



## NA2XS(F)2Y / N2XS(F)2Y – 6/10(12) kV Cables

### 1. Applications

This specification covers high-voltage cables, suitable for use in distribution systems, having a working voltage of 6/10(12) 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 <sub>m</sub> = " 36) " 30 (U <sub>m</sub> = " 1.2) " 1- . (U <sub>m</sub> = " 36) " 30 (U <sub>m</sub> = " 7.2) " 6-
2.2	IEC 60502-2	Power cables with extruded insulation and their accessories for rated voltages from 1 kV (U <sub>m</sub> = 1,2 kV) up to 30 kV (U <sub>m</sub> = 36 kV) – Part 2: Cables for rated voltages from 6 kV (U <sub>m</sub> = 7,2 kV) up to 30 kV (U <sub>m</sub> = 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 <sub>m</sub> = 7,2 kV) up to 30 kV (U <sub>m</sub> = 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 mm<sup>2</sup> 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;

**Typical Drawing of Medium-Voltage Cable**





## NA2XS(F)2Y 6/10 (12) 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 <sup>2</sup>	/km	mm	mm	mm <sup>2</sup>	mm	mm	mm	mm	kg/km
1681A050D	50	0.641	8.3	3.4	16	1.7	24.0	360	600	580
1681A070D	70	0.443	9.9	3.4	16	1.7	26.0	390	650	680
1681A095D	95	0.320	11.7	3.4	16	1.8	28.0	420	700	780
1681A120D	120	0.253	13.2	3.4	16	1.8	29.5	445	740	875
1681A150D	150	0.206	14.5	3.4	25	1.9	31.0	465	775	1,070
1681A185D	185	0.164	16.3	3.4	25	1.9	33.0	495	825	1,200
1681A240D	240	0.125	18.6	3.4	25	2.0	35.5	535	890	1,415
1681A300D	300	0.100	20.9	3.4	25	2.1	38.0	570	950	1,635
1681A400D	400	0.0778	24.0	3.4	35	2.2	42.0	630	1,050	2,080
1681A500D	500	0.0605	26.8	3.4	35	2.3	45.0	675	1,125	2,440
1681A630D	630	0.0469	31.0	3.4	35	2.4	49.5	745	1,240	2,920
1681A800D	800	0.0367	35.0	3.4	35	2.5	54.0	810	1,350	3,510

**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 6/10 (12) kV/ ALUMINUM CONDUCTOR (...continued...)

### Continuous current ratings

Item P/N	Conductor/ Metal Screen Cross- Sectional Area	Direct Buried, Touching- Trefoil <i>(1), (4), (7)</i>	Direct Buried, Spaced Flat- Parallel <i>(1), (5), (7)</i>	Buried in Ducts, Spaced Flat- Parallel <i>(2), (6), (7)</i>	In Free Air <i>(3), (4), (7)</i>	In Free Air <i>(3), (5), (7)</i>
		A	A	A	A	A
1681A050D	50/16	151	158	152	185	223
1681A070D	70/16	184	193	185	231	278
1681A095D	95/16	219	230	219	282	340
1681A120D	120/16	249	260	248	327	393
1681A150D	150/25	278	288	271	370	441
1681A185D	185/25	314	325	303	426	507
1681A240D	240/25	363	374	356	504	597
1681A300D	300/25	409	419	395	580	684
1681A400D	400/35	465	466	430	679	784
1681A500D	500/35	528	523	477	788	899
1681A630D	630/35	599	587	532	922	1042
1681A800D	800/35	673	651	586	1062	1184

**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 6/10(12) 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 <sup>2</sup>	μF/km	/km	/km	/km	/km	/km	/km	/km	/km
1681A050D	50/16	0.255	0.824	0.126	1.761	0.672	0.826	0.183	1.718	0.674
1681A070D	70/16	0.291	0.571	0.119	1.501	0.662	0.574	0.176	1.460	0.663
1681A095D	95/16	0.328	0.413	0.114	1.340	0.661	0.417	0.170	1.300	0.662
1681A120D	120/16	0.359	0.327	0.110	1.252	0.660	0.332	0.166	1.212	0.661
1681A150D	150/25	0.386	0.268	0.106	0.991	0.358	0.277	0.162	0.969	0.364
1681A185D	185/25	0.425	0.214	0.102	0.937	0.358	0.224	0.159	0.915	0.364
1681A240D	240/25	0.473	0.165	0.099	0.886	0.357	0.174	0.155	0.864	0.363
1681A300D	300/25	0.522	0.133	0.097	0.853	0.357	0.142	0.152	0.831	0.363
1681A400D	400/35	0.596	0.106	0.094	0.666	0.219	0.119	0.148	0.653	0.224
1681A500D	500/35	0.657	0.084	0.091	0.644	0.218	0.098	0.146	0.631	0.224
1681A630D	630/35	0.743	0.067	0.088	0.627	0.218	0.080	0.143	0.613	0.223
1681A800D	800/35	0.840	0.055	0.086	0.614	0.219	0.067	0.141	0.600	0.224

**Remarks:**

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



## N2XS(F)2Y 6/10 (12) 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 <sup>2</sup>	/km	mm	mm	mm <sup>2</sup>	mm	mm	mm	mm	kg/km
1681C050D	50	0.387	8.3	3.4	16	1.7	24.0	360	600	870
1681C070D	70	0.268	9.9	3.4	16	1.7	26.0	390	650	1,085
1681C095D	95	0.193	11.7	3.4	16	1.8	28.0	420	700	1,365
1681C120D	120	0.153	13.2	3.4	16	1.8	29.5	445	740	1,600
1681C150D	150	0.124	14.5	3.4	25	1.9	31.0	465	775	1,975
1681C185D	185	0.0991	16.3	3.4	25	1.9	33.0	495	825	2,355
1681C240D	240	0.0754	18.6	3.4	25	2.0	35.5	535	890	2,910
1681C300D	300	0.0601	20.9	3.4	25	2.1	38.0	570	950	3,510
1681C400D	400	0.0470	23.6	3.4	35	2.2	41.5	625	1,040	4,460
1681C500D	500	0.0366	26.5	3.4	35	2.3	45.0	675	1,125	5,480
1681C630D	630	0.0283	30.8	3.4	35	2.4	49.0	735	1,225	6,900
1681C800D	800	0.0221	35.8	3.4	35	2.5	54.0	810	1,350	8,480

**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).

## N2XS(F)2Y 6/10 (12) kV/ COPPER CONDUCTOR (...continued...)

### Continuous current ratings

Item P/N	Conductor/ Metal Screen Cross- Sectional Area	Direct Buried, Touching- Trefoil <i>(1), (4), (7)</i>	Direct Buried, Spaced Flat- Parallel <i>(1), (5), (7)</i>	Buried in Ducts, Spaced Flat- Parallel <i>(2), (6), (7)</i>	In Free Air <i>(3), (4), (7)</i>	In Free Air <i>(3), (5), (7)</i>
		A	A	A	A	A
1681C050D	50/16	195	203	195	239	287
1681C070D	70/16	237	246	236	298	357
1681C095D	95/16	283	294	279	364	436
1681C120D	120/16	320	333	314	420	502
1681C150D	150/25	357	366	340	475	562
1681C185D	185/25	401	410	378	545	643
1681C240D	240/25	462	469	436	643	753
1681C300D	300/25	519	523	481	737	858
1681C400D	400/35	581	568	509	847	960
1681C500D	500/35	651	628	557	971	1089
1681C630D	630/35	726	694	612	1118	1242
1681C800D	800/35	799	756	659	1263	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 6/10(12) 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 <sup>2</sup>	μF/km	/km	/km	/km	/km	/km	/km	/km	/km
1681C050D	50/16	0.255	0.496	0.126	1.433	0.672	0.500	0.183	1.393	0.674
1681C070D	70/16	0.291	0.345	0.119	1.275	0.662	0.349	0.176	1.236	0.664
1681C095D	95/16	0.328	0.249	0.114	1.176	0.661	0.254	0.170	1.137	0.662
1681C120D	120/16	0.359	0.198	0.110	1.123	0.660	0.204	0.166	1.084	0.661
1681C150D	150/25	0.386	0.163	0.106	0.886	0.358	0.172	0.162	0.865	0.365
1681C185D	185/25	0.425	0.131	0.102	0.854	0.358	0.141	0.159	0.832	0.364
1681C240D	240/25	0.473	0.102	0.099	0.823	0.357	0.111	0.155	0.801	0.363
1681C300D	300/25	0.522	0.083	0.097	0.802	0.357	0.092	0.152	0.781	0.363
1681C400D	400/35	0.588	0.068	0.095	0.630	0.221	0.081	0.149	0.617	0.226
1681C500D	500/35	0.650	0.055	0.091	0.615	0.219	0.068	0.146	0.601	0.224
1681C630D	630/35	0.735	0.046	0.087	0.605	0.218	0.058	0.143	0.591	0.223
1681C800D	800/35	0.827	0.039	0.086	0.598	0.218	0.050	0.141	0.583	0.224

**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 <sup>2</sup>	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 <sup>2</sup>	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.