11	20.98	24.48	6.33	85	1.403	7.48
30	6/2.59	1/2.59	31.61	36.88	7.77	128	0.935 2	10.78
50	6/3.35	1/3.35	52.88	61.70	10.05	214	0.556 0	17.48
80	6/4.09	1/4.09	78.83	91.97	12.27	319	0.373 6	24.96
100	6/4.72	7/1.57	105.0	118.5	14.15	394	0.281 0	30.98
150	30/2.59	7/2.59	158.1	194.9	18.13	726	0.188 4	65.02
200	30/3.00	7/3.00	212.1	261.5	21.00	974	0.140 0	86.58
400	42/3.50	7/1.96	404.1	425.2	26.88	1 281	0.073 59	86.59
420	54/3.18	7/3.18	428.9	484.5	28.62	1 621	0.069 15	125.45
520	54/3.53	7/3.53	528.5	597.0	31.77	1 998	0.056 33	153.53
560	42/4.13	7/2.30	562.7	591.7	31.68	1 781	0.052 65	118.31

NOTE 1 — For the basis of calculation of this table, *see* Appendix A.

NOTE 2 — The sectional area is the sum of the cross-sectional areas of the relevant individual wires.

8.2 Aluminized Steel Wires — There shall be no joints, except those made in the base rod or wire before final drawing, in steel wires forming the core of a steel reinforced aluminium conductor, unless the core consists of seven or more aluminized steel wires. In the latter case joints in individual wires are permitted in addition to those made in the base rod or wire before final drawing, but no two such joints shall be less than 15 m apart in the complete steel core. Joints in aluminized steel wires shall be made by resistance butt-welding or brazing and shall be protected against corrosion.

9. STRANDING

9.1 The wires used in the construction of aluminium conductors aluminized-steel reinforced shall, before stranding, satisfy all the relevant requirements of this standard.

9.2 The lay ratio of the different layers shall be within the limits given in Table 4.

9.3 The ratio of the nominal diameter of the aluminium wires to the nominal diameter of the aluminized steel wires in any particular construction of aluminized-steel reinforced aluminium conductor, shall conform to the appropriate value given in Table 4.

9.4 In all constructions, the successive layers shall have opposite directions of lay, the outermost layer being right-handed. The wires in each layer shall be evenly and closely stranded.

9.5 In conductors having multiple layers of aluminium wires, the lay ratio of any aluminium layer shall be not greater than the lay ratio of the aluminium layer immediately beneath it.

10. LENGTHS AND VARIATIONS IN LENGTHS

10.1 Unless otherwise agreed between the purchaser and the manufacturer, aluminized-steel reinforced aluminium conductors shall be supplied in the manufacturer's usual production lengths and with a permitted variation of ± 5 percent in the length of any one conductor length.

10.2 Random Lengths — Unless otherwise agreed between the purchaser and the manufacturer, it shall be permissible to supply not more than 10 percent of the lengths on any one order in random lengths; none of them will be shorter than one-third of the nominal length.

SECTION IV PACKING AND MARKING

11. PACKING AND MARKING

11.1 The conductor shall be wound on reels or drums* and marked with the following:

a) Manufacturer's name or trade-name;

*It is recommended that reels and drums conforming to IS : 1778-1961 'Specification for reels and drums for bare wire' be used.

TABLE 4 LAY RATIOS OF ALUMINIUM CONDUCTORS, ALUMINIZED-STEEL REINFORCED

(*Clauses* 9.2 *and* 9.3)

Number of Wires		Ratio Aluminium Wire Diameter to Steel Wire Diameter	Lay Ratios for Steel Core (6-Wire Layer)		Lay Ratios for Aluminium Wire					
					Outside Layer		Layer Immediately Beneath Outside Layer		Innermost Layer of Conductors with 3 Aluminium Wire Layers	
Aluminium	Steel		*Min*	*Max*	*Min*	*Max*	*Min*	*Max*	*Min*	*Max*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
6	1	1.000	—	—	10	14	—	—	—	—
6	7	3.000	13	28	10	14	—	—	—	—
30	7	1.000	13	28	10	14	10	16	—	—
42	7	1.800	13	28	10	14	10	16	10	17
54	7	1.000	13	28	10	14	10	16	10	17

NOTE — For the purpose of calculation, the mean lay ratio shall be taken as the arithmetic mean of the relevant minimum and maximum values given in this table.

b) Size of conductor;

c) Net and gross mass of conductor; and

d) Length of conductor.

11.1.1 The conductor may also be marked with the Standard Mark.

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

SECTION V TESTS

12. TESTS

12.1 Selection of Test Samples

12.1.1 Samples of individual wires for tests specified in **12.2**, **12.3**, **12.4**, **12.5** and **12.6** shall normally be taken by the manufacturer before stranding, from the outer ends of not less than 10 percent of wire coils.

12.1.2 Alternatively, if desired by the purchaser at the time of placing an order that the tests be made in the presence of his representative, samples of wire shall be taken from lengths of stranded conductors. Samples shall then be obtained by cutting 1.2 metres from the outer end of the finished conductor from not more than 10 percent of the finished reels or drums. If there is more than one length on any reel or drum, the sample shall be taken from the outer length.

12.1.3 Coils offered for inspection shall be divided* into equal lots, the number of lots being equal to the number of samples to be selected, a fraction of a lot being counted as a complete lot. One sample coil shall be selected at random from each lot.

12.2 Breaking Load Test — This test shall be made on both aluminium and aluminized steel wires.

12.2.1 The breaking load of one specimen cut from each of the sample taken under **12.1.1** or **12.1.2** shall be determined by means of a suitable tensile testing machine. The load shall be applied gradually and the rate of separation of the jaws of the testing machine shall be not less than 25 mm/min and not greater than 100 mm/min.

The ultimate breaking load of the specimens shall be not less than the appropriate value specified in Tables 1 and 2.

*This may be done physically or on the basis of identification numbers of the coils offered for supply.

12.3 Ductility Test — This test shall be made on aluminized steel wires only, by either of the two tests given in **12.3.1** and **12.3.2**.

12.3.1 *Torsion Test* — One specimen cut from each of the samples taken under **12.1.1** or **12.1.2** shall be gripped at its ends in two vices, one of which shall be free to move longitudinally during the test. A small tensile load not exceeding 2 percent of the breaking load of the wire, shall be applied to the sample during testing. The specimen shall be twisted by causing one of the vices to revolve until fracture occurs and the number of twists shall be indicated by a counter or other suitable device. The rate of twisting shall not exceed 60 rev/min.

When tested before stranding, the number of complete twists before fracture occurs shall be not less than 18 on a length equal to 100 times the diameter of the wire. The primary fracture shall show a smooth surface at right angles to the axis of the wire. Any secondary fracture shall be ignored.

When tested after stranding, the number of complete twists before fracture occurs shall be not less than 16 on a length equal to 100 times the diameter of the wire. The fracture shall show a smooth surface at right angles to the axis of the wire.

12.3.2 *Elongation Test* — The elongation of one specimen cut from each of the samples taken under **12.1.1** or **12.1.2** shall be determined. The specimen shall be straightened by hand and an original gauge length of 200 mm shall be marked on the wire. A tensile load shall be applied as described in **12.2** and the elongation shall be measured after the fractured ends have been fitted together. If the fracture occurs outside the gauge marks, or within 25 mm of either mark and the required elongation is not obtained, the test shall be disregarded and another test made. When tested before stranding, the elongation shall be not less than 4 percent. When tested after stranding, the elongation shall be not less than 3.5 percent.

NOTE — The choice between the torsion test and the elongation test shall be at the discretion of the purchaser. In the absence of any definite indication from the purchaser torsion test shall be carried out in preference to elongation test.

12.4 Wrapping Test — This test shall be made on both aluminium and aluminized steel wires.

12.4.1 *Aluminium Wires* — One specimen cut from each of the samples of aluminium wire taken under **12.1.1** or **12.1.2** shall be wrapped round a wire of its own diameter to form a close helix of eight turns. Six turns shall then be unwrapped and again closely wrapped in the same direction as before. The wire shall not break or show any crack.

NOTE — Slight surface cracks shall not constitute cause for rejection.

12.4.2 *Aluminized Steel Wires* — One specimen cut from each of the samples of aluminized steel wire taken under **12.1.1** or **12.1.2** shall be wrapped round a mandrel of diameter equal to 4 times the wire diameter to form a close helix of 8 turns. Six turns shall then be unwrapped and again closely wrapped in the same direction as before. The wire shall not break.

12.5 Resistance Test — This test shall be made on aluminium wires only.

The electrical resistance of one specimen of aluminium wire cut from each of the samples taken under **12.1.1** or **12.1.2** shall be measured at ambient temperature. The measured resistance shall be corrected to the value at 20°C by means of the formula:

$$R_{20} = R_T \frac{1}{1 + \alpha(T - 20)}$$

where

R_{20} = resistance corrected at 20°C;

R_T = resistance measured at T°C;

α = constant-mass temperature coefficient of resistance, 0.004; and

T = the ambient temperature during measurement.

The resistance corrected at 20°C shall be not more than the maximum value specified in Table 1.

12.6 Aluminizing Test — This test shall be made on aluminized steel wires only.

12.6.1 This test shall be made on one specimen cut from each of the samples of aluminized steel wires taken under **12.1.1** or **12.1.2**.

12.6.2 The adherance of aluminium coating, mass of coating and continuity of coating shall be in accordance with IS : 3835-1966*.

13. REJECTION AND RETESTS

13.1 Should any one of the test pieces selected fail to pass the tests, three further samples from the same batch shall be selected, one of which shall be from the length from which the original test sample was taken, unless that length has been withdrawn by the supplier.

13.2 Should all of the three test pieces from these additional samples satisfy the requirements of the tests, the batch represented by these samples shall be deemed to comply with the standard. Should the test pieces from any of the three additional samples fail, the batch represented shall be deemed not to comply with the standard.

*Specification for aluminized steel core wire for aluminium conductors (ACSR).

APPENDIX A

(*Table* 3, *Note* 1)

NOTES ON CALCULATION OF TABLE 3

A-1. INCREASE IN LENGTH DUE TO STRANDING

A-1.1 When straightened out, each wire in any particular layer of stranded conductor, except the central wire, is longer than the stranded conductor by an amount depending on the lay ratio of that layer.

A-2. RESISTANCE AND MASS OF CONDUCTOR

A-2.1 In aluminized-steel reinforced aluminium conductors, the conductivity of the steel core is neglected and the resistance of the conductor is calculated with reference to the resistance of the aluminium wires only. The resistance of any length of stranded conductor is the resistance of the same length of any one aluminium wire multiplied by a constant, as set out in Table 5.

TABLE 5 STRANDING CONSTANTS

NUMBER OF WIRES		STRANDING CONSTANTS		
		Mass		Electrical Resistance
Aluminium	Steel	Aluminium	Steel	
(1)	(2)	(3)	(4)	(5)
6	1	6.091	1.000	0.169 2
6	7	6.091	7.032	0.169 2
30	7	30.67	7.032	0.034 08
42	7	42.90	7.032	0.024 32
54	7	55.23	7.032	0.018 94

A-2.2 The mass of each wire in a length of stranded conductor, except the central wire, will be greater than that of an equal length of straight wire by an amount depending on the lay ratio of the layer (*see* **A-1.1** above). The total mass of any length of conductor is, therefore, obtained by multiplying the mass of an equal length of straight wire by the appropriate constant set out in Table 5. The masses of the steel core and aluminium wires are calculated separately and added together.

A-2.3 In calculating the stranding constants in Table 5, the mean lay ratio, that is, the arithmetic mean of the relevant minimum and maximum values in Table 4, has been assumed for each layer.

A-3. CALCULATED BREAKING LOAD OF CONDUCTOR

A-3.1 The breaking load of an aluminized-steel reinforced aluminium conductor in terms of the sum of the strengths of the individual component wires may be taken to be as follows:

a) 98 percent of the sum of the breaking loads of the aluminium wires plus 89 percent of the sum of the breaking loads of the aluminized steel wires, when taken from the stranded conductor and tested; or

b) 98 percent of the sum of the breaking loads of the aluminium wires plus 85 percent of the sum of the breaking loads of the aluminized steel wires, based on the breaking loads of the component wires before stranding, that is, the coil.

A-3.2 The values of approximate breaking load of conductors, given in Table 3 have been calculated in accordance with **A-3.1** (b) and on the basis of the minimum breaking loads of the component wires given in Tables 1 and 2.

APPENDIX B

(*Clause* 0.5)

MODULUS OF ELASTICITY AND CO-EFFICIENT OF LINEAR EXPANSION

No. of Wires		*Final Modulus of Elasticity (Practical)* GN/m^2	*Coefficient of Linear Expansion/°C*
Aluminium	Steel		
(1)	(2)	(3)	(4)
6	1	79	19.1×10^{-6}
6	7	75	19.8×10^{-6}
30	7	80	17.3×10^{-6}
42	7	62	21.5×10^{-6}
54	7	69	19.3×10^{-6}

NOTE 1 — These values are given for information only.

NOTE 2 — Moduli values quoted may be regarded as being accurate to within ± 3 GN/m^2.

NOTE 3 — Moduli values quoted may be taken as applying to conductors stressed between 15 and 50 percent of the ultimate strength of the conductor.

NOTE 4 — Coefficients of linear expansion have been calculated from the final (practical) moduli for the aluminium and steel components of the conductors and coefficients of linear expansion of 23.0×10^{-6} and 11.5×10^{-6}/°C for aluminium and steel respectively.

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