

NA2XS(F)2Y / N2XS(F)2Y – 18/30(36) kV Cables

1. Applications

This specification covers high-voltage cables, suitable for use in distribution systems, having a working voltage of 18/30(36) kV.

The cables covered by this specification are designed for outdoor and indoor installation, for direct burial and for buried duct installation.

They may also be used in conjunction with overhead transmission lines.

2. Reference Standards and documents

The cables covered by this specification are manufactured and tested as per the following references:

2.1	SI 1516-2	:($U_m = U_n 36$) $U_n 30$ $(U_m = U_n 1.2)$ $U_n 1$ $U_n 30$ $(U_m = U_n 36)$ $U_n 30$ $(U_m = U_n 7.2)$ $U_n 6$
2.2	IEC 60502-2	Power cables with extruded insulation and their accessories for rated voltages from 1 kV ($U_m = 1,2$ kV) up to 30 kV ($U_m = 36$ kV) – Part 2: Cables for rated voltages from 6 kV ($U_m = 7,2$ kV) up to 30 kV ($U_m = 36$ kV)
2.3	HD 620	Distribution cables with extruded insulation for rated voltages from 3,6/6(7.2) kV up to 20.8/36(42) kV
2.3	IEC 60183	Guidance for the selection of high-voltage A.C. cable systems
2.4	IEC 60228	Conductors of insulated cables
2.5	IEC 60986	Short-circuit temperature limits of electric cables with rated voltages from 6 kV ($U_m = 7,2$ kV) up to 30 kV ($U_m = 36$ kV)
2.6	IEC 60811 series	Common test methods for insulation and sheathing materials of electrical and optical cables
2.7	HD 605	Electric Cables – Additional test methods

3. Medium-Voltage Cables Construction

3.1 Conductor

Conductors used in Medium-Voltage Cables construction are stranded from aluminum or copper wires. Conductors have a cross-sectional area up to and including 1000 mm² and are class 2, compact-round stranded.

3.2 Conductor screen

An extruded layer of semi-conductive, cross-linked polymer, firmly bonded to the insulation, is applied over the conductor.

3.3 Insulation

An extruded layer of extra-clean XLPE (cross-linked polyethylene) is subsequently applied.

3.4 Insulation screen

An extruded layer of semi-conductive, cross-linked polymer firmly bonded to the insulation. Note: Conductor screen, insulation and insulation screen are extruded in a single operation.

3.5 Metal screen

A semi-conductive tape is helically applied around the completed insulated core, as bedding between insulation screen and metal screen components.

Metal screen is built from copper round wires and copper equalizing tape.

3.6 Longitudinal water-blocking barrier

A semi-conductive and swelling tape is helically applied around the screened core.

Metal screen is built from copper round wires and copper equalizing tape.

3.7 Outer protective sheath

A black polymeric sheath (complying with the designation ST7, as per IEC 60502-2 standard) is extruded overall.

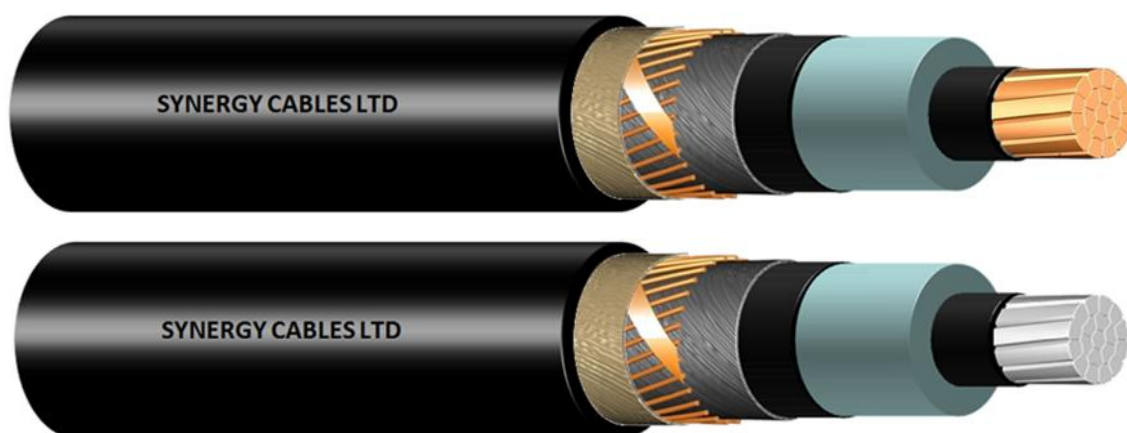
3.8 Constructive options

Conductor: water-blocked conductor, available as option;

Metal Screen: Other cross-sectional area than those listed in this specification, available as option;

Outer protective sheath: Extruded, thermoplastic HFFR, instead ST7, available as option;

Typical Drawing of Medium-Voltage Cable



NA2XS(F)2Y 18/30 (36) kV/ ALUMINUM CONDUCTOR

Construction and Dimensional Data

Item P/N	Conductor Cross-Sectional Area	Conductor dc resistance at 20°C (max.)	Conductor Diameter (Approx.)	Insulation Thickness (Nom.)	Metal Screen Cross-Sectional Area	Outer Protective Sheath Thickness (Nom.)	Overall Diameter (approx.)	Min. Bending Radius - Static (1)	Min. Bending Radius - Dynamic (2), (3)	Completed Cable Weight (approx.)
	mm ²	Ω/km	mm	mm	mm ²	mm	mm	mm	mm	kg/km
1684A050D	50	0.641	8.3	8.0	16	2.0	34.0	510	850	945
1684A070D	70	0.443	9.9	8.0	16	2.0	36.0	540	900	1,075
1684A095D	95	0.320	11.7	8.0	16	2.1	37.5	565	940	1,200
1684A120D	120	0.253	13.2	8.0	16	2.1	39.0	585	975	1,315
1684A150D	150	0.206	14.5	8.0	25	2.2	40.5	610	1,015	1,530
1684A185D	185	0.164	16.3	8.0	25	2.2	42.5	640	1,065	1,685
1684A240D	240	0.125	18.6	8.0	25	2.3	45.0	675	1,125	1,940
1684A300D	300	0.100	20.9	8.0	25	2.4	47.5	715	1,190	2,195
1684A400D	400	0.0778	24.0	8.0	35	2.5	51.5	775	1,290	2,700
1684A500D	500	0.0605	26.8	8.0	35	2.6	55.0	825	1,375	3,110
1684A630D	630	0.0469	31.0	8.0	35	2.7	59.5	895	1,490	3,655
1684A800D	800	0.0367	35.0	8.0	35	2.8	63.5	955	1,590	4,310

Remarks:

(1)– Minimum bending radius for permanent training;

(2)– Minimum bending radius for pulling in duct;

(3) – The sidewall pressure shall be kept below the value of 1000 daN/m (10 kN/m).

NA2XS(F)2Y 18/30 (36) kV/ ALUMINUM CONDUCTOR (...continued...)

Continuous current ratings

Item P/N	Conductor Cross-Sectional Area	Direct Buried, Touching-Trefoil (1), (4), (7)	Direct Buried, Spaced Flat-Parallel (1), (5), (7)	Buried in Ducts, Spaced Flat-Parallel (2), (6), (7)	In Free Air (3), (4), (7)	In Free Air (3), (5), (7)
	mm ²	A	A	A	A	A
1684A050D	50/16	152	159	150	192	221
1684A070D	70/16	185	194	182	239	276
1684A095D	95/16	221	231	216	291	335
1684A120D	120/16	250	262	254	335	387
1684A150D	150/25	279	290	278	378	435
1684A185D	185/25	316	327	312	435	499
1684A240D	240/25	365	376	357	512	587
1684A300D	300/25	412	422	398	588	671
1684A400D	400/35	469	471	439	685	771
1684A500D	500/35	531	529	490	793	886
1684A630D	630/35	603	594	550	924	1025
1684A800D	800/35	678	659	606	1060	1127

Remarks:

- (1)– Direct Buried, burial depth = 0.8 m, native soil thermal resistivity = 1.5 K*m/w, soil ambient temperature = 20°C;
 (2)– Buried in single way ducts, burial depth = 0.8 m, native soil thermal resistivity = 1.5 K*m/w, soil ambient temperature = 20°C;
 (3) – In Free Air, protected against direct sun radiation, ambient air temperature = 30°C
 (4)– Touching-trefoil formation;
 (5) – Flat-parallel formation, inter-axial spacing = 2 x D of cable;
 (6) – Flat-parallel formation, inter-axial spacing = 2 x D of duct;
 (7) – Conductor continuous working temperature = 90°C, metal screens bonded in multiple points.

NA2XS(F)2Y 18/30 (36) kV/ ALUMINUM CONDUCTOR (...continued)

Electrical parameters (Capacitance and Sequence Impedances)

Item P/N	Conductor Cross-Sectional Area	Electrostatic Capacitance (Nom.)	Touching Trefoil Formation (1)				Flat-Parallel Formation (1), (2)			
			R1	X1	R0	X0	R1	X1	R0	X0
	mm ²	μF/km	Ω/km	Ω/km	Ω/km	Ω/km	Ω/km	Ω/km	Ω/km	Ω/km
1684A050D	50/15	0.140	0.824	0.147	1.736	0.692	0.825	0.204	1.692	0.692
1684A070D	70/16	0.156	0.570	0.139	1.481	0.688	0.573	0.197	1.437	0.688
1684A095D	95/16	0.172	0.413	0.133	1.321	0.685	0.416	0.190	1.278	0.684
1684A120D	120/16	0.186	0.327	0.126	1.234	0.682	0.331	0.185	1.191	0.681
1684A150D	150/25	0.198	0.268	0.123	0.982	0.382	0.277	0.180	0.959	0.387
1684A185D	185/25	0.215	0.213	0.118	0.928	0.379	0.223	0.176	0.905	0.385
1684A240D	240/25	0.235	0.164	0.114	0.877	0.377	0.174	0.171	0.855	0.383
1684A300D	300/25	0.257	0.132	0.111	0.845	0.376	0.142	0.167	0.822	0.381
1684A400D	400/35	0.289	0.106	0.107	0.661	0.236	0.119	0.162	0.648	0.241
1684A500D	500/35	0.313	0.0836	0.103	0.640	0.234	0.0970	0.159	0.626	0.239
1684A630D	630/35	0.350	0.0666	0.0987	0.623	0.232	0.0799	0.154	0.609	0.237
1684A800D	800/35	0.387	0.0543	0.0966	0.610	0.231	0.0672	0.152	0.596	0.236

Remarks:

- (1) - Metal screens bonded in multiple points;
- (2) - Flat-parallel formation, inter-axial spacing = 2 x D of cable;

N2XS(F)2Y 18/30 (36) kV/ COPPER CONDUCTOR

Construction and Dimensional Data

Item P/N	Conductor Cross-Sectional Area	Conductor dc resistance at 20°C (max.)	Conductor Diameter (Approx.)	Insulation Thickness (Nom.)	Metal Screen Cross-Sectional Area	Outer Protective Sheath Thickness (Nom.)	Overall Diameter (approx.)	Min. Bending Radius - Static (1)	Min. Bending Radius - Dynamic (2), (3)	Completed Cable Weight (approx.)
	mm ²	Ω/km	mm	mm	mm ²	mm	mm	mm	mm	kg/km
1684C050D	50	0.387	8.3	8.0	16	2.0	34.0	510	850	1,240
1684C070D	70	0.268	9.9	8.0	16	2.0	35.5	535	890	1,480
1684C095D	95	0.193	11.7	8.0	16	2.1	37.5	565	940	1,790
1684C120D	120	0.153	13.2	8.0	16	2.1	39.0	585	975	2,045
1684C150D	150	0.124	14.5	8.0	25	2.2	40.5	610	1,015	2,445
1684C185D	185	0.0991	16.3	8.0	25	2.2	42.5	640	1,065	2,850
1684C240D	240	0.0754	18.6	8.0	25	2.3	45.0	675	1,125	3,440
1684C300D	300	0.0601	20.9	8.0	25	2.4	47.5	715	1,190	4,080
1684C400D	400	0.0470	23.6	8.0	35	2.5	51.5	775	1,290	5,080
1684C500D	500	0.0366	26.5	8.0	35	2.6	54.5	820	1,365	6,145
1684C630D	630	0.0283	30.8	8.0	35	2.7	59.0	885	1,475	7,635
1684C800D	800	0.0221	35.0	8.0	35	2.8	64.0	960	1,600	9,275

Remarks:

(1)– Minimum bending radius for permanent training;

(2)– Minimum bending radius for pulling in duct;

(3) – The sidewall pressure shall be kept below the value of 1000 daN/m (10 kN/m).

N2XS(F)2Y 18/30 (36) kV/ COPPER CONDUCTOR (...continued...)

Continuous current ratings

Item P/N	Conductor/ Metal screen Cross- Sectional Area	Direct Buried, Touching- Trefoil (1), (4), (7)	Direct Buried, Spaced Flat- Parallel (1), (5), (7)	Buried in Ducts, Spaced Flat- Parallel (2), (6), (7)	In Free Air (3), (4), (7)	In Free Air (3), (5), (7)
	mm ²	A	A	A	A	A
1684C050D	50/16	196	204	193	248	285
1684C070D	70/16	238	248	234	308	354
1684C095D	95/16	285	296	277	375	431
1684C120D	120/16	322	335	335	431	496
1684C150D	150/25	359	369	351	487	553
1684C185D	185/25	405	414	391	557	635
1684C240D	240/25	467	474	444	655	744
1684C300D	300/25	525	529	493	750	833
1684C400D	400/35	590	576	528	863	953
1684C500D	500/35	662	639	583	987	1083
1684C630D	630/35	741	707	639	1137	1237
1684C800D	800/35	820	772	696	1286	1387

Remarks:

(1)– Direct Buried, burial depth = 0.8 m, native soil thermal resistivity = 1.5 K*m/w, soil ambient temperature = 20°C;

(2)– Buried in single way ducts, burial depth = 0.8 m, native soil thermal resistivity = 1.5 K*m/w, soil ambient temperature = 20°C;

(3) – In Free Air, protected against direct sun radiation, ambient air temperature = 30°C

(4)- Touching-trefoil formation;

(5) – Flat-parallel formation, inter-axial spacing = 2 x D of cable;

(6) – Flat-parallel formation, inter-axial spacing = 2 x D of duct;

(7) – Conductor continuous working temperature = 90°C, metal screens bonded in multiple points.

N2XS(F)2Y 18/30 (36) kV/ COPPER CONDUCTOR (...continued)

Electrical parameters (Capacitance and Sequence Impedances)

Item P/N	Conductor/ Metal screen Cross- Sectional Area	Electrostatic Capacitance (Nom.)	Touching Trefoil Formation (1)				Flat-Parallel Formation (1), (2)			
			R1	X1	R0	X0	R1	X1	R0	X0
	mm ²	μF/km	Ω/km	Ω/km	Ω/km	Ω/km	Ω/km	Ω/km	Ω/km	Ω/km
1684C050D	50/16	0.140	0.496	0.147	1.408	0.629	0.499	0.204	1.366	0.692
1684C050D	70/16	0.156	0.344	0.139	1.255	0.688	0.349	0.197	1.213	0.688
1684C050D	95/16	0.172	0.249	0.133	1.157	0.685	0.254	0.190	1.116	0.684
1684C050D	120/16	0.186	0.198	0.128	1.102	0.676	0.203	0.185	1.061	0.676
1684C050D	150/25	0.198	0.162	0.123	0.877	0.382	0.172	0.180	0.854	0.387
1684C050D	185/25	0.215	0.131	0.118	0.845	0.379	0.140	0.176	0.822	0.385
1684C050D	240/25	0.235	0.101	0.114	0.814	0.377	0.110	0.171	0.792	0.383
1684C050D	300/25	0.257	0.0818	0.111	0.794	0.376	0.0912	0.167	0.772	0.382
1684C050D	400/35	0.285	0.0671	0.108	0.613	0.230	0.0805	0.163	0.601	0.235
1684C050D	500/35	0.311	0.0543	0.104	0.611	0.234	0.0672	0.159	0.597	0.240
1684C050D	630/35	0.349	0.0404	0.0992	0.600	0.232	0.0571	0.154	0.587	0.238
1684C050D	800/35	0.392	0.0372	0.101	0.590	0.237	0.0481	0.152	0.577	0.242

Remarks:

- (1) - Metal screens bonded in multiple points;
- (2) - Flat-parallel formation, inter-axial spacing = 2 x D of cable;

SHORT-CIRCUIT LIMITS

During the short-circuit working, the current-carrying components of the cable may reach a high temperature which could endanger the polymeric materials used for insulation.

In order to prevent this, the fault-current and/or fault-duration shall be limited to the values specified in the following tables:

SHORT-CIRCUIT CURRENT IN CONDUCTOR

Conductor Cross- Sectional Area	COPPER CONDUCTORS				ALUMINUM CONDUCTORS			
	Fault duration (s)				Fault duration (s)			
	0.5	1	1.5	2	0.5	1	1.5	2
	Fault-Current (max.)				Fault-Current (max.)			
mm ²	kA	kA	kA	kA	kA	kA	kA	kA
50	10	7	6	5.0	6.5	4.5	4	3.5
70	14	10	8	7.0	9.5	6.5	5.5	4.5
95	19	13.5	11	9.5	12.5	9	7.5	6.5
120	24.5	17	14	12.0	16	11.5	9.5	8
150	30.5	21.5	17.5	15.0	20	14	11.5	10
185	37.5	26.5	21.5	18.5	24.5	17.5	14.5	12.5
240	49	34.5	28	24.5	32	22.4	18.5	16
300	61	43	35	30.5	40	28.4	23	20
400	80.5	57	46.5	40	54	38	31	27
500	100.5	71	58	51	67	47	38.5	33.5
630	127.5	90	73.5	64	84	60	49	42
800	161	114	93	81	107	76	62	54

Remark:

- Maximum fault-current calculated considering adiabatic heating of the conductor from 90°C up to 250°C.

SHORT-CIRCUIT CURRENT IN METAL SCREEN

Metal screen Cross- Sectional Area	Fault duration (s)			
	0.5	1	1.5	2
	Fault-Current			
mm ²	kA	kA	kA	kA
16	2.9	2.1	1.7	1.5
25	4.5	3.2	2.6	2.3
35	6.4	4.5	3.7	3.2

Remark:

- Maximum fault-current calculated considering adiabatic heating of the metal screen from 80°C up to 200°C.