

# SPECIFICATION

For

## FD-12/20KV-CV-AWA (VM)

12/20(24)kV

XLPE Insulated PVC Inner Sheathed

Aluminium Wire Armored PVC Outer Sheathed

Flame Retardant and Vermin Proof Power Cable

(12/20(24)kV, Cu/XLPE/CTS/FR-PVC/AWA/FR-VM-PVC)

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Rev.	Date	Description
0	04/08/2020	Issued specification
1	09/10/2020	Add sheath's color
2	6/4/2021	Cancel cable code "0010"

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CUSTOMER

Customer Document	Rev.

**Remark:**

This document is based on the Customer Document for the structure and properties of electric wire and cable only. If there are different points, will be shown in deviation table.

## 1. Scope

This specification covers 22000V copper conductor cross-linked polyethylene (XLPE) insulated polyvinyl chloride (PVC) inner sheathed aluminium wire armored polyvinyl chloride (PVC) outer sheathed flame retardant and vermin proof power cable.

The cable shall be in accordance with IEC 60502-2 : 2014.

The finished cables shall meet the vertical tray flame test requirements per IEC 60332-1 and IEC 60332-3-24; Category C.

## 2. Conductor

The conductor shall be compacted concentric stranded uncoated annealed copper conductor in accordance with IEC 60228 : 2004, Class 2.

The direction of lay shall be left-hand (S) lay in the outermost layer.

## 3. Conductor Shield

The conductor shield shall be a semi-conducting nylon tape and shall be applied helically with a wrap over the conductor and a layer of extruded semi-conducting compound.

Size  $\leq 150 \text{ mm}^2$  : Applied extruded semi-conducting compound

Size  $\geq 185 \text{ mm}^2$  : Applied semi-conducting nylon tape and extruded semi-conducting compound

The thickness of the conductor shield shall be approximate 0.5 mm.

## 4. Insulation

The insulation shall be cross-linked polyethylene (XLPE) compound meet the requirements of IEC 60502-2 : 2014.

The average thickness of the insulation shall be not less than that given in Table 1.

The minimum thickness shall not fall below the value in Table 1 by more than 10% plus 0.1 mm.

The thickness of insulation shall not be included that of conductor shield.

## 5. Insulation Shield

The insulation shield shall be a layer of extruded semi-conducting compound and shall be free stripping.

The thickness of the insulation shield shall be approximate 0.5 mm.

## 6. Metallic Shield

The metallic shield shall be an uncoated annealed copper tape and shall be applied helically with a lap over the insulation shield.

The thickness of the copper tape shall be approximate 0.1 mm.

A suitable separator tape shall be applied helically over the shielded.

## 7. Inner Sheath

The inner sheath shall be flame retardant polyvinyl chloride (PVC) compound applied over the separator tape.

The approximate thickness given in Table 1.

The color of the inner sheath shall be black.

## 8. Aluminium Wire Armor

The armor shall be round aluminium wires and shall be applied with a minimum gap between adjacent wires over the inner sheathed.

A suitable tape may be applied helically over the armored core.

## 9. Outer Sheath

The outer sheath shall be sunlight resistant, flame retardant and resistant to vermin by special chemical treated polyvinyl chloride (PVC/ST2) compound meet the requirements of IEC 60502-2 : 2014. (vermin means rat, termite).


The average thickness of the outer sheath shall not be less than that given in Table 1.

The minimum thickness shall not fall below the value in Table 1 by more than 20% plus 0.2 mm.

The color of the outer sheath shall be black or red.

## 10. Marking on Cable

The marking items shall be marked with suitable means throughout the length of cable.

1. Manufacturer's name and/or trade mark "  YAZAKI..... : TYE"
2. Year of manufacture
3. Flame retardant "FD"
4. Rated circuit voltage "12/20(24)KV"
5. Type of insulation "XLPE"
6. Type of cable "POWER CABLE"
7. Number of core and size of conductor
8. The continuous reel length marking (in figure) shall be made on the outer sheath at every 1 meter

## 11. Test and Properties

The cable shall meet the requirements in Test and Inspection and Table 1 , when tested in accordance with IEC 60502-2 : 2014, IEC 60228 : 2004, IEC 60332-1 and IEC 60332-3-24; Category C.

Remark: Sunlight resistant test meet the requirement of TIS 293-2541.


Except black color sheath ; For longer life of cable should be avoid exposure to direct solar radiation it necessary, cover is required.

## 12. Packing

The cable shall be placed on non-returnable wooden reels.

The reels shall be covered with suitable covering to provide the cable with physical protection during transportation and during ordinary storage and handling operations.

Each reel shall be clearly marked as follows.

1. Designation "FD-12/20KV-CV-AWA (VM)"
2. Number of core and size of conductor
3. Cable length
4. Net and gross weight
5. Manufacturer's name and trade mark "  **YAZAKI** "
6. Rolling direction of reel

## Test and Inspection

### Routine Tests

- Maximum conductor resistance, Ohm/km.....specified in Table 1
- AC test voltage for 5 minutes, kV.....42
- Maximum partial discharge level\*.....10 pC or better, at 20.76 kV
- Electrical test on over sheath .....No breakdown

\*The partial discharge level shall be no detectable discharge exceeding the declared sensitivity

### Sample Tests

- Construction.....specified in Table 1
- AC test voltage for 4 hours, kV.....48
- Hot set test at  $200\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$  for XLPE
  - Maximum elongation under load (%) .....175
  - Maximum permanent elongation after cooling (%).....15

### Type Tests

- Flame retardant tested according to IEC 60332-1 and IEC 60332-3-24; Category C.

### Definition concerning the tests

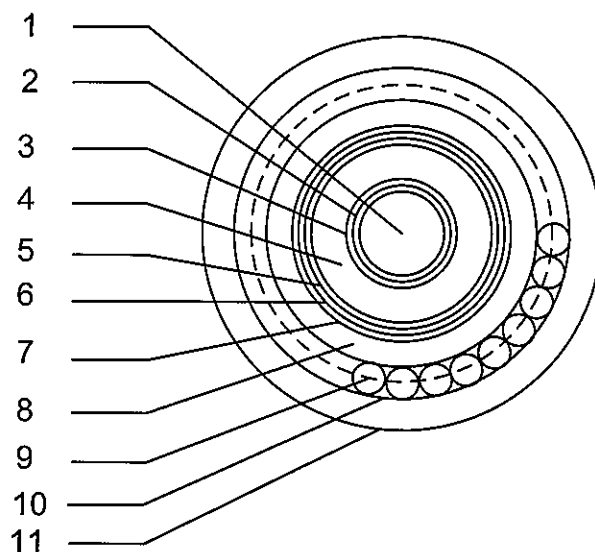
**Routine tests:** Tests made by the manufacturer on each manufactured length of cable to check that each length meets the specified requirements.

**Sample tests:** Tests made by the manufacturer on samples of completed cable or components taken from a completed cable, at a specified frequency, so as to verify that the finished product meets the specified requirements.

**Type tests:** Tests made before supplying, on a general commercial basis, a type of cable covered by this standard, in order to demonstrate satisfactory performance characteristics to meet the intended application.

### Cable structure

Cross-sectional (Not scale)



No.	Structure	Material
1	Conductor	Compacted concentric stranded annealed copper
2	Nylon tape	Semi-conducting nylon tape (For size $\geq 185 \text{ mm}^2$ only)
3	Conductor shield	Semi-conducting XLPE compound
4	Insulation	Cross-Linked Polyethylene (XLPE)
5	Insulation shield	Semi-conducting XLPE compound
6	Shield tape	Copper tape
7	Separator tape	Spun bond tape or suitable tape
8	Inner sheath	Flame retardant Polyvinyl chloride (PVC)
9	Armor	Aluminium wire
10	Binder tape	PS tape or suitable tape
11	Outer Sheath	Flame retardant and vermin proof Polyvinyl chloride (PVC/ST2)

**Application:** Use for installation exposed, or in raceway, wet or dry location, or direct burial in ground.

Maximum conductor temperature of  $90^\circ\text{C}$  for normal operation and  $250^\circ\text{C}$  for short circuit conditions

**Table 1**

No. of core	Size (mm <sup>2</sup> )	Conductor (wires/type)	Conductor diameter approx. (mm)	Insulation thickness nominal (mm)	Inner sheath thickness approx. (mm)	Dia. of inner sheath approx. (mm)	Armor wire dia. nominal (mm)	Outer sheath thickness nominal (mm)	Overall diameter approx. (mm)	Conductor resistance at 20 °C maximum (Ohm/km)	Weight of cable approx. (kg/km)	Standard packing length (m)
1	35	7/Compacted	7.10	5.5	1.2	24.5	2.00	1.9	33.0	0.524	1400	500
1	50	19/Compacted	8.30	5.5	1.2	26.0	2.00	2.0	34.5	0.387	1600	500
1	70	19/Compacted	9.90	5.5	1.2	27.5	2.00	2.1	36.5	0.268	1900	500
1	95	19/Compacted	11.70	5.5	1.2	29.5	2.00	2.1	38.5	0.193	2300	500
1	120	37/Compacted	13.20	5.5	1.2	31.0	2.00	2.2	40.0	0.153	2600	500
1	150	37/Compacted	14.60	5.5	1.2	32.0	2.00	2.2	41.5	0.124	2900	500
1	185	37/Compacted	16.30	5.5	1.2	34.0	2.00	2.3	43.5	0.0991	3400	500
1	240	61/Compacted	18.70	5.5	1.3	37.0	2.50	2.4	47.5	0.0754	4300	500
1	300	61/Compacted	20.90	5.5	1.3	39.0	2.50	2.5	50.0	0.0601	4900	500
1	400	61/Compacted	23.50	5.5	1.4	42.0	2.50	2.6	53.0	0.0470	6000	500
1	500	61/Compacted	26.70	5.5	1.4	45.5	2.50	2.7	57.0	0.0366	7000	500
1	630	61/Compacted	30.30	5.5	1.5	49.5	2.50	2.9	61.0	0.0283	9000	500
1	800	61/Compacted	34.10	5.5	1.6	53.5	2.50	3.0	65.5	0.0221	10500	300
1	1000	127/Compacted	39.50	5.5	1.7	59.0	2.50	3.2	71.5	0.0176	13500	300