

NA2XS(F)2Y / N2XS(F)2Y – 12/20(24) kV Cables

1. Applications

This specification covers high-voltage cables, suitable for use in distribution systems, having a working voltage of 12/20(24) 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	כבלי כוח בעלי בידוד משוחל ואביזרים למתח נקוב מ-1 ק"ו (1.2 ק"ו) עד 30 ק"ו (36 ק"ו): ($U_m = 1$ ק"ו) עד 30 ק"ו (7.2 ק"ו) ($U_m = 1$ ק"ו).
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 800 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**

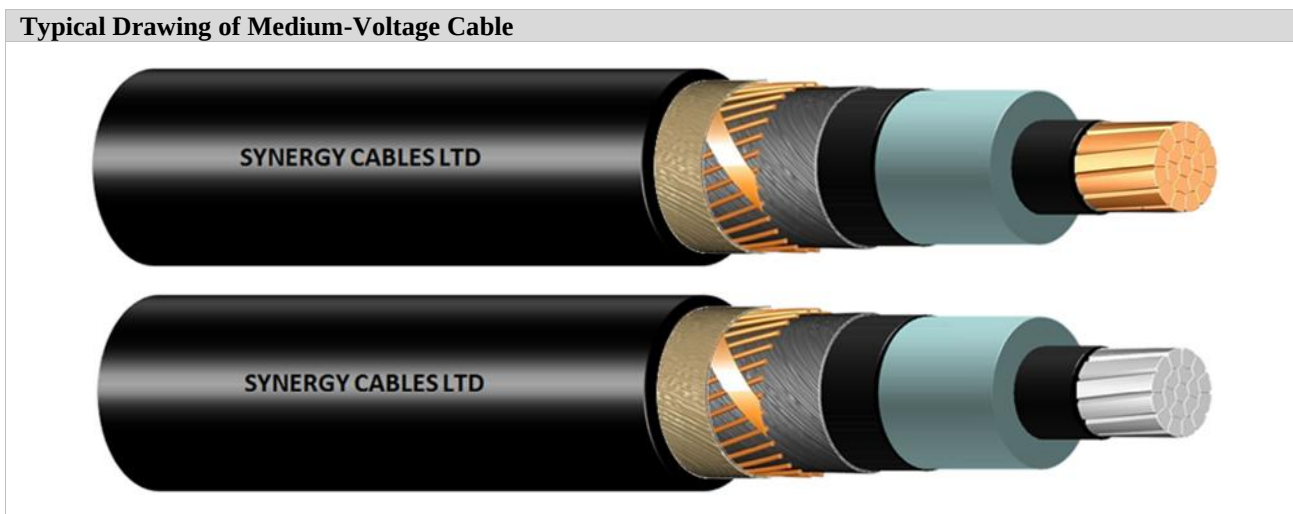
An UV resistant black polymeric sheath (complying with the designation ST7, as per IEC 60502-2 standard) is extruded overall.

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;

Typical Drawing of Medium-Voltage Cable





NA2XS(F)2Y 12/20 (24) 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
1683A050D	50	0.641	8.3	5.5	16	1.8	28.5	430	715	730
1683A070D	70	0.443	9.9	5.5	16	1.9	30.5	460	765	850
1683A095D	95	0.320	11.7	5.5	16	1.9	32.5	490	815	950
1683A120D	120	0.253	13.2	5.5	16	2.0	34.0	510	850	1,065
1683A150D	150	0.206	14.5	5.5	25	2.0	35.5	535	890	1,260
1683A185D	185	0.164	16.3	5.5	25	2.1	37.5	565	940	1,415
1683A240D	240	0.125	18.6	5.5	25	2.1	39.5	595	990	1,635
1683A300D	300	0.100	20.9	5.5	25	2.2	42.5	640	1,065	1,875
1683A400D	400	0.0778	24.0	5.5	35	2.3	46.5	700	1,165	2,345
1683A500D	500	0.0605	26.8	5.5	35	2.4	49.5	745	1,240	2,720
1683A630D	630	0.0469	31.0	5.5	35	2.5	54.0	810	1,350	3,230
1683A800D	800	0.0367	35.0	5.5	35	2.7	58.5	880	1,465	3,870

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 12/20 (24) 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
1683A050D	50/16	151	158	150	189	222
1683A070D	70/16	185	193	183	236	277
1683A095D	95/16	220	230	217	287	338
1683A120D	120/16	250	261	245	332	390
1683A150D	150/25	279	289	269	375	439
1683A185D	185/25	315	326	304	431	504
1683A240D	240/25	364	375	356	509	587
1683A300D	300/25	410	420	397	585	679
1683A400D	400/35	467	468	435	683	779
1683A500D	500/35	530	526	485	790	895
1683A630D	630/35	601	591	542	922	1035
1683A800D	800/35	745	656	599	1058	1180

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 12/20 (24) 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 (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
1683A050D	50/16	0.179	0.824	0.135	1.749	0.682	0.825	0.194	1.705	0.683
1683A070D	70/16	0.202	0.570	0.129	1.493	0.679	0.573	0.186	1.450	0.679
1683A095D	95/16	0.225	0.413	0.122	1.333	0.676	0.417	0.180	1.290	0.676
1683A120D	120/16	0.245	0.327	0.118	1.244	0.674	0.331	0.175	1.203	0.674
1683A150D	150/25	0.262	0.268	0.115	0.988	0.372	0.277	0.171	0.966	0.378
1683A185D	185/25	0.286	0.214	0.111	0.934	0.371	0.224	0.167	0.912	0.376
1683A240D	240/25	0.316	0.164	0.107	0.883	0.369	0.174	0.163	0.861	0.374
1683A300D	300/25	0.346	0.132	0.103	0.850	0.367	0.142	0.159	0.828	0.373
1683A400D	400/35	0.392	0.106	0.100	0.665	0.228	0.119	0.155	0.652	0.233
1683A500D	500/35	0.428	0.0839	0.0971	0.643	0.227	0.0971	0.152	0.630	0.232
1683A630D	630/35	0.482	0.0670	0.0932	0.626	0.225	0.0800	0.148	0.612	0.231
1683A800D	800/35	0.535	0.0546	0.0911	0.613	0.225	0.0671	0.146	0.599	0.231

Remarks:

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



N2XS(F)2Y 12/20 (24) 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
1683C050D	50	0.387	8.3	5.5	16	1.8	28.5	430	715	1,015
1683C070D	70	0.268	9.9	5.5	16	1.9	30.5	460	765	1,250
1683C095D	95	0.193	11.7	5.5	16	1.9	32.5	490	815	1,535
1683C120D	120	0.153	13.2	5.5	16	2.0	34.0	510	850	1,785
1683C150D	150	0.124	14.5	5.5	25	2.0	35.5	535	890	2,160
1683C185D	185	0.0991	16.3	5.5	25	2.1	37.5	565	940	2,560
1683C240D	240	0.0754	18.6	5.5	25	2.1	39.5	595	990	3,120
1683C300D	300	0.0601	20.9	5.5	25	2.2	42.5	640	1,065	3,740
1683C400D	400	0.0470	23.6	5.5	35	2.3	46.0	690	1,150	4,725
1683C500D	500	0.0366	26.5	5.5	35	2.4	49.5	745	1,240	5,765
1683C630D	630	0.0283	30.8	5.5	35	2.5	54.0	810	1,350	7,210
1683C800D	800	0.0221	35.8	5.5	35	2.7	58.5	880	1,465	8,835

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 12/20 (24) 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
1683C050D	50/16	195	204	193	244	286
1683C070D	70/16	238	247	234	304	356
1683C095D	95/16	283	295	277	370	434
1683C120D	120/16	322	333	312	426	500
1683C150D	150/25	358	368	343	482	560
1683C185D	185/25	404	412	380	553	640
1683C240D	240/25	465	471	441	650	750
1683C300D	300/25	522	526	488	745	855
1683C400D	400/35	586	573	522	856	959
1683C500D	500/35	656	634	574	981	1088
1683C630D	630/35	736	702	634	1130	1189
1683C800D	800/35	811	766	684	1278	1393

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 12/20 (24) 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
1683C050D	50/16	0.179	0.496	0.135	1.422	0.682	0.500	0.194	1.379	0.683
1683C070D	70/16	0.202	0.344	0.129	1.267	0.679	0.349	0.186	1.226	0.679
1683C095D	95/16	0.225	0.249	0.122	1.169	0.676	0.254	0.180	1.128	0.677
1683C120D	120/16	0.245	0.198	0.118	1.116	0.674	0.203	0.175	1.075	0.675
1683C150D	150/25	0.262	0.162	0.115	0.883	0.372	0.173	0.170	0.862	0.379
1683C185D	185/25	0.286	0.131	0.111	0.851	0.371	0.140	0.167	0.829	0.377
1683C240D	240/25	0.316	0.101	0.107	0.820	0.369	0.111	0.163	0.798	0.375
1683C300D	300/25	0.346	0.082	0.103	0.800	0.368	0.0913	0.159	0.778	0.374
1683C400D	400/35	0.387	0.0672	0.100	0.627	0.228	0.0802	0.155	0.614	0.234
1683C500D	500/35	0.424	0.0547	0.0965	0.614	0.227	0.0675	0.153	0.601	0.233
1683C630D	630/35	0.479	0.0453	0.0936	0.604	0.226	0.0574	0.149	0.590	0.231
1683C800D	800/35	0.541	0.0383	0.0911	0.597	0.225	0.0500	0.146	0.582	0.232

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.