



## 1. Scope

This specification covers 1000V copper conductor cross-linked polyethylene (XLPE) insulated polyolefin sheathed flame retardant and vermin proof with low smoke and zero halogen control cable.

The cable shall be based on IEC 60502-1 : 2021.

The maximum conductor temperature shall be 90°C.

The finished cables shall meet the vertical tray flame test requirements per IEC 60332-1 and IEC 60332-3-22; Category A.

Low smoke test requirements per IEC 61034 and acid gas determinations test requirements per IEC 60754-1 and IEC 60754-2.

## 2. Conductor

The conductor shall be non-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.

## 3. Insulation

The insulation shall be cross-linked polyethylene (XLPE) compound meet the requirements of IEC 60502-1 : 2021.

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

The minimum thickness shall be not fall below 90% of the nominal value in Table 1 by more than 0.1 mm.

## 4. Cabling

The individual insulated cores shall be cabled together with suitable non-hygroscopic filler to give the completed cable 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 cabled core.

## 5. Core Identification

The cores shall be identified by colors or by numbers printed on the insulation, as follows:

2-cores : blue, brown

3-cores : brown, black, grey

4-cores : blue, brown, black, grey

For 5-cores to 30-cores :

The cores shall be identified by the arabic numerals printed longitudinally and continuously on the surface of white insulation.

## 6. Sheath

The sheath shall be sunlight resistant, low smoke and zero halogen flame retardant and resistant to vermin by special chemical treated polyolefin (ST8) compound meet the requirements of IEC 60502-1 : 2021. (vermin means rat, termite)


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

The minimum thickness shall not fall below 80% of the nominal value in Table 1 by more than 0.2 mm.

The color of the sheath shall be black.

## 7. 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. Cable property code "FDLH"
4. Rated circuit voltage "0.6/1KV"
5. Type of conductor "CU"
6. Type of insulation and sheath "XLPE/LSOH"
7. Type of cable "CONTROL CABLE"
8. Number cores and size of conductor
9. The continuous reel length marking (in figure) shall be made on the sheath at every 1 meter

## 8. Test and Properties

The cable shall meet the requirements in Test and Inspection and Table 1, when tested in accordance with IEC 60502-1 : 2021, IEC 60228 : 2004, IEC 60332-1, IEC 60332-3-22; Category A., IEC 61034, IEC 60754-1 and IEC 60754-2.


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

## 9. 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 "FDLH-0.6/1KV-CCE (VM)"
2. Number of cores and size of cable
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 Tests

- Maximum conductor resistance, Ohm/km..... specified in Table 1
- AC test voltage for 5 minutes, kV..... 3.5

### Sample Tests

- Construction ..... specified in Table 1
- 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 60332-3-22; Category A.
- Smoke emission tested according to IEC 61034.
- Halogen gases tested according to IEC 60754-1 and IEC 60754-2.

### Definition concerning the tests

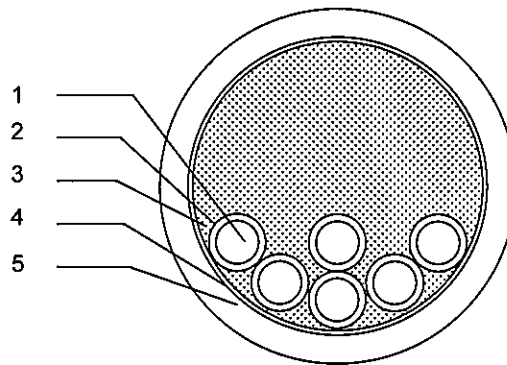
**Routine tests:** Tests made by the manufacturer on each manufactured length of cable to check that each length meets the specified requirements.

**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	Stranded annealed copper
2	Insulation	Cross-linked polyethylene (XLPE)
3	Filler	Non-hygroscopic
4	Binder tape	PS tape or suitable tape
5	Sheath	Low smoke and zero halogen flame retardant and vermin proof polyolefin (ST8)

**Application:** For installed into tray, conduit, underground duct trench or direct burial in ground which provide flame retardant, low smoke and non toxic emission under fire. Maximum conductor temperature of 90°C for normal operation and 250°C for short circuit conditions.

**Table 1**

No. of cores	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)
2	1	7/Non-compacted	1.29	0.7	1.8	10.5	18.1	108	300
2	1.5	7/Non-compacted	1.59	0.7	1.8	11.0	12.1	127	300
2	2.5	7/Non-compacted	2.01	0.7	1.8	12.0	7.41	156	300
2	4	7/Non-compacted	2.55	0.7	1.8	13.0	4.61	200	300
2	6	7/Non-compacted	3.12	0.7	1.8	14.0	3.08	256	300
3	1	7/Non-compacted	1.29	0.7	1.8	11.0	18.1	125	300
3	1.5	7/Non-compacted	1.59	0.7	1.8	11.5	12.1	152	300
3	2.5	7/Non-compacted	2.01	0.7	1.8	12.5	7.41	190	300
3	4	7/Non-compacted	2.55	0.7	1.8	13.5	4.61	249	300
3	6	7/Non-compacted	3.12	0.7	1.8	15.0	3.08	326	300
4	1	7/Non-compacted	1.29	0.7	1.8	11.5	18.1	149	300
4	1.5	7/Non-compacted	1.59	0.7	1.8	12.0	12.1	180	300
4	2.5	7/Non-compacted	2.01	0.7	1.8	13.5	7.41	229	300
4	4	7/Non-compacted	2.55	0.7	1.8	14.5	4.61	305	300
4	6	7/Non-compacted	3.12	0.7	1.8	16.0	3.08	406	300
5	1	7/Non-compacted	1.29	0.7	1.8	12.5	18.1	176	300
5	1.5	7/Non-compacted	1.59	0.7	1.8	13.0	12.1	212	300
5	2.5	7/Non-compacted	2.01	0.7	1.8	14.5	7.41	273	300
5	4	7/Non-compacted	2.55	0.7	1.8	16.0	4.61	369	300
5	6	7/Non-compacted	3.12	0.7	1.8	17.5	3.08	488	300
6	1	7/Non-compacted	1.29	0.7	1.8	13.0	18.1	196	300
6	1.5	7/Non-compacted	1.59	0.7	1.8	14.0	12.1	247	300
6	2.5	7/Non-compacted	2.01	0.7	1.8	15.5	7.41	318	300
6	4	7/Non-compacted	2.55	0.7	1.8	17.0	4.61	428	300
6	6	7/Non-compacted	3.12	0.7	1.8	19.0	3.08	576	300
7	1	7/Non-compacted	1.29	0.7	1.8	13.0	18.1	208	300
7	1.5	7/Non-compacted	1.59	0.7	1.8	14.0	12.1	264	300
7	2.5	7/Non-compacted	2.01	0.7	1.8	15.5	7.41	344	300
7	4	7/Non-compacted	2.55	0.7	1.8	17.0	4.61	467	300
7	6	7/Non-compacted	3.12	0.7	1.8	19.0	3.08	634	300

**Table 1**

No. of cores	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)
8	1	7/Non-compacted	1.29	0.7	1.8	14.0	18.1	233	300
8	1.5	7/Non-compacted	1.59	0.7	1.8	15.0	12.1	297	300
8	2.5	7/Non-compacted	2.01	0.7	1.8	17.0	7.41	398	300
8	4	7/Non-compacted	2.55	0.7	1.8	18.5	4.61	542	300
8	6	7/Non-compacted	3.12	0.7	1.8	20.5	3.08	738	300
9	1	7/Non-compacted	1.29	0.7	1.8	15.0	18.1	267	300
9	1.5	7/Non-compacted	1.59	0.7	1.8	16.0	12.1	331	300
9	2.5	7/Non-compacted	2.01	0.7	1.8	18.0	7.41	447	300
9	4	7/Non-compacted	2.55	0.7	1.8	20.0	4.61	608	300
9	6	7/Non-compacted	3.12	0.7	1.8	22.0	3.08	827	300
10	1	7/Non-compacted	1.29	0.7	1.8	16.0	18.1	296	300
10	1.5	7/Non-compacted	1.59	0.7	1.8	17.0	12.1	366	300
10	2.5	7/Non-compacted	2.01	0.7	1.8	19.0	7.41	491	300
10	4	7/Non-compacted	2.55	0.7	1.8	21.0	4.61	675	300
10	6	7/Non-compacted	3.12	0.7	1.8	23.5	3.08	915	300
11	1	7/Non-compacted	1.29	0.7	1.8	16.0	18.1	304	300
11	1.5	7/Non-compacted	1.59	0.7	1.8	17.0	12.1	380	300
11	2.5	7/Non-compacted	2.01	0.7	1.8	19.0	7.41	516	300
11	4	7/Non-compacted	2.55	0.7	1.8	21.0	4.61	707	300
11	6	7/Non-compacted	3.12	0.7	1.8	23.5	3.08	969	300
12	1	7/Non-compacted	1.29	0.7	1.8	16.5	18.1	331	300
12	1.5	7/Non-compacted	1.59	0.7	1.8	18.0	12.1	417	300
12	2.5	7/Non-compacted	2.01	0.7	1.8	20.0	7.41	560	300
12	4	7/Non-compacted	2.55	0.7	1.8	22.0	4.61	769	300
12	6	7/Non-compacted	3.12	0.7	1.8	24.5	3.08	1052	300



**Table 1 (continued)**

No. of cores	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)
13	1	7/Non-compacted	1.29	0.7	1.8	17.5	18.1	351	300
13	1.5	7/Non-compacted	1.59	0.7	1.8	18.5	12.1	450	300
13	2.5	7/Non-compacted	2.01	0.7	1.8	21.0	7.41	595	300
13	4	7/Non-compacted	2.55	0.7	1.8	23.0	4.61	826	300
13	6	7/Non-compacted	3.12	0.7	1.8	26.0	3.08	1129	300
14	1	7/Non-compacted	1.29	0.7	1.8	17.5	18.1	358	300
14	1.5	7/Non-compacted	1.59	0.7	1.8	18.5	12.1	454	300
14	2.5	7/Non-compacted	2.01	0.7	1.8	21.0	7.41	619	300
14	4	7/Non-compacted	2.55	0.7	1.8	23.0	4.61	856	300
14	6	7/Non-compacted	3.12	0.7	1.8	26.0	3.08	1170	300
15	1	7/Non-compacted	1.29	0.7	1.8	18.0	18.1	383	300
15	1.5	7/Non-compacted	1.59	0.7	1.8	19.0	12.1	485	300
15	2.5	7/Non-compacted	2.01	0.7	1.8	21.5	7.41	665	300
15	4	7/Non-compacted	2.55	0.7	1.8	24.0	4.61	923	300
15	6	7/Non-compacted	3.12	0.7	1.8	26.5	3.08	1263	300
16	1	7/Non-compacted	1.29	0.7	1.8	18.0	18.1	399	300
16	1.5	7/Non-compacted	1.59	0.7	1.8	19.5	12.1	507	300
16	2.5	7/Non-compacted	2.01	0.7	1.8	22.0	7.41	695	300
16	4	7/Non-compacted	2.55	0.7	1.8	24.5	4.61	966	300
16	6	7/Non-compacted	3.12	0.7	1.8	27.0	3.08	1323	300
17	1	7/Non-compacted	1.29	0.7	1.8	19.0	18.1	436	300
17	1.5	7/Non-compacted	1.59	0.7	1.8	20.5	12.1	552	300
17	2.5	7/Non-compacted	2.01	0.7	1.8	23.0	7.41	750	300
17	4	7/Non-compacted	2.55	0.7	1.8	25.5	4.61	1051	300
17	6	7/Non-compacted	3.12	0.7	1.8	28.5	3.08	1433	300
18	1	7/Non-compacted	1.29	0.7	1.8	19.0	18.1	441	300
18	1.5	7/Non-compacted	1.59	0.7	1.8	20.5	12.1	563	300
18	2.5	7/Non-compacted	2.01	0.7	1.8	23.0	7.41	760	300
18	4	7/Non-compacted	2.55	0.7	1.8	25.5	4.61	1065	300
18	6	7/Non-compacted	3.12	0.7	1.8	28.5	3.08	1466	300

**Table 1 (continued)**

No. of cores	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)
19	1	7/Non-compacted	1.29	0.7	1.8	19.0	18.1	453	300
19	1.5	7/Non-compacted	1.59	0.7	1.8	20.5	12.1	579	300
19	2.5	7/Non-compacted	2.01	0.7	1.8	23.0	7.41	785	300
19	4	7/Non-compacted	2.55	0.7	1.8	25.5	4.61	1104	300
19	6	7/Non-compacted	3.12	0.7	1.8	28.5	3.08	1523	300
20	1	7/Non-compacted	1.29	0.7	1.8	19.5	18.1	473	300
20	1.5	7/Non-compacted	1.59	0.7	1.8	21.0	12.1	612	300
20	2.5	7/Non-compacted	2.01	0.7	1.8	23.5	7.41	829	300
20	4	7/Non-compacted	2.55	0.7	1.8	26.0	4.61	1163	300
20	6	7/Non-compacted	3.12	0.7	1.8	29.5	3.08	1610	300
21	1	7/Non-compacted	1.29	0.7	1.8	20.0	18.1	494	300
21	1.5	7/Non-compacted	1.59	0.7	1.8	21.5	12.1	635	300
21	2.5	7/Non-compacted	2.01	0.7	1.8	24.0	7.41	862	300
21	4	7/Non-compacted	2.55	0.7	1.8	27.0	4.61	1245	300
21	6	7/Non-compacted	3.12	0.7	1.9	30.5	3.08	1736	300
22	1	7/Non-compacted	1.29	0.7	1.8	21.0	18.1	528	300
22	1.5	7/Non-compacted	1.59	0.7	1.8	22.5	12.1	676	300
22	2.5	7/Non-compacted	2.01	0.7	1.8	25.5	7.41	918	300
22	4	7/Non-compacted	2.55	0.7	1.8	28.0	4.61	1289	300
22	6	7/Non-compacted	3.12	0.7	1.9	32.0	3.08	1796	300
23	1	7/Non-compacted	1.29	0.7	1.8	21.0	18.1	538	300
23	1.5	7/Non-compacted	1.59	0.7	1.8	22.5	12.1	691	300
23	2.5	7/Non-compacted	2.01	0.7	1.8	25.5	7.41	990	300
23	4	7/Non-compacted	2.55	0.7	1.8	28.0	4.61	1388	300
23	6	7/Non-compacted	3.12	0.7	1.9	32.0	3.08	1934	300
24	1	7/Non-compacted	1.29	0.7	1.8	22.0	18.1	565	300
24	1.5	7/Non-compacted	1.59	0.7	1.8	23.5	12.1	726	300
24	2.5	7/Non-compacted	2.01	0.7	1.8	26.5	7.41	988	300
24	4	7/Non-compacted	2.55	0.7	1.8	29.5	4.61	1391	300
24	6	7/Non-compacted	3.12	0.7	2.0	33.5	3.08	1955	300

**Table 1 (continued)**

No. of cores	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)
25	1	7/Non-compacted	1.29	0.7	1.8	22.0	18.1	581	300
25	1.5	7/Non-compacted	1.59	0.7	1.8	23.5	12.1	748	300
25	2.5	7/Non-compacted	2.01	0.7	1.8	26.5	7.41	1019	300
25	4	7/Non-compacted	2.55	0.7	1.8	29.5	4.61	1437	300
25	6	7/Non-compacted	3.12	0.7	2.0	33.5	3.08	2021	300
26	1	7/Non-compacted	1.29	0.7	1.8	22.0	18.1	597	300
26	1.5	7/Non-compacted	1.59	0.7	1.8	23.5	12.1	770	300
26	2.5	7/Non-compacted	2.01	0.7	1.8	26.5	7.41	1051	300
26	4	7/Non-compacted	2.55	0.7	1.8	29.5	4.61	1484	300
26	6	7/Non-compacted	3.12	0.7	2.0	33.5	3.08	2089	300
27	1	7/Non-compacted	1.29	0.7	1.8	22.5	18.1	612	300
27	1.5	7/Non-compacted	1.59	0.7	1.8	24.0	12.1	789	300
27	2.5	7/Non-compacted	2.01	0.7	1.8	27.5	7.41	1079	300
27	4	7/Non-compacted	2.55	0.7	1.9	30.5	4.61	1540	300
27	6	7/Non-compacted	3.12	0.7	2.0	34.5	3.08	2148	300
28	1	7/Non-compacted	1.29	0.7	1.8	23.0	18.1	653	300
28	1.5	7/Non-compacted	1.59	0.7	1.8	25.0	12.1	841	300
28	2.5	7/Non-compacted	2.01	0.7	1.8	28.5	7.41	1148	300
28	4	7/Non-compacted	2.55	0.7	1.9	31.5	4.61	1635	300
28	6	7/Non-compacted	3.12	0.7	2.0	36.0	3.08	2279	300
29	1	7/Non-compacted	1.29	0.7	1.8	23.0	18.1	651	300
29	1.5	7/Non-compacted	1.59	0.7	1.8	25.0	12.1	842	300
29	2.5	7/Non-compacted	2.01	0.7	1.8	28.5	7.41	1152	300
29	4	7/Non-compacted	2.55	0.7	1.9	31.5	4.61	1646	300
29	6	7/Non-compacted	3.12	0.7	2.0	36.0	3.08	2299	300

**Table 1 (continued)**

No. of cores	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)
30	1	7/Non-compacted	1.29	0.7	1.8	23.0	18.1	667	300
30	1.5	7/Non-compacted	1.59	0.7	1.8	25.0	12.1	864	300
30	2.5	7/Non-compacted	2.01	0.7	1.8	28.5	7.41	1184	300
30	4	7/Non-compacted	2.55	0.7	1.9	31.5	4.61	1693	300
30	6	7/Non-compacted	3.12	0.7	2.0	36.0	3.08	2367	300