

NA2XS(F)2Y/ N2XS(F)2Y 26/45(52) kV Cables

Applications

This specification covers medium-voltage cables, for rating voltage of 26/45 kV, having XLPE (cross-linked polyethylene) insulation.

The cables covered by this specification are designed to be used mainly in utilities, for transmission and distribution lines having working voltage 26/45 kV, for outdoor or indoor installation.

They may be use at a maximum conductor working temperature of 90°C.

They may be used inside stations or sub-stations.

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

1. Reference Standards and documents

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

2.1	IEC 60840	Power cables with extruded insulation and their accessories for rated voltages above 30 kV (Um = 36 kV) up to 150 kV (Um = 170 kV) – Test methods and requirements
2.2	HD 632	Power cables with extruded insulation and their accessories for rated voltages above 36 kV (Um = 42 kV) up to 150 kV (Um = 170 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 60229	Electric Cables – Tests on extruded oversheaths with a special protective function.
2.6	IEC 61443	Short-circuits temperature limits of electric cables with rated voltages above 30kV(Um=36kV)
2.7	IEC 60811 series	Common test methods for insulation and sheathing materials of electrical and optical cables

2. Medium-Voltage Cables Construction

2.1 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 800 mm² and are class 2, compact-round stranded.

2.2 Conductor screen

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

2.3 Insulation

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

2.4 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.

2.5 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.

2.6 Longitudinal water-blocking barrier

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

2.7 Outer protective sheath

A black HDPE sheath is extruded overall.

2.8 Constructive options

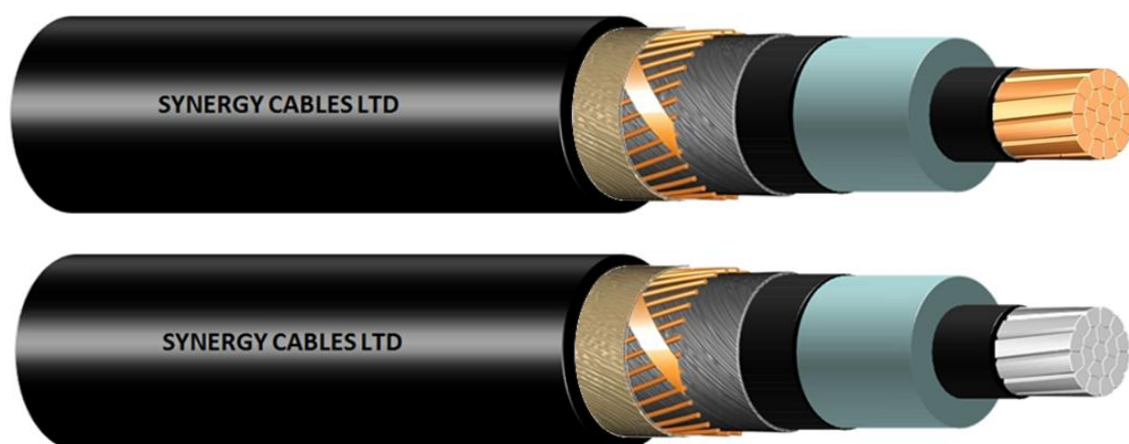
Conductor: water-blocked conductor, available as option;

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

Optical fibers tubes: (for DTS – Distributed temperature sensing), available as option;

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

Typical Drawing of Medium-Voltage Cables



NA2XS(F)2Y 26/45(52) 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	Min. Bending Radius - Static (1)	Min. Bending Radius - Dynamic (2), (3)	Completed Cable Weight (approx.)
	mm ²	-	mm	mm	mm ²	mm	mm	mm	mm	kg/km
1685A095D	95	0.320	11.7	10.5	25	2.5	43.5	655	1090	1,615
1685A120D	120	0.253	13.2	10.5	25	2.5	45.0	675	1125	1,745
1685A150D	150	0.206	14.5	10.5	25	2.5	46.5	700	1165	1,870
1685A185D	185	0.164	16.3	10.5	25	2.5	48.0	720	1200	2,045
1685A240D	240	0.125	18.6	10.5	35	2.5	50.5	760	1265	2,390
1685A240D0	240	0.120	18.6	10.5	25	2.5	49.7	745	1245	2,290
1685A300D	300	0.100	20.9	10.5	35	2.6	53.5	805	1340	2,670
1685A300D0	300	0.100	20.9	10.5	25	2.6	52.8	795	1320	2,565
1685A400D	400	0.0778	24.0	10.5	50	2.7	57.5	865	1440	3,255
1685A400D1	400	0.0778	24.0	10.5	35	2.7	57.0	855	1425	3,115
1685A400D0	400	0.0778	24.0	10.5	25	2.7	57.0	855	1425	3,020
1685A500D	500	0.0605	26.8	10.5	50	2.8	60.5	910	1515	3,680
1685A630D	630	0.0469	31.0	10.5	50	2.9	65.0	975	1625	4,260
1685A630D1	630	0.0469	31.0	10.5	35	2.9	65.5	975	1625	4,130
1685A630D0	630	0.0469	31.0	10.5	25	2.9	65.1	975	1625	4,030
1685A800D	800	0.0367	35.0	10.5	50	3.0	69.5	1045	1740	4,950

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 26/45(52) kV ALUMINUM 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
1685A095D	95/25	221	230	222	293	331
1685A120D	120/25	251	261	251	337	382
1685A150D	150/25	280	291	278	380	431
1685A185D	185/25	317	328	313	437	494
1685A240D	240/35	365	373	352	514	577
1685A240D0	240/25	360	378	360	514	581
1685A300D	300/35	412	412	385	588	658
1685A300D0	300/25	406	425	401	591	667
1685A400D	400/50	467	461	431	683	751
1685A400D1	400/35	462	473	446	687	764
1685A400D0	400/25	465	482	460	690	774
1685A500D	500/50	529	516	477	789	859
1685A630D	630/50	600	575	529	918	990
1685A630D1	630/35	599	597	552	931	1017
1685A630D0	630/25	601	616	578	936	1038
1685A800D	800/50	673	634	580	1051	1121

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 the cable;

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

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

NA2XS(F)2Y 26/45(52) kV ALUMINUM CONDUCTOR (...continued)

Electrical parameters (Capacitance and Sequence Impedances)

Item P/N	Conductor/ Metal Screen Cross- Sectional Area	Electrostatic Capacitance (Nom.)	Touching Trefoil Formation				Flat-Parallel Formation			
			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
1685A095D	95/25	0.144	0.414	0.141	1.122	0.396	0.421	0.197	1.098	0.401
1685A120D	120/25	0.154	0.328	0.135	1.036	0.392	0.336	0.192	1.012	0.397
1685A150D	150/25	0.164	0.268	0.132	0.976	0.390	0.276	0.188	0.952	0.395
1685A185D	185/25	0.177	0.214	0.127	0.922	0.387	0.223	0.183	0.899	0.392
1685A240D	240/35	0.193	0.165	0.122	0.717	0.247	0.179	0.177	0.704	0.252
1685A240D0	240/25	0.193	0.164	0.121	0.870	0.382	0.173	0.177	0.849	0.389
1685A300D	300/35	0.209	0.134	0.118	0.686	0.245	0.147	0.172	0.673	0.250
1685A300D0	300/25	0.209	0.132	0.116	0.827	0.370	0.142	0.174	0.806	0.378
1685A400D	400/50	0.234	0.107	0.114	0.512	0.155	0.126	0.165	0.504	0.159
1685A400D1	400/35	0.234	0.105	0.114	0.647	0.235	0.119	0.168	0.635	0.241
1685A400D0	400/25	0.234	0.104	0.114	0.798	0.369	0.114	0.170	0.777	0.376
1685A500D	500/50	0.253	0.0852	0.109	0.491	0.152	0.104	0.162	0.483	0.156
1685A630D	630/50	0.281	0.0682	0.104	0.474	0.149	0.0871	0.157	0.467	0.153
1685A630D1	630/35	0.281	0.0667	0.106	0.609	0.231	0.0803	0.161	0.597	0.238
1685A630D0	630/25	0.281	0.0654	0.106	0.768	0.377	0.0747	0.162	0.746	0.384
1685A800D	800/50	0.310	0.0560	0.102	0.462	0.147	0.0743	0.154	0.454	0.151

Remarks:

Flat-parallel formation, inter-axial spacing = $2 \times D$ of the cable;

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

N2XS(F)2Y 26/45(52) 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	Min. Bending Radius - Static (1)	Min. Bending Radius - Dynamic (2), (3)	Completed Cable Weight (approx.)
	mm ²	-	mm	mm	mm ²	mm	mm	mm	mm	kg/km
1685C095D	95	0.193	11.7	10.5	25	2.5	43.5	655	1090	2,200
1685C120D	120	0.153	13.2	10.5	25	2.5	45.0	675	1125	2,465
1685C150D	150	0.124	14.5	10.5	25	2.5	46.5	700	1165	2,775
1685C185D	185	0.0991	16.3	10.5	25	2.5	48.0	720	1200	3,195
1685C240D	240	0.0754	18.6	10.5	35	2.5	50.5	760	1265	3,885
1685C300D	300	0.0601	20.9	10.5	35	2.6	53.5	805	1340	4,545
1685C400D	400	0.0470	23.6	10.5	50	2.7	57.0	855	1425	5,625
1685C500D	500	0.0366	26.5	10.5	50	2.8	60.5	910	1515	6,720
1685C630D	630	0.0283	30.8	10.5	50	2.9	65.0	975	1625	8,240
1685C800D	800	0.0221	35.0	10.5	50	3.0	69.5	1045	1740	9,915

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 26/45(52) 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
1685C095D	95/25	285	295	282	377	425
1685C120D	120/25	322	333	317	433	488
1685C150D	150/25	361	371	352	490	551
1685C185D	185/25	406	416	393	560	629
1685C240D	240/35	466	467	435	657	729
1685C300D	300/35	524	519	481	750	828
1685C400D	400/50	585	559	509	858	922
1685C500D	500/50	657	615	556	982	1043
1685C630D	630/50	735	676	608	1128	1185
1685C800D	800/50	810	731	656	1272	1321

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 the cable;

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

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

N2XS(F)2Y 26/45(52) 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				Flat-Parallel Formation			
			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
1685C095D	95/25	0.144	0.250	0.141	0.958	0.396	0.259	0.197	0.935	0.401
1685C120D	120/25	0.154	0.199	0.135	0.907	0.392	0.208	0.192	0.885	0.398
1685C150D	150/25	0.164	0.162	0.132	0.870	0.390	0.172	0.188	0.848	0.396
1685C185D	185/25	0.177	0.131	0.127	0.839	0.387	0.140	0.183	0.816	0.393
1685C240D	240/35	0.193	0.102	0.122	0.655	0.247	0.116	0.177	0.642	0.253
1685C300D	300/35	0.209	0.0829	0.118	0.636	0.245	0.0963	0.172	0.623	0.250
1685C400D	400/50	0.231	0.0683	0.113	0.473	0.156	0.0874	0.166	0.466	0.160
1685C500D	500/50	0.251	0.0558	0.110	0.461	0.153	0.0745	0.162	0.454	0.157
1685C630D	630/50	0.280	0.0461	0.105	0.452	0.149	0.0643	0.157	0.445	0.154
1685C800D	800/50	0.308	0.0391	0.101	0.446	0.147	0.0570	0.154	0.438	0.151

Remarks:

Flat-parallel formation, inter-axial spacing = 2 x D of the cable;

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

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 (N2XS(F)2Y cables)				ALUMINUM CONDUCTORS (NA2XS(F)2Y cables)			
	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
95	19.0	13.5	11	9.5	12.5	9.0	7.5	6.5
120	24.5	17	14	12	16	11.5	9.5	8.0
150	30.5	21.5	17.5	15	20	14	11.5	10
185	37.5	26.5	21.5	18.4	24.5	17.5	14.5	12.5
240	49	34.5	28	24.5	32	22.5	18.5	16
300	61	43	35	30.5	40	28.5	23	20
400	81	57	47	40	54	38	31	27
500	101	71	58	51	67	47	38.5	33.5
630	127	90	74	64	84	60	49	42
800	162	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
25	4.5	3.2	2.6	2.3
35	6.4	4.5	3.7	3.2
50	9.1	6.4	5.2	4.5

Remark:

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