

NA2XS(F)2Y / N2XS(F)2Y – 3.6/6(7.2) kV Cables

1. Applications

This specification covers high-voltage cables, suitable for use in distribution systems, having a working voltage of 3.6/6(7.2) 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;

Radial water-blocking barrier: Aluminum foil – Polymer laminate, longitudinal applied, available as option;

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

Typical Drawing of Medium-Voltage Cable



NA2XS(F)2Y 3.6/6(7.2) 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)	Complete Cable Weight (approx.)
	mm ²	Ω/km	mm	mm	mm ²	mm	mm	mm	mm	kg/km
1680A050D	50	0.641	8.3	2.5	16	1.6	22.5	340	565	520
1680A070D	70	0.443	9.9	2.5	16	1.6	24.5	370	615	615
1680A095D	95	0.320	11.7	2.5	16	1.7	26.0	390	650	710
1680A120D	120	0.253	13.2	2.5	16	1.8	27.5	415	690	805
1680A150D	150	0.206	14.5	2.5	25	1.8	29.5	445	740	990
1680A185D	185	0.164	16.3	2.5	25	1.9	31.5	475	790	1,120
1680A240D	240	0.125	18.6	2.6	25	1.9	33.5	505	840	1,330
1680A300D	300	0.100	20.9	2.8	25	2.0	36.5	550	915	1,565
1680A400D	400	0.0778	24.0	3.0	35	2.2	41.5	625	1,040	2,050
1680A500D	500	0.0605	26.8	3.2	35	2.3	44.5	670	1,115	2,415
1680A630D	630	0.0469	31.0	3.2	35	2.4	49.0	735	1,225	2,890
1680A800D	800	0.0367	35.0	3.2	35	2.5	53.5	805	1,340	3,480

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 3.6/6(7.2) 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
1680A050D	50/16	151	158	151	184	224
1680A070D	70/16	184	192	183	230	280
1680A095D	95/16	220	229	221	281	341
1680A120D	120/16	250	260	245	325	395
1680A150D	150/25	277	287	269	368	444
1680A185D	185/25	314	324	302	425	510
1680A240D	240/25	363	373	345	503	601
1680A300D	300/25	409	418	385	580	688
1680A400D	400/35	466	466	432	681	789
1680A500D	500/35	527	524	481	789	906
1680A630D	630/35	598	588	537	921	1048
1680A800D	800/35	669	651	593	1057	1191

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 3.6/6(7.2) 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
1680A050D	50/16	0.326	0.824	0.122	1.761	0.655	0.826	0.179	1.719	0.658
1680A070D	70/16	0.373	0.571	0.115	1.504	0.654	0.574	0.173	1.462	0.656
1680A095D	95/16	0.424	0.413	0.110	1.342	0.652	0.417	0.167	1.302	0.653
1680A120D	120/16	0.466	0.327	0.106	1.254	0.651	0.332	0.163	1.214	0.653
1680A150D	150/25	0.502	0.268	0.101	0.998	0.358	0.277	0.159	0.976	0.365
1680A185D	185/25	0.555	0.214	0.0986	0.943	0.358	0.224	0.156	0.921	0.364
1680A240D	240/25	0.598	0.165	0.0964	0.892	0.358	0.174	0.152	0.870	0.364
1680A300D	300/25	0.620	0.133	0.0940	0.858	0.359	0.142	0.151	0.836	0.365
1680A400D	400/35	0.667	0.106	0.0937	0.670	0.221	0.119	0.148	0.657	0.226
1680A500D	500/35	0.690	0.0841	0.0907	0.647	0.221	0.0973	0.145	0.634	0.226
1680A630D	630/35	0.781	0.0674	0.0880	0.630	0.220	0.0802	0.143	0.616	0.225
1680A800D	800/35	0.873	0.0550	0.0856	0.617	0.220	0.0675	0.141	0.603	0.225

Remarks:

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

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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
1680C050D	50	0.387	8.3	2.5	16	1.6	22.5	340	565	810
1680C070D	70	0.268	9.9	2.5	16	1.6	24.0	360	600	1,020
1680C095D	95	0.193	11.7	2.5	16	1.7	26.0	390	650	1,295
1680C120D	120	0.153	13.2	2.5	16	1.8	27.5	415	690	1,530
1680C150D	150	0.124	14.5	2.5	25	1.8	29.0	435	725	1,895
1680C185D	185	0.0991	16.3	2.5	25	1.9	31.5	475	790	2,275
1680C240D	240	0.0754	18.6	2.6	25	1.9	33.5	505	840	2,825
1680C300D	300	0.0601	20.9	2.8	25	2.0	36.5	550	915	3,440
1680C400D	400	0.0470	23.6	3.0	35	2.2	40.5	610	1,015	4,430
1680C500D	500	0.0366	26.5	3.2	35	2.3	44.5	670	1,115	5,455
1680C630D	630	0.0283	30.8	3.2	35	2.4	49.0	735	1,225	6,875
1680C800D	800	0.0221	35.0	3.2	35	2.5	53.5	805	1,340	8,450

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 3.6/6(7.2) 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
1680C050D	50/16	195	203	194	238	288
1680C070D	70/16	237	247	234	296	358
1680C095D	95/16	283	294	277	362	438
1680C120D	120/16	321	332	309	418	505
1680C150D	150/16	356	365	339	473	566
1680C185D	185/25	401	410	380	544	647
1680C240D	240/25	463	468	429	642	758
1680C300D	300/25	519	522	477	738	861
1680C400D	400/35	582	569	514	851	966
1680C500D	500/35	653	630	566	976	1096
1680C630D	630/35	728	697	625	1124	1251
1680C800D	800/35	802	760	681	1268	1404

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 3.6/6(7.2) 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
1680C050D	50/16	0.326	0.496	0.122	1.433	0.656	0.500	0.179	1.393	0.658
1680C070D	70/16	0.373	0.345	0.115	1.278	0.654	0.350	0.173	1.238	0.656
1680C095D	95/16	0.424	0.249	0.110	1.179	0.652	0.255	0.167	1.140	0.653
1680C120D	120/16	0.466	0.198	0.106	1.125	0.651	0.204	0.163	1.086	0.653
1680C150D	150/25	0.502	0.163	0.101	0.893	0.358	0.172	0.159	0.871	0.365
1680C185D	185/25	0.555	0.131	0.0986	0.860	0.358	0.141	0.156	0.839	0.365
1680C240D	240/25	0.598	0.102	0.0964	0.829	0.358	0.111	0.152	0.807	0.364
1680C300D	300/25	0.620	0.0825	0.0940	0.808	0.358	0.0916	0.151	0.785	0.364
1680C400D	400/35	0.657	0.0678	0.0932	0.632	0.221	0.0807	0.149	0.618	0.226
1680C500D	500/35	0.683	0.0554	0.0914	0.619	0.221	0.0678	0.146	0.605	0.226
1680C630D	630/35	0.777	0.0457	0.0871	0.609	0.220	0.0577	0.143	0.594	0.226
1680C800D	800/35	0.866	0.0392	0.0856	0.601	0.220	0.0502	0.140	0.586	0.225

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.