

SPECIFICATION**For****FDLH-0.6/1KV-CE-SWA**

0.6/1(1.2)kV Copper Conductor XLPE Insulated

Polyolefin Inner Sheathed Steel Wire Armored

Polyolefin Outer Sheathed Flame Retardant

with Low Smoke and Zero Halogen Power Cable

(0.6/1(1.2)kV, Cu/XLPE/FR-LSOH/SWA/FR-LSOH)

BY Wachara

(Wachara Sangsomritphon)

MANAGER, Cable Design Section

APP. Wachara

(Winai Ariyasakulsap)

MANAGER, Development Department

APP. _____

()

CUSTOMER

Rev.	Date	Description
0	4/12/2019	Issued specification
1	11/5/2020	Correct the value in Table 1
2	22/3/2021	- Cancel cable code "0010" - Add 5-cores
3	26/08/2021	Update the test standard version

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 1000V copper conductor cross-linked polyethylene (XLPE) insulated polyolefin inner sheathed steel wire armored polyolefin outer sheathed flame retardant with low smoke and zero halogen power cable.

The cable shall be based on IEC 60502-1 : 2004 and Amend.1 : 2009.

The maximum conductor temperature shall be 90°C.

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

Extremely low toxicity gases test requirements per IEC 60684-2 and Defence Standard 02-713

2. Conductor

For size $\leq 6 \text{ mm}^2$:

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.

For size $\geq 10 \text{ mm}^2$:

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. Insulation

The insulation shall be cross-linked polyethylene (XLPE) compound meet the requirements of IEC 60502-1 : 2004.

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 2 by more than 10% plus 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, as follows :

2-cores : blue, brown

3-cores : brown, black, grey

4-cores : blue, brown, black, grey

5-cores : blue, brown, black, grey, green/yellow

6. Inner Sheath

The inner sheath shall be low smoke and zero halogen flame retardant polyolefin compound applied over the binder tape.

The approximate thickness given in Table 1.

The color of the inner sheath shall be black.

7. Steel Wire Armor

The armor shall be galvanized round steel wire applied with a minimum gap between adjacent wires over the inner sheathed.

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

8. Outer Sheath

The outer sheath shall be sunlight resistant, low smoke and zero halogen flame retardant polyolefin (ST8) compound meet the requirements of IEC 60502-1 : 2004.

The average thickness of the outer 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 20% plus 0.2 mm.

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

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. Cable property code "FDLH"

4. Rated circuit voltage "0.6/1KV"

5. Type of insulation "XLPE"

6. Type of cable "POWER CABLE"

7. Number of cores and size of conductor

8. The continuous reel length marking (in figure) shall be made on the outer sheath at every 1 meter

10. Test and Properties

The cable shall meet the requirements in Test and Inspection and Table 1, when tested in accordance with IEC 60502-1 : 2004 and Amend. 1 : 2009, IEC 60228 : 2004, IEC 60332-1, IEC 60332-3-24; Category C, IEC 60332-3-22; Category A, IEC 61034, IEC 60754-1, IEC 60754-2, IEC 60684-2 and Defence Standard 02-713

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.

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 "FDLH-0.6/1KV-CE-SWA"
2. Number of cores 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 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, IEC 60332-3-24; Category C 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.
- Extremely low toxicity gases test according to IEC 60684-2 and Defence Standard 02-713

Definition concerning the tests

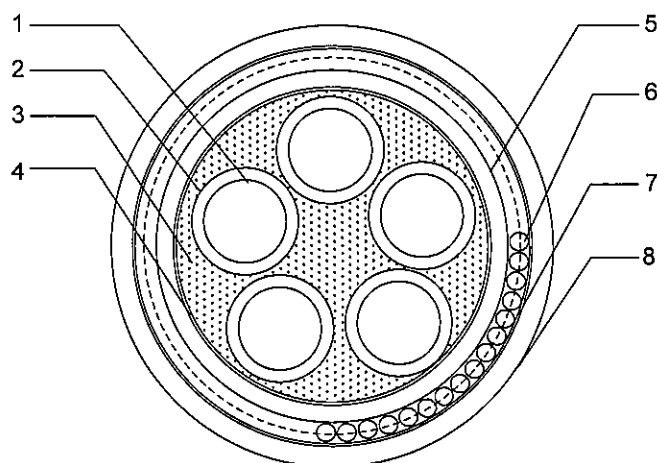
Routine tests: Tests made by the manufacturer on each manufactured length of cable to check that each length meets the specified requirements.

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 & Compacted concentric stranded annealed copper
2	Insulation	Cross-Linked Polyethylene (XLPE)
3	Filler	PP Calcium Yarn (Non-hygrosopic)
4	Binder tape	PS tape or suitable tape
5	Inner sheath	Low smoke and Zero halogen Flame retardant Polyolefin
6	Armor	Galvanized steel wire
7	Binder tape	PS tape or suitable tape
8	Outer sheath	Low smoke and zero halogen flame retardant 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 ²)	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)
2	1.5	7/Non-compacted	1.59	0.7	1.2	9.5	0.80	1.8	15.5	12.1	360	500
2	2.5	7/Non-compacted	2.01	0.7	1.2	10.5	0.80	1.8	16.5	7.41	410	500
2	4	7/Non-compacted	2.55	0.7	1.2	11.5	1.25	1.8	18.5	4.61	600	500
2	6	7/Non-compacted	3.12	0.7	1.2	13.0	1.25	1.8	19.5	3.08	700	500
2	10	7/Compacted	3.80	0.7	1.2	14.0	1.25	1.8	20.5	1.83	800	500
2	16	7/Compacted	4.80	0.7	1.2	16.0	1.60	1.8	23.5	1.15	1100	500
2	25	7/Compacted	6.00	0.9	1.2	19.5	1.60	1.8	26.5	0.727	1500	500
2	35	7/Compacted	7.10	0.9	1.2	21.5	1.60	1.8	29.0	0.524	1800	500
2	50	19/Compacted	8.30	1.0	1.2	24.5	2.00	2.0	33.0	0.387	2400	500
2	70	19/Compacted	9.90	1.1	1.2	28.0	2.00	2.1	37.0	0.268	3000	500
2	95	19/Compacted	11.70	1.1	1.2	31.5	2.00	2.2	41.0	0.193	3800	500
2	120	37/Compacted	13.20	1.2	1.2	35.0	2.00	2.4	45.0	0.153	4500	500
2	150	37/Compacted	14.60	1.4	1.3	39.0	2.50	2.5	50.0	0.124	6000	500
2	185	37/Compacted	16.30	1.6	1.4	43.5	2.50	2.7	55.0	0.0991	7000	500
2	240	61/Compacted	18.70	1.7	1.5	49.5	2.50	2.9	61.0	0.0754	8500	500
2	300	61/Compacted	20.90	1.8	1.6	54.5	2.50	3.1	67.0	0.0601	10000	300
2	400	61/Compacted	23.50	2.0	1.7	61.0	2.50	3.3	73.5	0.0470	12500	300

Table 1 (continued)

No. of cores	Size (mm ²)	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)
3	1.5	7/Non-compacted	1.59	0.7	1.2	10.0	0.80	1.8	16.0	12.1	400	500
3	2.5	7/Non-compacted	2.01	0.7	1.2	11.0	1.25	1.8	18.0	7.41	550	500
3	4	7/Non-compacted	2.55	0.7	1.2	12.5	1.25	1.8	19.0	4.61	650	500
3	6	7/Non-compacted	3.12	0.7	1.2	13.5	1.25	1.8	20.5	3.08	750	500
3	10	7/Compacted	3.80	0.7	1.2	14.5	1.25	1.8	21.5	1.83	950	500
3	16	7/Compacted	4.80	0.7	1.2	17.0	1.60	1.8	24.5	1.15	1300	500
3	25	7/Compacted	6.00	0.9	1.2	20.5	1.60	1.8	28.0	0.727	1800	500
3	35	7/Compacted	7.10	0.9	1.2	23.0	2.00	1.9	31.5	0.524	2400	500
3	50	19/Compacted	8.30	1.0	1.2	26.0	2.00	2.0	35.0	0.387	2900	500
3	70	19/Compacted	9.90	1.1	1.2	30.0	2.00	2.2	39.5	0.268	3800	500
3	95	19/Compacted	11.70	1.1	1.2	34.0	2.00	2.3	43.5	0.193	4800	500
3	120	37/Compacted	13.20	1.2	1.3	38.0	2.50	2.5	49.0	0.153	6000	500
3	150	37/Compacted	14.60	1.4	1.4	42.0	2.50	2.6	53.0	0.124	7500	500
3	185	37/Compacted	16.30	1.6	1.5	47.5	2.50	2.8	59.0	0.0991	9000	500
3	240	61/Compacted	18.70	1.7	1.6	53.0	2.50	3.0	65.5	0.0754	11000	300
3	300	61/Compacted	20.90	1.8	1.7	58.5	2.50	3.2	71.0	0.0601	13500	300
3	400	61/Compacted	23.50	2.0	1.8	65.5	3.15	3.5	80.0	0.0470	17500	200

Table 1 (continued)

No. of cores	Size (mm ²)	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)
4	1.5	7/Non-compacted	1.59	0.7	1.2	11.0	0.80	1.8	16.5	12.1	440	500
4	2.5	7/Non-compacted	2.01	0.7	1.2	12.0	1.25	1.8	19.0	7.41	650	500
4	4	7/Non-compacted	2.55	0.7	1.2	13.5	1.25	1.8	20.0	4.61	750	500
4	6	7/Non-compacted	3.12	0.7	1.2	15.0	1.25	1.8	21.5	3.08	900	500
4	10	7/Compacted	3.80	0.7	1.2	16.0	1.60	1.8	23.5	1.83	1200	500
4	16	7/Compacted	4.80	0.7	1.2	18.5	1.60	1.8	26.0	1.15	1600	500
4	25	7/Compacted	6.00	0.9	1.2	22.5	2.00	1.9	31.0	0.727	2300	500
4	35	7/Compacted	7.10	0.9	1.2	25.5	2.00	2.0	34.0	0.524	2900	500
4	50	19/Compacted	8.30	1.0	1.2	29.0	2.00	2.1	38.0	0.387	3600	500
4	70	19/Compacted	9.90	1.1	1.2	33.0	2.00	2.3	42.5	0.268	4600	500
4	95	19/Compacted	11.70	1.1	1.3	37.5	2.50	2.5	48.5	0.193	6500	500
4	120	37/Compacted	13.20	1.2	1.4	42.0	2.50	2.6	53.5	0.153	7500	500
4	150	37/Compacted	14.60	1.4	1.5	47.0	2.50	2.8	58.5	0.124	9000	300
4	185	37/Compacted	16.30	1.6	1.6	52.5	2.50	3.0	65.0	0.0991	11000	300
4	240	61/Compacted	18.70	1.7	1.7	59.0	2.50	3.2	72.0	0.0754	14000	300
4	300	61/Compacted	20.90	1.8	1.8	65.5	3.15	3.5	80.0	0.0601	18000	200
4	400	61/Compacted	23.50	2.0	2.0	73.5	3.15	3.7	88.5	0.0470	22000	200

Table 1 (continued)

No. of cores	Size (mm ²)	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)
5	4	7/Non-compacted	2.55	0.7	1.2	14.5	1.25	1.8	21.5	4.61	850	500
5	6	7/Non-compacted	3.12	0.7	1.2	16.0	1.60	1.8	23.5	3.08	1100	500
5	10	7/Compacted	3.80	0.7	1.2	17.5	1.60	1.8	25.0	1.83	1400	500
5	16	7/Compacted	4.80	0.7	1.2	20.5	1.60	1.8	27.5	1.15	1800	500
5	25	7/Compacted	6.00	0.9	1.2	25.0	2.00	2.0	34.0	0.727	2700	500
5	35	7/Compacted	7.10	0.9	1.2	28.0	2.00	2.1	37.0	0.524	3400	500
5	50	19/Compacted	8.30	1.0	1.2	32.0	2.00	2.2	41.0	0.387	4200	500
5	95	19/Compacted	11.70	1.1	1.4	42.0	2.50	2.6	53.0	0.193	7500	500
5	120	37/Compacted	13.20	1.2	1.5	47.0	2.50	2.8	58.5	0.153	9500	300
5	185	37/Compacted	16.30	1.6	1.7	58.5	2.50	3.2	71.5	0.0991	13500	300