

# SPECIFICATION

For

## FD-KPVV-SLA

500V Copper Conductor PVC Insulated

PVC Sheathed Flame Retardant Shielded Instrument Cable

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

BY 

(Wachara Sangsomritphon)

MANAGER, Cable Design Section

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CUSTOMER

Rev.	Date	Description
0	10/10/2024	Issued specification
1	13/1/2025	Update Table 1

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 flame retardant shielded instrument cable.

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

- Flame retardant test requirements per IEC 60332-1.
- Flame propagation test requirements per IEC 60332-3-24; Category C.

## 2. Conductor

For size  $\leq 0.5 \text{ mm}^2$  :

The conductor shall be flexible stranded uncoated annealed copper conductor accordance with BS EN 60228 : 2005, Class 5.

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

For size  $\geq 1 \text{ mm}^2$  :

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

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 and flame retardant 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 by printed at intervals not exceeding 1 meter 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 "500V"
5. Type of conductor "CU"
6. Type of insulation and sheath "PVC/PVC"
7. Type of cable "INSTRUMENT CABLE"
8. Number of pairs and size of conductor
9. The continuous reel length marking (in figure) shall be made on the sheath at every 1 meter  
Except size 1P x 0.5 mm<sup>2</sup>

## 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, IEC 60332-1 and IEC 60332-3-24 ; Category C.


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 "FD-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 "  YAZAKI "
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 IEC 60332-1.
- Flame propagation test according to IEC 60332-3-24; Category C.

### **Definition concerning the tests**

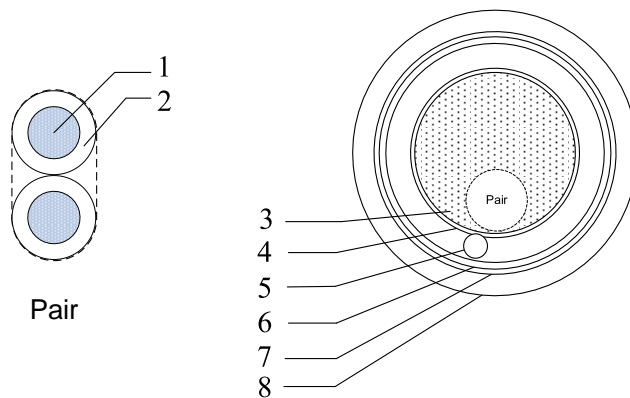
**Routine tests:** Tests made by the manufacturer on each manufactured length of cable to check that each length meets the specified requirements.

**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	Annealed copper
2	Insulation	Polyvinyl chloride (PVC) compound
3	Filler	Non-hygroscopic
4	Binder tape	PS tape or suitable tape
5	Drain wire	Tin-coated copper drain wire
6	Metallic shield	Aluminium foil tape
7	Separator tape	PS tape or suitable tape (For multi-pairs only)
8	Sheath	Flame retardant polyvinyl chloride (PVC) compound

**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	7.5	39.0	59	300
1P	0.75	Flexible	1.15	0.6	1.0	8.0	26.0	67	300
1P	1	7/Non-compacted	1.29	0.6	1.0	8.5	18.1	79	300
1P	1.5	7/Non-compacted	1.59	0.6	1.0	9.0	12.1	94	300
1P	2.5	7/Non-compacted	2.01	0.6	1.0	10.0	7.41	122	300
2P	0.5	Flexible	0.95	0.6	1.0	12.0	39.8	114	300
2P	0.75	Flexible	1.15	0.6	1.1	13.0	26.5	139	300
2P	1	7/Non-compacted	1.29	0.6	1.1	13.0	18.5	155	300
2P	1.5	7/Non-compacted	1.59	0.6	1.1	14.0	12.3	196	300
2P	2.5	7/Non-compacted	2.01	0.6	1.2	16.0	7.56	261	300
3P	0.5	Flexible	0.95	0.6	1.0	12.5	39.8	129	300
3P	0.75	Flexible	1.15	0.6	1.1	13.5	26.5	160	300
3P	1	7/Non-compacted	1.29	0.6	1.1	14.0	18.5	188	300
3P	1.5	7/Non-compacted	1.59	0.6	1.1	15.0	12.3	234	300
3P	2.5	7/Non-compacted	2.01	0.6	1.2	17.0	7.56	316	300
4P	0.5	Flexible	0.95	0.6	1.1	14.0	39.8	162	300
4P	0.75	Flexible	1.15	0.6	1.1	14.5	26.5	190	300
4P	1	7/Non-compacted	1.29	0.6	1.2	15.5	18.5	235	300
4P	1.5	7/Non-compacted	1.59	0.6	1.2	16.5	12.3	296	300
4P	2.5	7/Non-compacted	2.01	0.6	1.3	19.0	7.56	404	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	15.0	39.8	189	300
5P	0.75	Flexible	1.15	0.6	1.2	16.5	26.5	237	300
5P	1	7/Non-compacted	1.29	0.6	1.2	17.0	18.5	280	300
5P	1.5	7/Non-compacted	1.59	0.6	1.3	18.5	12.3	365	300
5P	2.5	7/Non-compacted	2.01	0.6	1.3	21.0	7.56	488	300
6P	0.5	Flexible	0.95	0.6	1.2	16.5	39.8	229	300
6P	0.75	Flexible	1.15	0.6	1.2	18.0	26.5	272	300
6P	1	7/Non-compacted	1.29	0.6	1.3	18.5	18.5	340	300
6P	1.5	7/Non-compacted	1.59	0.6	1.3	20.0	12.3	433	300
6P	2.5	7/Non-compacted	2.01	0.6	1.4	23.0	7.56	589	300
7P	0.5	Flexible	0.95	0.6	1.2	16.5	39.8	238	300
7P	0.75	Flexible	1.15	0.6	1.2	18.0	26.5	286	300
7P	1	7/Non-compacted	1.29	0.6	1.3	18.5	18.5	356	300
7P	1.5	7/Non-compacted	1.59	0.6	1.3	20.0	12.3	457	300
7P	2.5	7/Non-compacted	2.01	0.6	1.4	23.0	7.56	628	300
8P	0.5	Flexible	0.95	0.6	1.2	18.0	39.8	282	300
8P	0.75	Flexible	1.15	0.6	1.3	19.5	26.5	350	300
8P	1	7/Non-compacted	1.29	0.6	1.3	20.0	18.5	427	300
8P	1.5	7/Non-compacted	1.59	0.6	1.4	22.0	12.3	549	300
8P	2.5	7/Non-compacted	2.01	0.6	1.5	25.5	7.56	760	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	1.2	18.0	39.8	314	300
9P	0.75	Flexible	1.15	0.6	1.3	19.5	26.5	387	300
9P	1	7/Non-compacted	1.29	0.6	1.3	20.0	18.5	464	300
9P	1.5	7/Non-compacted	1.59	0.6	1.4	22.0	12.3	612	300
9P	2.5	7/Non-compacted	2.01	0.6	1.5	25.5	7.56	849	300
10P	0.5	Flexible	0.95	0.6	1.3	21.0	39.8	365	300
10P	0.75	Flexible	1.15	0.6	1.4	23.0	26.5	445	300
10P	1	7/Non-compacted	1.29	0.6	1.4	23.5	18.5	536	300
10P	1.5	7/Non-compacted	1.59	0.6	1.5	26.0	12.3	707	300
10P	2.5	7/Non-compacted	2.01	0.6	1.6	30.0	7.56	958	300
11P	0.5	Flexible	0.95	0.6	1.3	21.0	39.8	370	300
11P	0.75	Flexible	1.15	0.6	1.4	23.0	26.5	456	300
11P	1.0	7/Non-compacted	1.29	0.6	1.4	23.5	18.5	546	300
11P	1.5	7/Non-compacted	1.59	0.6	1.5	26.0	12.3	729	300
11P	2.5	7/Non-compacted	2.01	0.6	1.6	30.0	7.56	993	300
12P	0.5	Flexible	0.95	0.6	1.4	22.0	39.8	408	300
12P	0.75	Flexible	1.15	0.6	1.4	23.5	26.5	501	300
12P	1	7/Non-compacted	1.29	0.6	1.5	25.0	18.5	616	300
12P	1.5	7/Non-compacted	1.59	0.6	1.6	27.5	12.3	802	300
12P	2.5	7/Non-compacted	2.01	0.6	1.7	31.5	7.56	1104	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	23.5	39.8	433	300
13P	0.75	Flexible	1.15	0.6	1.5	25.5	26.5	546	300
13P	1	7/Non-compacted	1.29	0.6	1.5	26.0	18.5	660	300
13P	1.5	7/Non-compacted	1.59	0.6	1.6	28.5	12.3	866	300
13P	2.5	7/Non-compacted	2.01	0.6	1.7	33.0	7.56	1186	300
14P	0.5	Flexible	0.95	0.6	1.4	23.5	39.8	426	300
14P	0.75	Flexible	1.15	0.6	1.5	25.5	26.5	545	300
14P	1	7/Non-compacted	1.29	0.6	1.5	26.0	18.5	657	300
14P	1.5	7/Non-compacted	1.59	0.6	1.6	28.5	12.3	867	300
14P	2.5	7/Non-compacted	2.01	0.6	1.7	33.0	7.56	1198	300
15P	0.5	Flexible	0.95	0.6	1.4	24.0	39.8	466	300
15P	0.75	Flexible	1.15	0.6	1.5	26.0	26.5	593	300
15P	1	7/Non-compacted	1.29	0.6	1.6	27.0	18.5	728	300
15P	1.5	7/Non-compacted	1.59	0.6	1.6	29.5	12.3	943	300
15P	2.5	7/Non-compacted	2.01	0.6	1.8	34.5	7.56	1309	300
16P	0.5	Flexible	0.95	0.6	1.4	24.5	39.8	476	300
16P	0.75	Flexible	1.15	0.6	1.5	26.5	26.5	611	300
16P	1	7/Non-compacted	1.29	0.6	1.6	28.0	18.5	750	300
16P	1.5	7/Non-compacted	1.59	0.6	1.7	30.5	12.3	990	300
16P	2.5	7/Non-compacted	2.01	0.6	1.8	35.0	7.56	1354	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	26.5	39.8	559	300
17P	0.75	Flexible	1.15	0.6	1.6	28.5	26.5	685	300
17P	1	7/Non-compacted	1.29	0.6	1.6	29.0	18.5	836	300
17P	1.5	7/Non-compacted	1.59	0.6	1.7	32.0	12.3	1092	300
17P	2.5	7/Non-compacted	2.01	0.6	1.9	37.0	7.56	1523	300
18P	0.5	Flexible	0.95	0.6	1.5	26.5	39.8	533	300
18P	0.75	Flexible	1.15	0.6	1.6	28.5	26.5	665	300
18P	1	7/Non-compacted	1.29	0.6	1.6	29.0	18.5	811	300
18P	1.5	7/Non-compacted	1.59	0.6	1.7	32.0	12.3	1069	300
18P	2.5	7/Non-compacted	2.01	0.6	1.9	37.0	7.56	1497	300
19P	0.5	Flexible	0.95	0.6	1.5	26.5	39.8	542	300
19P	0.75	Flexible	1.15	0.6	1.6	28.5	26.5	679	300
19P	1	7/Non-compacted	1.29	0.6	1.6	29.0	18.5	827	300
19P	1.5	7/Non-compacted	1.59	0.6	1.7	32.0	12.3	1092	300
19P	2.5	7/Non-compacted	2.01	0.6	1.9	37.0	7.56	1534	300
20P	0.5	Flexible	0.95	0.6	1.5	27.0	39.8	578	300
20P	0.75	Flexible	1.15	0.6	1.6	29.0	26.5	721	300
20P	1	7/Non-compacted	1.29	0.6	1.7	30.0	18.5	897	300
20P	1.5	7/Non-compacted	1.59	0.6	1.8	33.0	12.3	1181	300
20P	2.5	7/Non-compacted	2.01	0.6	1.9	38.0	7.56	1636	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	27.5	39.8	635	300
21P	0.75	Flexible	1.15	0.6	1.6	30.0	26.5	796	300
21P	1	7/Non-compacted	1.29	0.6	1.7	31.0	18.5	982	300
21P	1.5	7/Non-compacted	1.59	0.6	1.8	34.0	12.3	1294	300
21P	2.5	7/Non-compacted	2.01	0.6	1.9	39.0	7.56	1786	300
22P	0.5	Flexible	0.95	0.6	1.6	29.5	39.8	655	300
22P	0.75	Flexible	1.15	0.6	1.7	31.5	26.5	819	300
22P	1	7/Non-compacted	1.29	0.6	1.7	32.5	18.5	996	300
22P	1.5	7/Non-compacted	1.59	0.6	1.9	36.0	12.3	1326	300
23P	0.5	Flexible	0.95	0.6	1.6	29.5	39.8	668	300
23P	0.75	Flexible	1.15	0.6	1.7	31.5	26.5	837	300
23P	1	7/Non-compacted	1.29	0.6	1.7	32.5	18.5	999	300
23P	1.5	7/Non-compacted	1.59	0.6	1.9	36.0	12.3	1333	300
24P	0.5	Flexible	0.95	0.6	1.6	31.0	39.8	697	300
24P	0.75	Flexible	1.15	0.6	1.7	33.0	26.5	874	300
24P	1	7/Non-compacted	1.29	0.6	1.8	34.5	18.5	1081	300
24P	1.5	7/Non-compacted	1.59	0.6	1.9	38.0	12.3	1418	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	31.0	39.8	715	300
25P	0.75	Flexible	1.15	0.6	1.7	33.0	26.5	897	300
25P	1	7/Non-compacted	1.29	0.6	1.8	34.5	18.5	1112	300
25P	1.5	7/Non-compacted	1.59	0.6	1.9	38.0	12.3	1461	300
26P	0.5	Flexible	0.95	0.6	1.6	31.0	39.8	734	300
26P	0.75	Flexible	1.15	0.6	1.7	33.0	26.5	922	300
26P	1	7/Non-compacted	1.29	0.6	1.8	34.5	18.5	1143	300
26P	1.5	7/Non-compacted	1.59	0.6	1.9	38.0	12.3	1504	300
27P	0.5	Flexible	0.95	0.6	1.7	32.0	39.8	756	300
27P	0.75	Flexible	1.15	0.6	1.7	34.0	26.5	934	300
27P	1	7/Non-compacted	1.29	0.6	1.8	35.5	18.5	1158	300
27P	1.5	7/Non-compacted	1.59	0.6	2.0	39.0	12.3	1546	300
28P	0.5	Flexible	0.95	0.6	1.7	33.0	39.8	834	300
28P	0.75	Flexible	1.15	0.6	1.8	35.5	26.5	1043	300
28P	1	7/Non-compacted	1.29	0.6	1.9	37.0	18.5	1288	300
29P	0.5	Flexible	0.95	0.6	1.7	33.0	39.8	786	300
29P	0.75	Flexible	1.15	0.6	1.8	35.5	26.5	986	300
29P	1	7/Non-compacted	1.29	0.6	1.9	37.0	18.5	1221	300
30P	0.5	Flexible	0.95	0.6	1.7	33.0	39.8	824	300
30P	0.75	Flexible	1.15	0.6	1.8	35.5	26.5	1035	300
30P	1	7/Non-compacted	1.29	0.6	1.9	37.0	18.5	1284	300