

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Low Voltage Cable**

with type designation(s)

250 V TFOI & TFOI(c) & TFOI(i) & TFOI(i&c) & FX-TFOI & FX-TFOI(c) & FX-TFOI(i) & FX-TFOI(i&c)

Issued to

TMC Co., Ltd**Cheonan-si Chungcheongnam-do, Republic of Korea**

is found to comply with

DNV GL rules for classification – Ships, offshore units, and high speed and light craft**IEC 60092-376 (2003-05)****IEC 60332-3-22 (2009-02)****Application :****Control and instrumentation. Flame retardant Cat.A. Halogen free. Low smoke. Low temperature.****Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.****Voltage class (V) 250****Temp. class (°C) 90**This Certificate is valid until **2021-10-31**.Issued at **Busan** on **2016-11-01**for **DNV GL**DNV GL local station: **Seoul**Approval Engineer: **Eun Jin Lee**

Baeg Soon Choi
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid. The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

Product description

Type : 250 V TFOI & TFOI(c) & TFOI(i) & TFOI(i&c) &
FX-TFOI & FX-TFOI(c) & FX-TFOI(i) & FX-TFOI(i&c)

Conductors: Plain or Tinned stranded copper class 2(class 5 for FX-type)
Core insulation: XLPE
Screen: AL/PS tape + Tinned copper drain wire
Inner covering: Non-hygroscopic material
Metal covering: Plain or Tinned copper wire braid
Outer sheath: SHF1

Number of cores x conductor cross-section mm ²	Number of cores x conductor cross-section mm ²	Number of cores x conductor cross-section mm ²	Number of cores x conductor cross-section mm ²	Number of cores x conductor cross-section mm ²
TFOI	16 x 2,5	24 x 2 x0,75		8 x 3 x0,75
FX-TFOI	19 x 2,5	30 x 2 x0,75	1 x 2 x2,5	10 x 3 x0,75
2 x 1,0	24 x 2,5	32 x 2 x0,75	2 x 2 x2,5	12 x 3 x0,75
3 x 1,0	27 x 2,5	37 x 2 x0,75	3 x 2 x2,5	14 x 3 x0,75
4 x 1,0	33 x 2,5	1 x 4 x 0,75	4 x 2 x2,5	16 x 3 x0,75
5 x 1,0	37 x 2,5		7 x 2 x2,5	19 x 3 x0,75
7 x 1,0	44 x 2,5	1 x 2 x1,0	8 x 2 x2,5	24 x 3 x0,75
9 x 1,0	TFOI & TFOI(c) FX-TFOI & FX-TFOI(c)	2 x 2 x1,0	10 x 2 x2,5	30 x 3 x0,75
12 x 1,0		3 x 2 x1,0	12 x 2 x2,5	32 x 3 x0,75
16 x 1,0		4 x 2 x1,0	14 x 2 x2,5	37 x 3 x0,75
19 x 1,0		7 x 2 x1,0	16 x 2 x2,5	
24 x 1,0		8 x 2 x1,0	19 x 2 x2,5	1 x 3 x1,0
27 x 1,0		10 x 2 x1,0	24 x 2 x2,5	2 x 3 x1,0
33 x 1,0		12 x 2 x1,0	30 x 2 x2,5	3 x 3 x1,0
37 x 1,0		14 x 2 x1,0	32 x 2 x2,5	4 x 3 x1,0
44 x 1,0		16 x 2 x1,0	37 x 2 x2,5	7 x 3 x1,0
		19 x 2 x1,0	1 x 4 x 2,5	8 x 3 x1,0
2 x 1,5	10 x 2 x0,5	24 x 2 x1,0		10 x 3 x1,0
3 x 1,5	12 x 2 x0,5	30 x 2 x1,0	1 x 3 x0,5	12 x 3 x1,0
4 x 1,5	14 x 2 x0,5	32 x 2 x1,0	2 x 3 x0,5	14 x 3 x1,0
5 x 1,5	16 x 2 x0,5	37 x 2 x1,0	3 x 3 x0,5	16 x 3 x1,0
7 x 1,5	19 x 2 x0,5	1 x 4 x 1,0	4 x 3 x0,5	19 x 3 x1,0
9 x 1,5	24 x 2 x0,5		7 x 3 x0,5	24 x 3 x1,0
12 x 1,5	30 x 2 x0,5	1 x 2 x1,5	8 x 3 x0,5	30 x 3 x1,0
16 x 1,5	32 x 2 x0,5	2 x 2 x1,5	10 x 3 x0,5	32 x 3 x1,0
19 x 1,5	37 x 2 x0,5	3 x 2 x1,5	12 x 3 x0,5	37 x 3 x1,0
24 x 1,5	1 x 4 x 0,5	4 x 2 x1,5	14 x 3 x0,5	
27 x 1,5		7 x 2 x1,5	16 x 3 x0,5	1 x 3 x1,5
33 x 1,5	1 x 2 x0,75	8 x 2 x1,5	19 x 3 x0,5	2 x 3 x1,5
37 x 1,5	2 x 2 x0,75	10 x 2 x1,5	24 x 3 x0,5	3 x 3 x1,5
44 x 1,5	3 x 2 x0,75	12 x 2 x1,5	30 x 3 x0,5	4 x 3 x1,5
	4 x 2 x0,75	14 x 2 x1,5	32 x 3 x0,5	7 x 3 x1,5
2 x 2,5	7 x 2 x0,75	16 x 2 x1,5	37 x 3 x0,5	8 x 3 x1,5
3 x 2,5	8 x 2 x0,75	19 x 2 x1,5		10 x 3 x1,5
4 x 2,5	10 x 2 x0,75	24 x 2 x1,5	1 x 3 x0,75	12 x 3 x1,5
5 x 2,5	12 x 2 x0,75	30 x 2 x1,5	2 x 3 x0,75	14 x 3 x1,5
7 x 2,5	14 x 2 x0,75	32 x 2 x1,5	3 x 3 x0,75	16 x 3 x1,5
9 x 2,5	16 x 2 x0,75	37 x 2 x1,5	4 x 3 x0,75	19 x 3 x1,5
12 x 2,5	19 x 2 x0,75	1 x 4 x 1,5	7 x 3 x0,75	24 x 3 x1,5

Number of cores x conductor cross-section mm ²	Number of cores x conductor cross-section mm ²	Number of cores x conductor cross-section mm ²	Number of cores x conductor cross-section mm ²	Number of cores x conductor cross-section mm ²
30 x 3 x1,5	37 x 2 x0,5	4 x 2 x1,5	14 x 3 x0,5	32 x 3 x1,0
32 x 3 x1,5		7 x 2 x1,5	16 x 3 x0,5	37 x 3 x1,0
37 x 3 x1,5	1 x 2 x0,75	8 x 2 x1,5	19 x 3 x0,5	
	2 x 2 x0,75	10 x 2 x1,5	24 x 3 x0,5	1 x 3 x1,5
1 x 3 x2,5	3 x 2 x0,75	12 x 2 x1,5	30 x 3 x0,5	2 x 3 x1,5
2 x 3 x2,5	4 x 2 x0,75	14 x 2 x1,5	32 x 3 x0,5	3 x 3 x1,5
3 x 3 x2,5	7 x 2 x0,75	16 x 2 x1,5	37 x 3 x0,5	4 x 3 x1,5
4 x 3 x2,5	8 x 2 x0,75	19 x 2 x1,5		7 x 3 x1,5
7 x 3 x2,5	10 x 2 x0,75	24 x 2 x1,5	1 x 3 x0,75	8 x 3 x1,5
8 x 3 x2,5	12 x 2 x0,75	30 x 2 x1,5	2 x 3 x0,75	10 x 3 x1,5
10 x 3 x2,5	14 x 2 x0,75	32 x 2 x1,5	3 x 3 x0,75	12 x 3 x1,5
12 x 3 x2,5	16 x 2 x0,75	37 x 2 x1,5	4 x 3 x0,75	14 x 3 x1,5
14 x 3 x2,5	19 x 2 x0,75		7 x 3 x0,75	16 x 3 x1,5
16 x 3 x2,5	24 x 2 x0,75	1 x 2 x2,5	8 x 3 x0,75	19 x 3 x1,5
19 x 3 x2,5	30 x 2 x0,75	2 x 2 x2,5	10 x 3 x0,75	24 x 3 x1,5
24 x 3 x2,5	32 x 2 x0,75	3 x 2 x2,5	12 x 3 x0,75	30 x 3 x1,5
30 x 3 x2,5	37 x 2 x0,75	4 x 2 x2,5	14 x 3 x0,75	32 x 3 x1,5
32 x 3 x2,5		7 x 2 x2,5	16 x 3 x0,75	37 x 3 x1,5
37 x 3 x2,5	1 x 2 x1,0	8 x 2 x2,5	19 x 3 x0,75	
TFOI (i) &	2 x 2 x1,0	10 x 2 x2,5	24 x 3 x0,75	1 x 3 x2,5
TFOI(i&c)	3 x 2 x1,0	12 x 2 x2,5	30 x 3 x0,75	2 x 3 x2,5
FX-TFOI(i) &	4 x 2 x1,0	14 x 2 x2,5	32 x 3 x0,75	3 x 3 x2,5
FX-TFOI(i&c)	7 x 2 x1,0	16 x 2 x2,5	37 x 3 x0,75	4 x 3 x2,5
1 x 2 x0,5	8 x 2 x1,0	19 x 2 x2,5		7 x 3 x2,5
2 x 2 x0,5	10 x 2 x1,0	24 x 2 x2,5	1 x 3 x1,0	8 x 3 x2,5
3 x 2 x0,5	12 x 2 x1,0	30 x 2 x2,5	2 x 3 x1,0	10 x 3 x2,5
4 x 2 x0,5	14 x 2 x1,0	32 x 2 x2,5	3 x 3 x1,0	12 x 3 x2,5
7 x 2 x0,5	16 x 2 x1,0	37 x 2 x2,5	4 x 3 x1,0	14 x 3 x2,5
8 x 2 x0,5	19 x 2 x1,0		7 x 3 x1,0	16 x 3 x2,5
10 x 2 x0,5	24 x 2 x1,0	1 x 3 x0,5	8 x 3 x1,0	19 x 3 x2,5
12 x 2 x0,5	30 x 2 x1,0	2 x 3 x0,5	10 x 3 x1,0	24 x 3 x2,5
14 x 2 x0,5	32 x 2 x1,0	3 x 3 x0,5	12 x 3 x1,0	30 x 3 x2,5
16 x 2 x0,5	37 x 2 x1,0	4 x 3 x0,5	14 x 3 x1,0	32 x 3 x2,5
19 x 2 x0,5		7 x 3 x0,5	16 x 3 x1,0	37 x 3 x2,5
24 x 2 x0,5	1 x 2 x1,5	8 x 3 x0,5	19 x 3 x1,0	
30 x 2 x0,5	2 x 2 x1,5	10 x 3 x0,5	24 x 3 x1,0	
32 x 2 x0,5	3 x 2 x1,5	12 x 3 x0,5	30 x 3 x1,0	

Application/Limitation

The requirement of SOLAS Chapter II-1 Part D Reg.45, 5.2 to limit Fire Propagation along Bunches of Cables or Wires are fulfilled without any additional measures.

Type Approval documentation

Tests carried out

Standard	Release	General description	Limitation
IEC 60092-376	2003-05	Cables for control and instrumentation circuits 150/250V(300V)	
IEC 60332-3-22	2009	Tests on electric and optical fibre cables under fire conditions - Part 3-22: Test for vertical flame spread of vertically-mounted bunched wires or cables - Category A	Bunch test Cat.A
IEC 60754-1	2011	Test on gases evolved during combustion of materials from cables – Determination of the amount of halogen acid gas	Low Halogen : < 0.5% halogen
IEC 60754-2	2011	Test on gases evolved during combustion of materials from cables – Determination of the degree of acidity of gases evolved during the combustion of materials taken from electric cables by measuring pH and conductivity	Halogen free : pH > 4.3, Conductivity < 10µS
IEC 61034-2	2005	Measurement of smoke density of cables burning under defined conditions – Test apparatus, procedure and requirements	Low smoke : > 60%
CSA C22.2 No.03	2009-09	5.11 Flexibility at any specified temperature	Cold bend: -40°C
CSA C22.2 No.03	2009-09	5.12 Abnormal low temperature – impact	Cold impact: -35°C

Marking of product

250V – Type designation – Size – IEC 60332-3 Cat.A – TMC – Year of manufacture – Length

Periodical assessment

The scope of the retention/renewal survey is to verify that the conditions stipulated for the Type Approval Certificate are complied with and that no alterations are made to the design and/or the material of product.

The main elements of the survey are:

- Inspection on factory samples, selected at random from the production line (where practicable)
- Check of the results from Production Sample Tests(PST) and Routine Tests(RT) (if not available, PST and RT are to be carried out)
- Review of type approval documentation
- Review of possible changes in design, material and performance
- Ensuring traceability between manufacturer's product type marking and Type Approval Certificate

Survey is to be performed at least every second year.

END OF CERTIFICATE