Technical Specification for 12.7/22kV Heat Shrink Cable Accessories

➢ Overview

This document specifies the construction, test requirements, package, and storage of cable accessories with rated voltage 12.7/22kV.

➢ Terms and definitions

1. Termination

Device fitted to the end of a cable to ensure electrical connection with other parts of the system and to maintain the insulation up to the point of connection

2. Indoor termination

Termination intended for use where it is not exposed to either solar radiation or weathering

3. Outdoor termination

Termination intended for use where it is exposed to either solar radiation or weathering or both

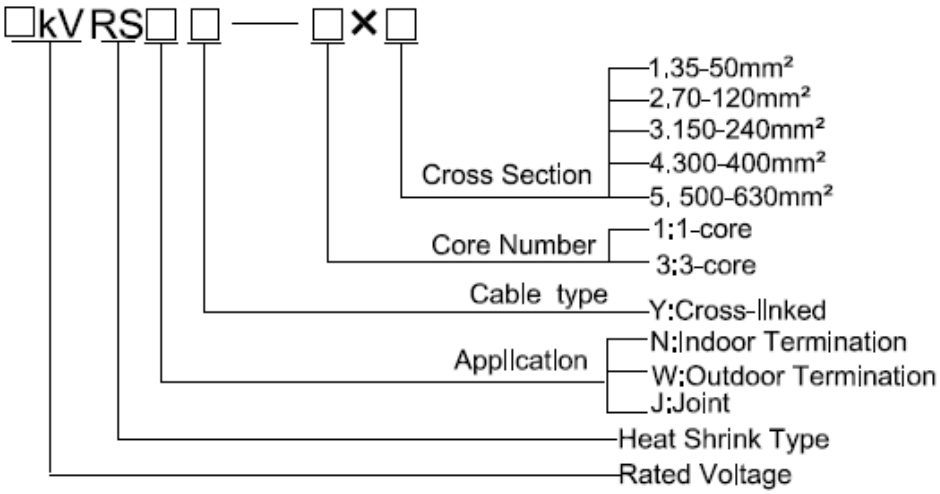
4. Straight joint

Accessory making a connection between two cables to form continuous circuit

➢ Standards

No.	Normative reference	
1	GB 311.1	Insulation co-ordination for high voltage transmission and distribution equipment
2	GB/T 3048	Test methods for electrical properties of electric cables and wires
3	GB/T 7354	Partial discharge measurements
4	GB/T 12706.4:2020	Power cables with extruded insulation and their accessories for rated voltages from 1kV (U_m=1.2kV) up to 35 kV (U_m =40.5kV) – Part 4: Test requirements on accessories for cables with rated voltages from 6kV (U_m=7.2kV) up to 35 kV (U_m =40.5kV)
5	GB 14315	Compression type terminal lugs and ferrules with copper or aluminum for power cables conductors
6	IEC61442:2005	Test methods for accessories for power cables with rated voltages from 6kV (U_m=7.2kV) up to 30 kV (U_m =36kV)
7	DL/T 413	Technical requirements of heat shrinkable accessories for power cable with rated voltages up to 35kV(Um=40.5kV)
8	IEC 60502-4:2010	Power cables with extruded insulation and their accessories for rated voltages from 1kV (U_m=1.2kV) up to 30 kV (U_m =36kV) – Part 4: Test requirements on accessories for cables with rated voltages from 6kV (U_m=7.2kV) up to 30 kV (U_m =36kV)

➢ **Product Designation**



➢ Rated Voltages

Rated voltage U_0/U (U_m): 12.7/22(24) kV

In the voltage designation of cables U_0/U (U_m):

U_0: Rated power frequency voltage between conductor and earth or metallic screen for which the cable is designed.

U: Rated power frequency voltage between conductors for which the cable is designed.

U_m: Maximum value of the "highest system voltage" for which the equipment may be used.

➢ Applicable to cables with extruded insulation

➢ Specific creepage distance

＞3.1cm/kV (applicable to outdoor termination)

➢ Maximum conductor temperature

Table 1. Maximum conductor temperatures for different types of insulating compound

Insulating Compound	Maximum conductor temperature/℃	
	Normal Operation	Short Circuit (5s maximum duration)
Cross-linked polyethylene (XLPE)	90	250
Ethylene propylene rubber (EPR and HEPR)	90	250

➢ Service conditions

1. Usual service conditions:

a) Environmental temperature within the range of -40℃ to +60℃.

b) Altitudes not exceeding 3000m above sea level.

c) Long term operation temperature, over-load temperature and short-circuit temperature of cable accessories shall meet the requirements of its mating cable.

2. Unusual service conditions :

(Performances and values of cable accessories need further consideration.)

a) Environmental temperature below -40℃, or above +60℃.

b) Altitudes exceeding 3000m above sea level.

c) Long term operation under severe environmental conditions, such as strong vibration, strong wind, ice and snow, heavy contamination areas, etc.

➢ Test

1. For type test requirements, please refer to Annex 1.
2. Sampling test(See Annex 2)
3. Acceptance test (recommended)

a. Insulation resistance of cable core insulation.

b. AC voltage withstand test of cable core insulation

After installation of cable accessories, apply $2U_0$ (2.5 U_0) between the conductor and metal shield for 60min (or 5min).

➢ Marking, packaging, transportation, and storage

1. Marking

The following information shall be printed with legible and durable color on the surface of cable accessories:

a. Name of manufacturer

b. Product name and part number

c. Rated voltage

d. Conductor cross-section

e. Date of manufacturing and lot number

f. The period of validity (applicable to some parts)

2. Packaging, transportation and storage

The packaging, transportation and storage of the products shall be conducted according to the instruction and information offered by the manufacturer.

Main content includes heat shrink tubes, copper braid, constant force spring, sealing mastics, semi-con tape, and vinyl tape.

Consumable material: cleaning tissue, lubricating grease, operation gloves and etc.

Woer Power Division

2021.09.17

Annex: Type Test

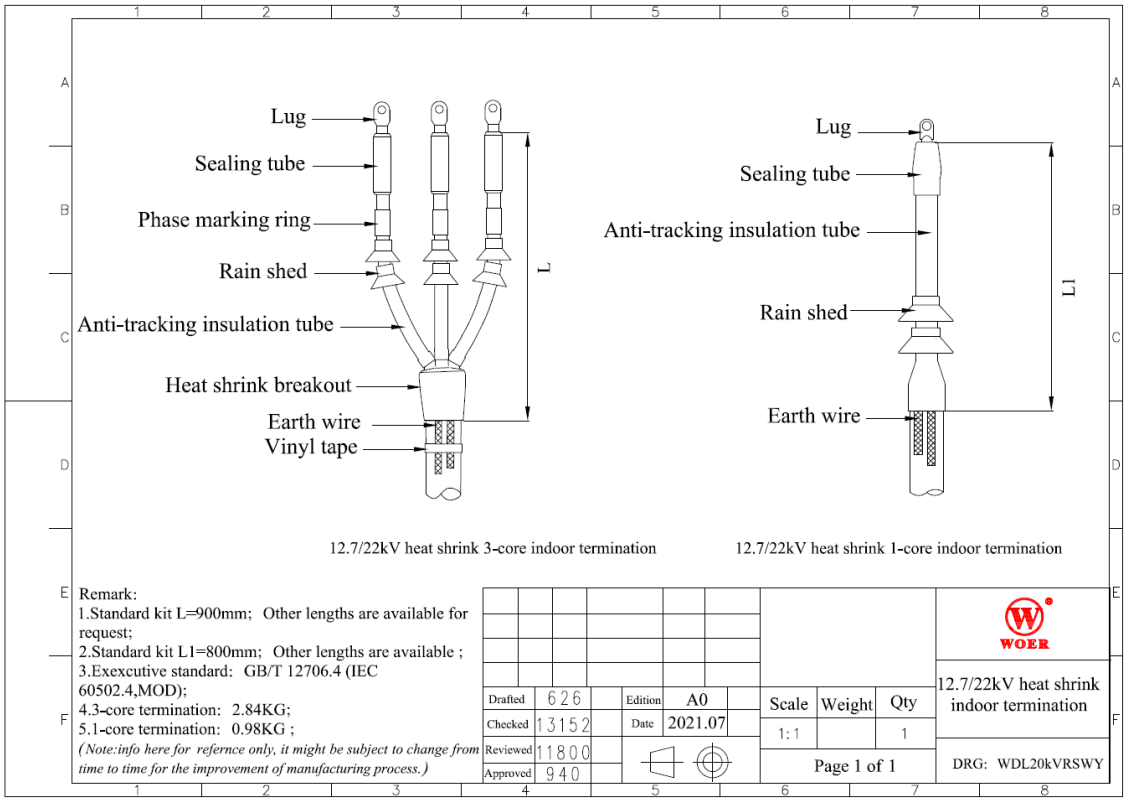
No	Items [1]	Standard Requirements		
		Indoor termination	**Outdoor termination**	**Joint**
1	AC and DC voltage	AC for 5min at 57kV and DC for 15min at 51kV, no breakdown nor flashover		
	AC voltage (wet)	/	1min at 51kV, no breakdown nor flashover	/
2	Partial discharge	10pC max. at 22kV		
3	Impulse voltage at elevated temperature θ_t [2]	10 impulses of each polarity at 125kV, no breakdown nor flashover		
4	Heating cycles	60 cycles [3] in air at θ_t [2] and 32kV		30 cycles [3] in air and 30 cycles [3] under water at θ_t and 32kV
5	Immersion test	---	10 cycles at θ_t [2]	---
6	Partial discharge at θ_t [2] [4] and ambient temperature	10pC max. at 22kV		
7	Thermal short-circuit (screen) [5]	Two short-circuits at I_{SC} of the cable screen, no visible deterioration		
8	Thermal short-circuit (conductor)	Two short-circuits to raise conductor to θ_{SC} of the cable, no visible deterioration		
9	Dynamic short-circuit [6]	One short-circuit at I_d, no visible deterioration		
10	Impulse voltage	10 impulses of each polarity at 125kV, no breakdown nor flashover		
11	AC voltage	15min at 32kV, no breakdown nor flashover		
12	Humidity	300h duration at 16kV	/	/
13	Salt fog	/	1000h duration at 16kV	/
14	Examination	No visible deterioration on appearance		

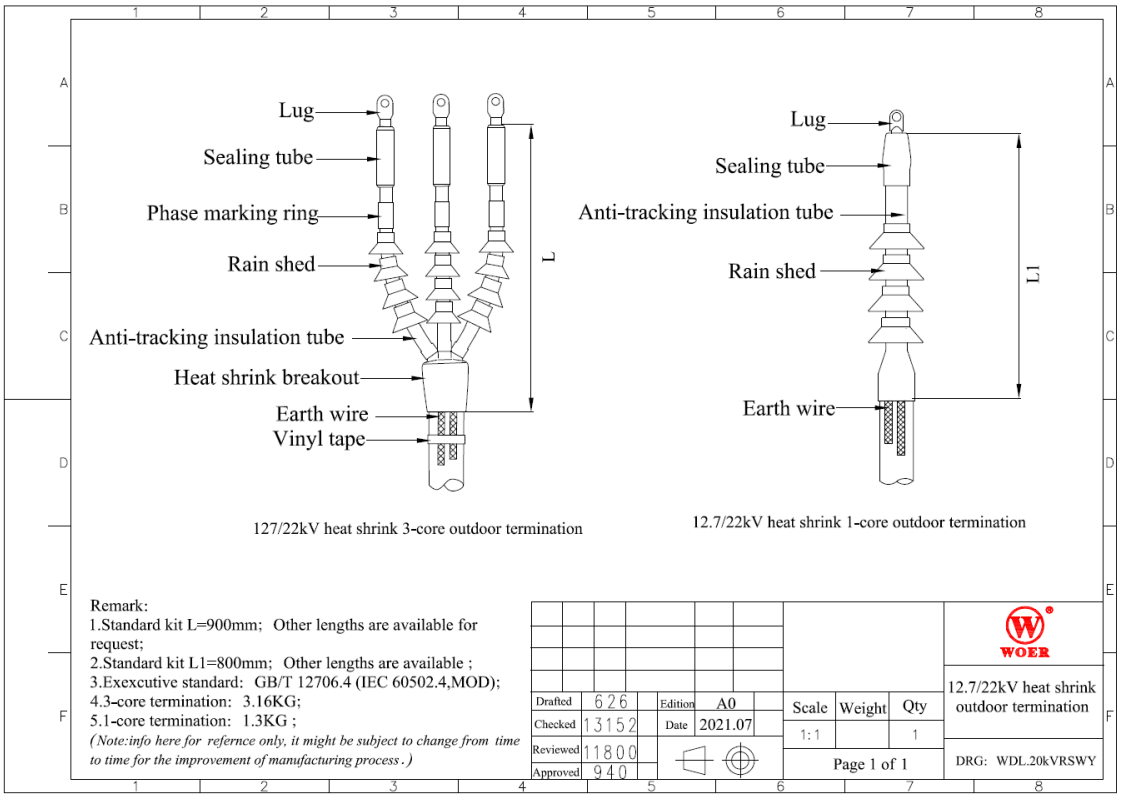
1) Unless otherwise specified, tests shall be carried out at ambient temperature.
2) θ_t is the maximum cable conductor temperature in normal operation +5K to 10K.
3) 8h total with ≥2 h steady and ≥3 h cooling.
4) Measurement is made at the end of the heating period.
5) This test is only required for terminations that are equipped with a connection to, or adaptor for, the metallic screen of the cable.
6) Only required for single-core cable accessories designed for initial peak current I_p＞80kA and three-core cable accessories designed for I_p＞63kA. Value of I_d shall be declared by the manufacturer.
7) Not required for termination having porcelain insulators.

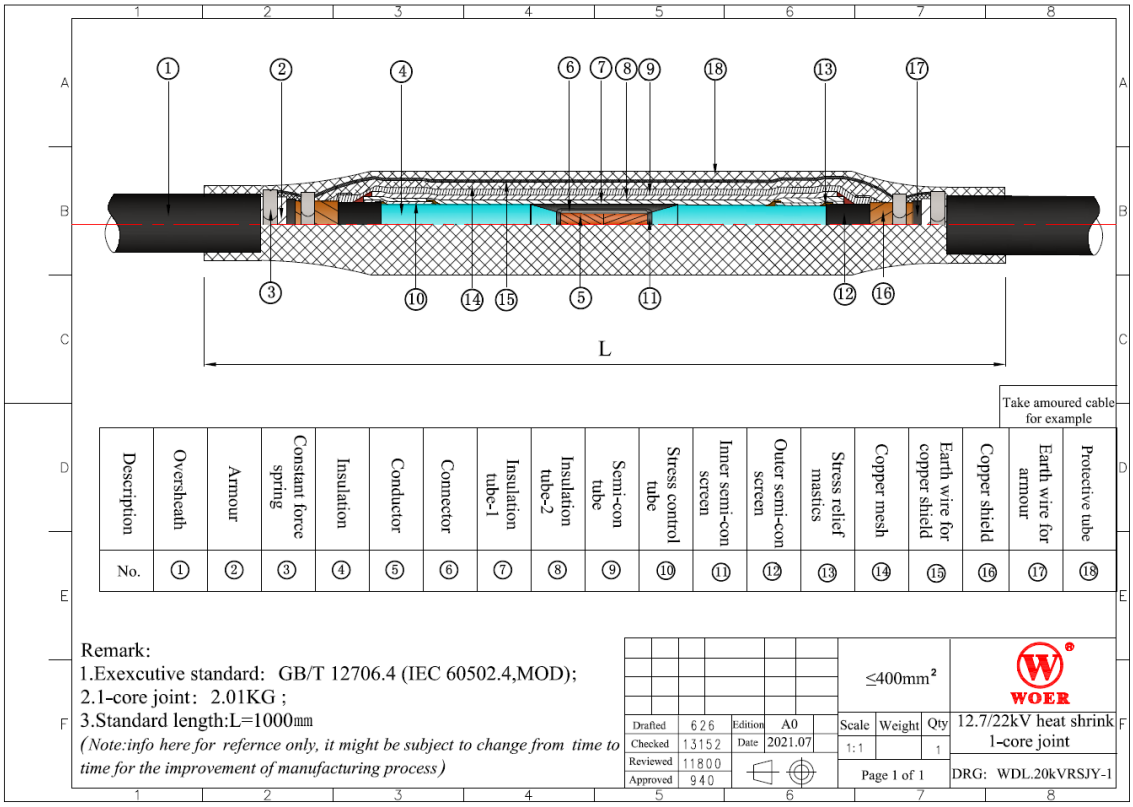
Annex 2（Sampling Test）:

No.	Items		Requirements
1	Termination	AC withstand for 5min	No breakdown and flashover occurs at 57kV for 5min
2		Partial discharge test	No detected partial discharge at 22kV
3		Impulse voltage withstand	No breakdown and flashover occurs at 10 positive and 10 negative impulses at 125kV
4	Joint	AC withstand for 5min	No breakdown and flashover occurs at 57kV for 5min
5		Partial discharge test	No detected partial discharge at 22kV
6		Impulse voltage withstand	No breakdown and flashover occurs at 10 positive and 10 negative impulses at 125kV

Annex 3: (Product drawing)





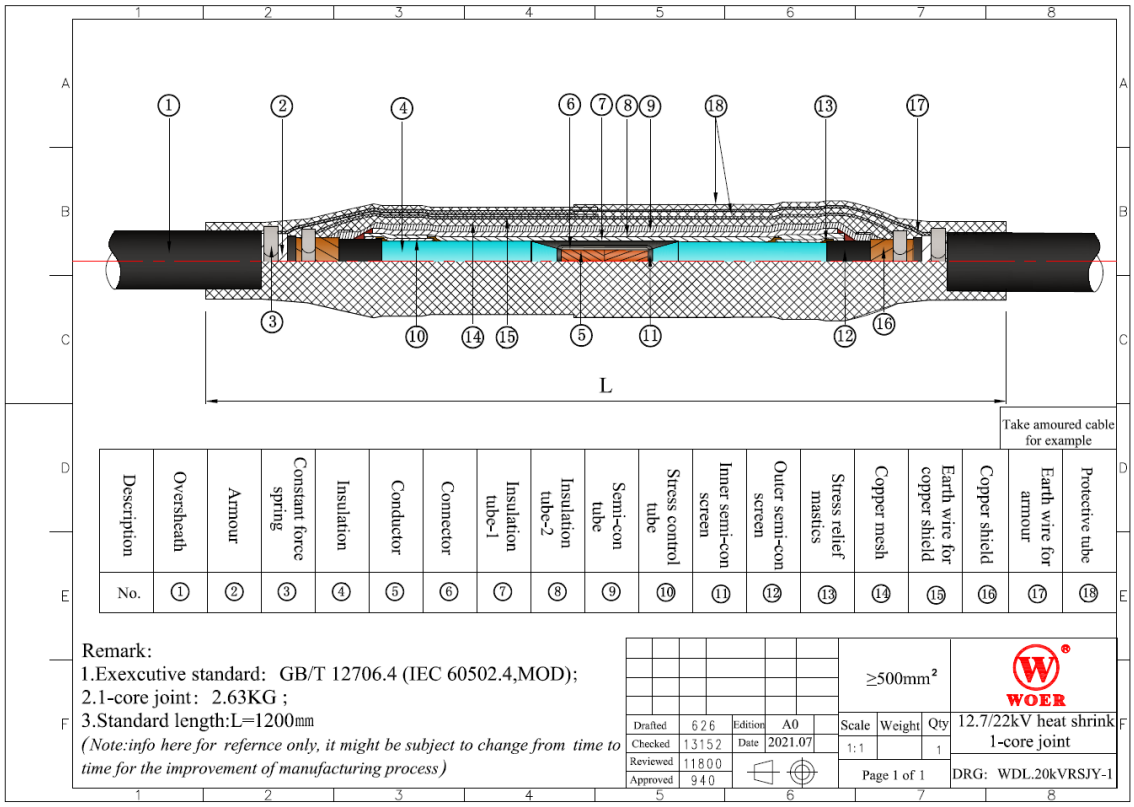


Take amoured cable for example

Description	Oversheath	Armour	Constant force spring	Insulation	Conductor	Connector	Insulation tube-1	Insulation tube-2	Semi-con tube	Stress control tube	Inner semi-con screen	Outer semi-con screen	Stress relief mastics	Copper mesh	Earth wire for copper shield	Copper shield	Earth wire for armour	Protective tube
No.	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰	⑱

Remark:
1.Exexcutive standard: GB/T 12706.4 (IEC 60502.4,MOD);
2.1-core joint: 2.01KG ;
3.Standard length:L=1000㎜
(Note:info here for refernce only, it might be subject to change from time to time for the improvement of manufacturing process)

Drafted	626	Edition	A0	≤400mm²	WOER
Checked	13152	Date	2021.07	Scale 1:1 / Weight / Qty 1	12.7/22kV heat shrink 1-core joint
Reviewed	11800			Page 1 of 1	DRG: WDL.20kVRSJY-1
Approved	940				

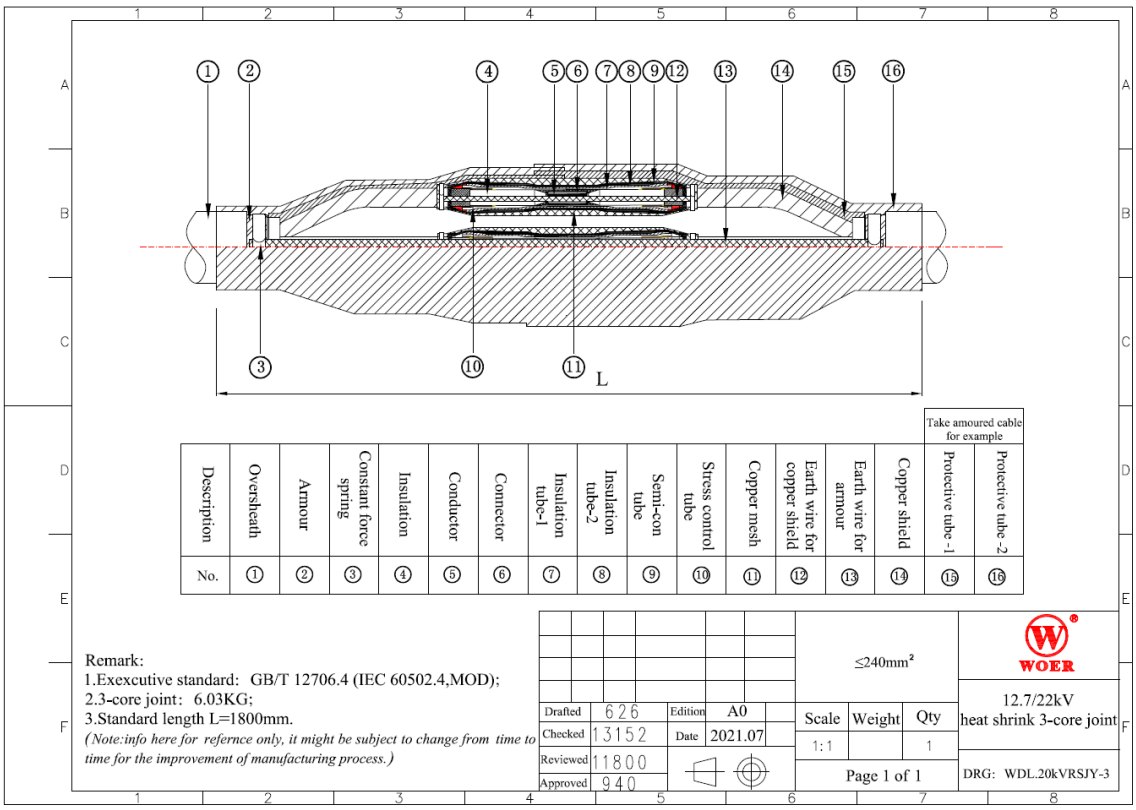


Take amoured cable for example

Description	Oversheath	Armour	Constant force spring	Insulation	Conductor	Connector	Insulation tube-1	Insulation tube-2	Semi-con tube	Stress control tube	Inner semi-con screen	Outer semi-con screen	Stress relief mastics	Copper mesh	Earth wire for copper shield	Copper shield	Earth wire for armour	Protective tube
No.	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰	⑱

Remark:
1.Exexcutive standard: GB/T 12706.4 (IEC 60502.4,MOD);
2.1-core joint: 2.63KG ;
3.Standard length:L=1200㎜
(Note:info here for refernce only, it might be subject to change from time to time for the improvement of manufacturing process)

Drafted	626	Edition	A0	≥500mm²	WOER
Checked	13152	Date	2021.07	Scale 1:1 / Weight / Qty 1	12.7/22kV heat shrink 1-core joint
Reviewed	11800			Page 1 of 1	DRG: WDL.20kVRSJY-1
Approved	940				



Description	Oversheath	Armour	Constant force spring	Insulation	Conductor	Connector	Insulation tube-1	Insulation tube-2	Semi-con tube	Stress control tube	Copper mesh	Earth wire for copper shield	Earth wire for armour	Copper shield	Take amoured cable for example: Protective tube -1	Protective tube -2
No.	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯

Remark:
1.Exexcutive standard: GB/T 12706.4 (IEC 60502.4,MOD);
2.3-core joint: 6.03KG;
3.Standard length L=1800mm.
(Note:info here for refernce only, it might be subject to change from time to time for the improvement of manufacturing process.)

Drafted	626	Edition	A0
Checked	13152	Date	2021.07
Reviewed	11800		
Approved	940		

≤240mm²

Scale	Weight	Qty
1:1		1

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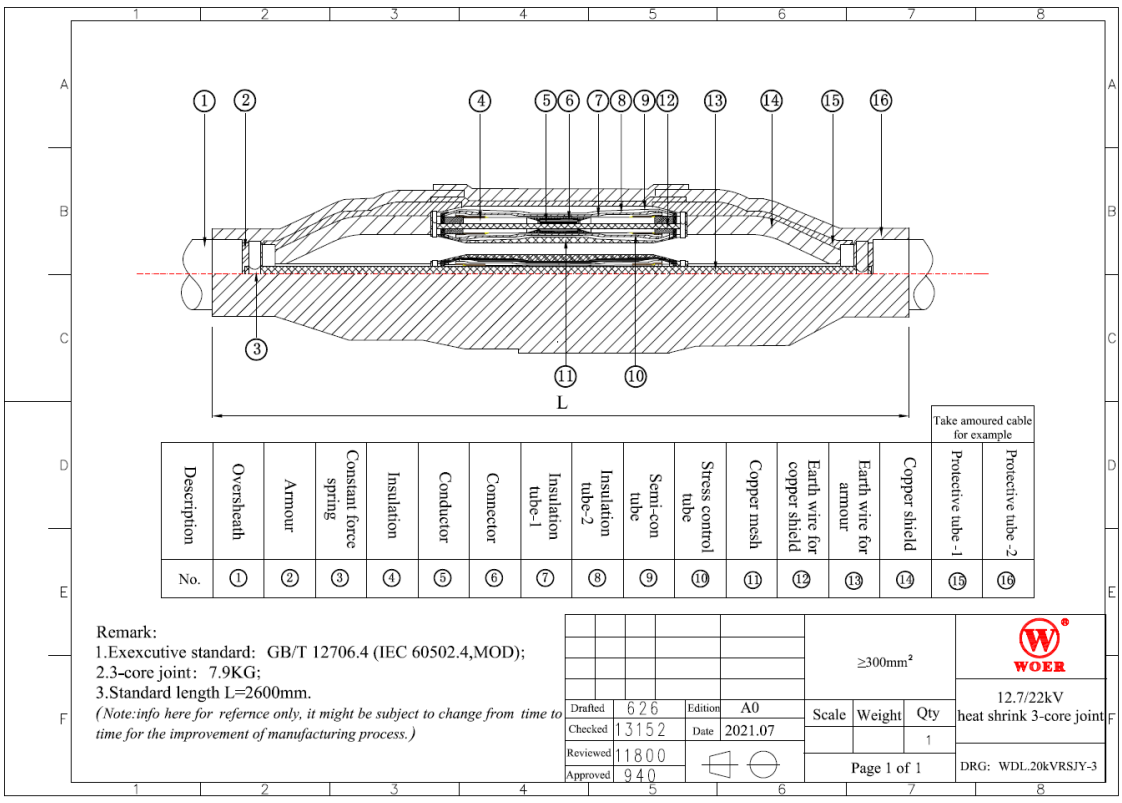
WOER
12.7/22kV heat shrink 3-core joint
DRG: WDL.20kVRSJY-3



Description	Oversheath	Armour	Constant force spring	Insulation	Conductor	Connector	Insulation tube-1	Insulation tube-2	Semi-con tube	Stress control tube	Copper mesh	Earth wire for copper shield	Earth wire for armour	Copper shield	Take amoured cable for example: Protective tube -1	Protective tube -2
No.	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯

Remark:
1.Exexcutive standard: GB/T 12706.4 (IEC 60502.4,MOD);
2.3-core joint: 7.9KG;
3.Standard length L=2600mm.
(Note:info here for refernce only, it might be subject to change from time to time for the improvement of manufacturing process.)

Drafted	626	Edition	A0
Checked	13152	Date	2021.07
Reviewed	11800		
Approved	940		

≥300mm²

Scale	Weight	Qty
		1

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WOER
12.7/22kV heat shrink 3-core joint
DRG: WDL.20kVRSJY-3