

# SPECIFICATION

## For

## KPVV-SLA

500V Copper Conductor PVC Insulated

PVC Sheathed Shielded Instrument Cable

(500V, Cu/PVC/OS/PVC)

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CUSTOMER

Rev.	Date	Description
0	7/11/2019	Issued specification
1	13/02/2020	Adjust Table 1 to Test and Inspection and it's reference
2	10/8/2022	- Correct the value in Table 1 - Add length mark
3	14/3/2023	Add binder tape for single-pair

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 500V copper conductor polyvinyl chloride (PVC) insulated polyvinyl chloride (PVC) sheathed shielded instrument cable.

The cable shall be based on BS EN 50288-7 : 2005.

The finished cables shall meet the flame test requirements per BS 4066-1 (Same IEC 60332-1).

## **2. Conductor**

The conductor shall be non-compacted concentric and flexible stranded uncoated annealed copper conductor accordance with BS EN 60228 : 2005, Class 2 and Class 5.

The direction of lay shall be left-hand (S) lay.

## **3. Insulation**

The insulation shall be polyvinyl chloride (PVC) compound meet the requirements of BS EN 50290-2-21 : 2002.

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.

## **4. Twisting**

Two insulated conductor, uniformly twisted together to form a pair.

For 1-pair : Two insulated conductor, uniformly twisted together to form a pair with suitable non-hygroscopic filler ;if necessary; to give the completed assembly a substantially circular cross section.

The direction of lay shall be left-hand (S) lay.

A suitable binder tape shall be applied helically over the twisted core.

## **5. Assembling (For multi-pairs only)**

The twisted pairs shall be assembled together with suitable length of lay or non-hygroscopic filler ;if necessary; to give the completed assembly a substantially circular cross section.

The direction of lay shall be left-hand (S) lay.

A suitable binder may shall be applied helically over the assembled core.

## 6. Pair Identification

The pairs shall be identified by colors or numerals printed on the insulation, as follow :

For 1-pair : black, white

For multi-pairs : black and white insulation mark numbering with (1.....n)

\*Remark : "n" is number of pairs

## 7. Metallic Shield

The metallic shield shall be an aluminium foil tape coated with polyethylene and applied helically with a lap over the binder tape.

The thickness of the tape shall be approx. 0.04 mm.

One annealed bare copper drain wire 0.5 mm<sup>2</sup> (7/0.3 mm.) shall be tin-coated high conductivity and shall be provided beneath the aluminium foil tape for grounding continuity.

A suitable separator tape may be applied helically over the shielded for multi pairs only.

## 8. Sheath

The sheath shall be sunlight resistant polyvinyl chloride (PVC) compound meet the requirements of BS EN 50290-2-22 : 2002.


The average thickness of the sheath 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 15% plus 0.1 mm.

The color of the sheath shall be black.

## 9. 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. Rated circuit voltage "500V"
4. Type of insulation "PVC"
5. Type of cable "INSTRUMENT CABLE"
6. Number of pairs and size of conductor
7. The continuous reel length marking (in figure) shall be made on the sheath at every 1 meter

## 10. Test and Properties

The cable shall be meet the requirements in Test and Inspection and Table 1, when tested in accordance with BS EN 50288-7, BS EN 60228 and BS 4066-1 (Same IEC 60332-1).


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

## 11. 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 "KPVV-SLA"
2. Number of pairs and size of conductor
3. Cable length
4. Net and gross weight
5. Manufacturer's name and/or trade mark "  "
6. Rolling direction of reel

## Test and Inspection

### **Routine Test**

1. Conductor resistance at 20 °C, maximum, Ohm/km..... specified in Table 1
2. A.C. test voltage for 1 minutes, kV .....2
3. Insulation resistance at 20 °C, minimum, MOhm-km.....10
4. Mutual capacitance at 1 kHz, less than, nF/km.....250
5. Inductance to resistance ratio (L/R),  $\mu\text{H}/\text{Ohm}$

Size of Conductor (mm <sup>2</sup> )	Inductance to resistance ratio (L/R) ( $\mu\text{H}/\text{Ohm}$ )
Up to 1	< 25
1.5	< 40
2.5	< 60

### **Type Test**

- Flame retardant tested according to BS 4066-1 (Same IEC 60332-1).

### **Definition concerning the tests**

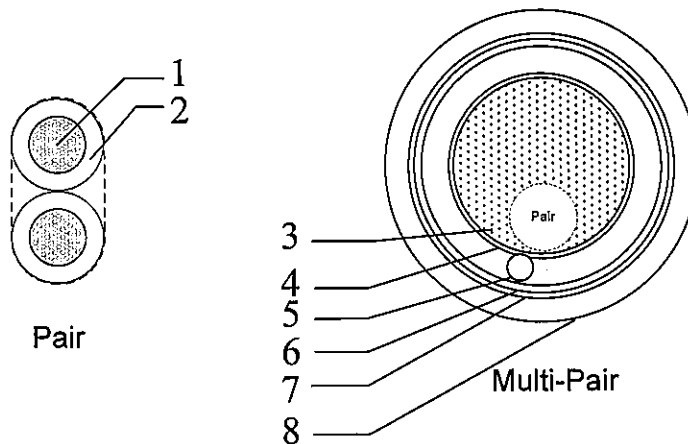
**Routine tests:** Tests made by the manufacturer on each manufactured length of cable to check that each length meets the specified requirements.

**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	Non-compacted concentric and flexible stranded uncoated annealed copper
2	Insulation	Polyvinyl chloride (PVC)
3	Filler	Non-hygrosopic filler
4	Binder tape	P.S tape or suitable tape
5	Drain wire	Tin-coated copper drain wire
6	Metallic shield	Aluminium foil tape
7	Separator tape	P.S tape or suitable tape
8	Sheath	Polyvinyl chloride (PVC)

**Application:** For supervisory electrical equipment, station control circuits, outdoor, suitable installation in the dry or wet cable trenches. Maximum conductor temperature of 70°C for normal operation and 160°C for short circuit conditions.

**Table 1**

No. of pairs	Size (mm <sup>2</sup> )	Conductor (wires/type)	Conductor diameter approx. (mm)	Insulation thickness nominal (mm)	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)
1P	0.5	Flexible	0.95	0.6	1.0	8.0	39.0	60	300
1P	0.75	Flexible	1.15	0.6	1.0	8.0	26.0	65	300
1P	1.0	7/Non-compacted	1.29	0.6	1.0	8.5	18.1	75	300
1P	1.5	7/Non-compacted	1.59	0.6	1.0	9.0	12.1	95	300
1P	2.5	7/Non-compacted	2.01	0.6	1.0	10.0	7.41	120	300
2P	0.5	Flexible	0.95	0.6	1.0	11.0	39.8	100	300
2P	0.75	Flexible	1.15	0.6	1.1	12.5	26.5	140	300
2P	1.0	7/Non-compacted	1.29	0.6	1.1	12.5	18.5	160	300
2P	1.5	7/Non-compacted	1.59	0.6	1.1	13.5	12.3	190	300
2P	2.5	7/Non-compacted	2.01	0.6	1.2	15.5	7.56	260	300
3P	0.5	Flexible	0.95	0.6	1.1	12.5	39.8	120	300
3P	0.75	Flexible	1.15	0.6	1.1	13.0	26.5	140	300
3P	1.0	7/Non-compacted	1.29	0.6	1.1	13.5	18.5	170	300
3P	1.5	7/Non-compacted	1.59	0.6	1.2	14.5	12.3	220	300
3P	2.5	7/Non-compacted	2.01	0.6	1.2	16.5	7.56	290	300
4P	0.5	Flexible	0.95	0.6	1.1	13.5	39.8	150	300
4P	0.75	Flexible	1.15	0.6	1.1	14.0	26.5	170	300
4P	1.0	7/Non-compacted	1.29	0.6	1.2	15.0	18.5	220	300
4P	1.5	7/Non-compacted	1.59	0.6	1.2	16.0	12.3	270	300
4P	2.5	7/Non-compacted	2.01	0.6	1.3	18.5	7.56	370	300

**Table 1 (continued)**

No. of pairs	Size (mm <sup>2</sup> )	Conductor (wires/type)	Conductor diameter approx. (mm)	Insulation thickness nominal (mm)	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)
5P	0.5	Flexible	0.95	0.6	1.1	14.5	39.8	180	300
5P	0.75	Flexible	1.15	0.6	1.2	15.5	26.5	220	300
5P	1.0	7/Non-compacted	1.29	0.6	1.2	16.0	18.5	260	300
5P	1.5	7/Non-compacted	1.59	0.6	1.3	18.0	12.3	340	300
5P	2.5	7/Non-compacted	2.01	0.6	1.3	20.0	7.56	460	300
6P	0.5	Flexible	0.95	0.6	1.2	16.0	39.8	210	300
6P	0.75	Flexible	1.15	0.6	1.2	17.0	26.5	250	300
6P	1.0	7/Non-compacted	1.29	0.6	1.3	18.0	18.5	300	300
6P	1.5	7/Non-compacted	1.59	0.6	1.3	19.5	12.3	390	300
6P	2.5	7/Non-compacted	2.01	0.6	1.4	22.0	7.56	550	300
7P	0.5	Flexible	0.95	0.6	1.2	16.0	39.8	220	300
7P	0.75	Flexible	1.15	0.6	1.2	17.0	26.5	270	300
7P	1.0	7/Non-compacted	1.29	0.6	1.3	18.0	18.5	340	300
7P	1.5	7/Non-compacted	1.59	0.6	1.3	19.5	12.3	430	300
7P	2.5	7/Non-compacted	2.01	0.6	1.4	22.0	7.56	600	300
8P	0.5	Flexible	0.95	0.6	1.2	17.5	39.8	250	300
8P	0.75	Flexible	1.15	0.6	1.3	18.5	26.5	310	300
8P	1.0	7/Non-compacted	1.29	0.6	1.3	19.5	18.5	380	300
8P	1.5	7/Non-compacted	1.59	0.6	1.4	21.0	12.3	500	300
8P	2.5	7/Non-compacted	2.01	0.6	1.5	24.5	7.56	700	300



**Table 1 (continued)**

No. of pairs	Size (mm <sup>2</sup> )	Conductor (wires/type)	Conductor diameter approx. (mm)	Insulation thickness nominal (mm)	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)
9P	0.5	Flexible	0.95	0.6	1.3	19.0	39.8	290	300
9P	0.75	Flexible	1.15	0.6	1.3	20.0	26.5	350	300
9P	1.0	7/Non-compacted	1.29	0.6	1.4	21.0	18.5	430	300
9P	1.5	7/Non-compacted	1.59	0.6	1.5	23.0	12.3	550	300
9P	2.5	7/Non-compacted	2.01	0.6	1.6	26.5	7.56	800	300
10P	0.5	Flexible	0.95	0.6	1.3	20.5	39.8	310	300
10P	0.75	Flexible	1.15	0.6	1.4	22.0	26.5	390	300
10P	1.0	7/Non-compacted	1.29	0.6	1.4	22.5	18.5	470	300
10P	1.5	7/Non-compacted	1.59	0.6	1.5	25.0	12.3	600	300
10P	2.5	7/Non-compacted	2.01	0.6	1.6	28.5	7.56	850	300
11P	0.5	Flexible	0.95	0.6	1.3	20.5	39.8	330	300
11P	0.75	Flexible	1.15	0.6	1.4	22.0	26.5	420	300
11P	1.0	7/Non-compacted	1.29	0.6	1.4	22.5	18.5	500	300
11P	1.5	7/Non-compacted	1.59	0.6	1.5	25.0	12.3	650	300
11P	2.5	7/Non-compacted	2.01	0.6	1.6	28.5	7.56	900	300
12P	0.5	Flexible	0.95	0.6	1.4	21.0	39.8	370	300
12P	0.75	Flexible	1.15	0.6	1.4	22.5	26.5	450	300
12P	1.0	7/Non-compacted	1.29	0.6	1.5	24.0	18.5	550	300
12P	1.5	7/Non-compacted	1.59	0.6	1.6	26.0	12.3	750	300
12P	2.5	7/Non-compacted	2.01	0.6	1.7	30.0	7.56	1000	300

**Table 1 (continued)**

No. of pairs	Size (mm <sup>2</sup> )	Conductor (wires/type)	Conductor diameter approx. (mm)	Insulation thickness nominal (mm)	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)
13P	0.5	Flexible	0.95	0.6	1.4	22.5	39.8	390	300
13P	0.75	Flexible	1.15	0.6	1.5	24.0	26.5	500	300
13P	1.0	7/Non-compacted	1.29	0.6	1.5	25.0	18.5	600	300
13P	1.5	7/Non-compacted	1.59	0.6	1.6	27.5	12.3	800	300
13P	2.5	7/Non-compacted	2.01	0.6	1.7	31.5	7.56	1100	300
14P	0.5	Flexible	0.95	0.6	1.4	22.5	39.8	410	300
14P	0.75	Flexible	1.15	0.6	1.5	24.0	26.5	500	300
14P	1.0	7/Non-compacted	1.29	0.6	1.5	25.0	18.5	650	300
14P	1.5	7/Non-compacted	1.59	0.6	1.6	27.5	12.3	850	300
14P	2.5	7/Non-compacted	2.01	0.6	1.7	31.5	7.56	1100	300
15P	0.5	Flexible	0.95	0.6	1.4	23.0	39.8	430	300
15P	0.75	Flexible	1.15	0.6	1.5	25.0	26.5	550	300
15P	1.0	7/Non-compacted	1.29	0.6	1.6	26.0	18.5	700	300
15P	1.5	7/Non-compacted	1.59	0.6	1.6	28.5	12.3	900	300
15P	2.5	7/Non-compacted	2.01	0.6	1.8	32.5	7.56	1200	300
16P	0.5	Flexible	0.95	0.6	1.4	23.5	39.8	460	300
16P	0.75	Flexible	1.15	0.6	1.5	25.5	26.5	600	300
16P	1.0	7/Non-compacted	1.29	0.6	1.6	26.5	18.5	700	300
16P	1.5	7/Non-compacted	1.59	0.6	1.7	29.0	12.3	950	300
16P	2.5	7/Non-compacted	2.01	0.6	1.8	33.5	7.56	1300	300

**Table 1 (continued)**

No. of pairs	Size (mm <sup>2</sup> )	Conductor (wires/type)	Conductor diameter approx. (mm)	Insulation thickness nominal (mm)	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)
17P	0.5	Flexible	0.95	0.6	1.5	25.0	39.8	500	300
17P	0.75	Flexible	1.15	0.6	1.6	27.0	26.5	650	300
17P	1.0	7/Non-compacted	1.29	0.6	1.6	28.0	18.5	750	300
17P	1.5	7/Non-compacted	1.59	0.6	1.7	30.5	12.3	1000	300
17P	2.5	7/Non-compacted	2.01	0.6	1.9	35.5	7.56	1400	300
18P	0.5	Flexible	0.95	0.6	1.5	25.0	39.8	500	300
18P	0.75	Flexible	1.15	0.6	1.6	27.0	26.5	650	300
18P	1.0	7/Non-compacted	1.29	0.6	1.6	28.0	18.5	800	300
18P	1.5	7/Non-compacted	1.59	0.6	1.7	30.5	12.3	1000	300
18P	2.5	7/Non-compacted	2.01	0.6	1.9	35.5	7.56	1500	300
19P	0.5	Flexible	0.95	0.6	1.5	25.0	39.8	550	300
19P	0.75	Flexible	1.15	0.6	1.6	27.0	26.5	700	300
19P	1.0	7/Non-compacted	1.29	0.6	1.6	28.0	18.5	800	300
19P	1.5	7/Non-compacted	1.59	0.6	1.7	30.5	12.3	1100	300
19P	2.5	7/Non-compacted	2.01	0.6	1.9	35.5	7.56	1500	300
20P	0.5	Flexible	0.95	0.6	1.5	26.0	39.8	550	300
20P	0.75	Flexible	1.15	0.6	1.6	28.0	26.5	700	300
20P	1.0	7/Non-compacted	1.29	0.6	1.7	29.0	18.5	850	300
20P	1.5	7/Non-compacted	1.59	0.6	1.8	31.5	12.3	1200	300
20P	2.5	7/Non-compacted	2.01	0.6	1.9	36.5	7.56	1600	300

**Table 1 (continued)**

No. of pairs	Size (mm <sup>2</sup> )	Conductor (wires/type)	Conductor diameter approx. (mm)	Insulation thickness nominal (mm)	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)
21P	0.5	Flexible	0.95	0.6	1.5	26.5	39.8	600	300
21P	0.75	Flexible	1.15	0.6	1.6	28.5	26.5	750	300
21P	1.0	7/Non-compacted	1.29	0.6	1.7	29.5	18.5	900	300
21P	1.5	7/Non-compacted	1.59	0.6	1.8	32.5	12.3	1200	300
21P	2.5	7/Non-compacted	2.01	0.6	1.9	37.5	7.56	1700	300
22P	0.5	Flexible	0.95	0.6	1.6	28.0	39.8	650	300
22P	0.75	Flexible	1.15	0.6	1.7	30.0	26.5	800	300
22P	1.0	7/Non-compacted	1.29	0.6	1.7	31.0	18.5	950	300
22P	1.5	7/Non-compacted	1.59	0.6	1.9	34.5	12.3	1300	300
23P	0.5	Flexible	0.95	0.6	1.6	28.0	39.8	650	300
23P	0.75	Flexible	1.15	0.6	1.7	30.0	26.5	800	300
23P	1.0	7/Non-compacted	1.29	0.6	1.7	31.0	18.5	1000	300
23P	1.5	7/Non-compacted	1.59	0.6	1.9	34.5	12.3	1300	300
24P	0.5	Flexible	0.95	0.6	1.6	29.5	39.8	700	300
24P	0.75	Flexible	1.15	0.6	1.7	31.5	26.5	850	300
24P	1.0	7/Non-compacted	1.29	0.6	1.8	33.0	18.5	1100	300
24P	1.5	7/Non-compacted	1.59	0.6	1.9	36.0	12.3	1400	300

**Table 1 (continued)**

No. of pairs	Size (mm <sup>2</sup> )	Conductor (wires/type)	Conductor diameter approx. (mm)	Insulation thickness nominal (mm)	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)
25P	0.5	Flexible	0.95	0.6	1.6	29.5	39.8	700	300
25P	0.75	Flexible	1.15	0.6	1.7	31.5	26.5	850	300
25P	1.0	7/Non-compacted	1.29	0.6	1.8	33.0	18.5	1100	300
25P	1.5	7/Non-compacted	1.59	0.6	1.9	36.0	12.3	1400	300
26P	0.5	Flexible	0.95	0.6	1.6	29.5	39.8	700	300
26P	0.75	Flexible	1.15	0.6	1.7	31.5	26.5	900	300
26P	1.0	7/Non-compacted	1.29	0.6	1.8	33.0	18.5	1100	300
26P	1.5	7/Non-compacted	1.59	0.6	1.9	36.0	12.3	1500	300
27P	0.5	Flexible	0.95	0.6	1.7	30.5	39.8	750	300
27P	0.75	Flexible	1.15	0.6	1.8	32.5	26.5	950	300
27P	1.0	7/Non-compacted	1.29	0.6	1.8	33.5	18.5	1200	300
27P	1.5	7/Non-compacted	1.59	0.6	2.0	37.5	12.3	1500	300
28P	0.5	Flexible	0.95	0.6	1.7	31.5	39.8	800	300
28P	0.75	Flexible	1.15	0.6	1.8	34.0	26.5	1000	300
28P	1.0	7/Non-compacted	1.29	0.6	1.9	35.0	18.5	1200	300
28P	1.5	7/Non-compacted	1.59	0.6	2.0	38.5	12.3	1600	300

**Table 1 (continued)**

No. of pairs	Size (mm <sup>2</sup> )	Conductor (wires/type)	Conductor diameter approx. (mm)	Insulation thickness nominal (mm)	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)
29P	0.5	Flexible	0.95	0.6	1.7	31.5	39.8	800	300
29P	0.75	Flexible	1.15	0.6	1.8	34.0	26.5	1000	300
29P	1.0	7/Non-compacted	1.29	0.6	1.9	35.0	18.5	1200	300
29P	1.5	7/Non-compacted	1.59	0.6	2.0	38.5	12.3	1600	300
30P	0.5	Flexible	0.95	0.6	1.7	31.5	39.8	800	300
30P	0.75	Flexible	1.15	0.6	1.8	34.0	26.5	1000	300
30P	1.0	7/Non-compacted	1.29	0.6	1.9	35.0	18.5	1300	300
30P	1.5	7/Non-compacted	1.59	0.6	2.0	38.5	12.3	1700	300