

TYPE APPROVAL CERTIFICATE

This is to certify:

That the High Voltage Cable

with type designation(s)

3.6/6kV RFOU P102, RFOU, RFCU, RFBU, 3.6/6kV FX-RFOU P102, FX-RFOU, -RFCU, -RFBU,
6/10kV RFOU P103, RFOU, RFCU, RFBU, 6/10kV FX-RFOU P103, FX-RFOU, -RFCU, -RFBU,
8.7/15kV RFOU P104, RFOU, RFCU, RFBU, 8.7/15kV FX-RFOU P104, FX-RFOU, -RFCU, -RFBU

Issued to

TMC Co., Ltd
Cheonan-si Chungcheongnam-do, Korea

is found to comply with

DNV GL rules for classification – Ships, offshore units, and high speed and light craft**IEC 60092-354 (2014-08)****IEC 60332-3-22 (2009-02)****IEC 60754-1/2 (2011-11)****IEC 61034-2 Ed. 3.1 (2013-06)****NEK TS 606 (2016)**

Application :

General power. Flame retardant Cat.A. Halogen free. Low smoke. Mud resistant. Cold bend (-40°C)/Cold impact (-35°C)

Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.

Type	Rated voltage (kV)	Temp. class (°C)
3.6/6kV RFOU P102, RFOU, RFCU, RFBU	3.6/6	90
3.6/6kV FX-RFOU P102, FX-RFOU, -RFCU, -RFBU	3.6/6	90
6/10kV RFOU P103, RFOU, RFCU, RFBU	6/10	90
6/10kV FX-RFOU P103, FX-RFOU, -RFCU, -RFBU	6/10	90
8.7/15kV RFOU P104, RFOU, RFCU, RFBU	8.7/15	90
8.7/15kV FX-RFOU P104, FX-RFOU, -RFCU, -RFBU	8.7/15	90

Issued at **Busan** on **2017-07-01**This Certificate is valid until **2022-06-30**.for **DNV GL**DNV GL local station: **Seoul**Approval Engineer: **Eun Sook Kim**

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Michael Jost Auf der Stroth
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 : RFOU P102 & RFOU & RFCU & RFBU, FX-RFOU P102 & FX-RFOU & -RFCU & -RFBU 3.6/6 kV
RFOU P103 & RFOU & RFCU & RFBU, FX-RFOU P103 & FX-RFOU & -RFCU & -RFBU 6/10 kV
RFOU P104 & RFOU & RFCU & RFBU, FX-RFOU P104 & FX-RFOU & -RFCU & -RFBU 8.7/15 kV

Conductors: Tinned stranded copper, Class 2 or Class 5(FX-types)
Core insulation: EPR
Inner covering: Halogen free compound
Metal covering: Tinned copper wire braid(O), Galvanized steel wire braid (except single-core cable)(C) or Bronze wire braid(B)
Outer sheath: SHF2 or SHF Mud

3.6/6 kV

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)
1 x 10	1 x 400*	3 x 185
1 x 16	1 x 500*	3 x 240
1 x 25	1 x 630*	3 x 25 + E
1 x 35	3 x 10	3 x 35 + E
1 x 50	3 x 16	3 x 50 + E
1 x 70	3 x 25	3 x 70 + E
1 x 95	3 x 35	3 x 95 + E
1 x 120	3 x 50	3 x 120 + E
1 x 150	3 x 70	3 x 150 + E
1 x 185	3 x 95	3 x 185 + E
1 x 240	3 x 120	3 x 240 + E
1 x 300	3 x 150	

* marked: Class 2 only (No Class 5)

6/10 kV

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)
1 x 16	1 x 400*	3 x 185
1 x 25	1 x 500*	3 x 240
1 x 35	1 x 630*	3 x 25 + E
1 x 50	3 x 16	3 x 35 + E
1 x 70	3 x 25	3 x 50 + E
1 x 95	3 x 35	3 x 70 + E
1 x 120	3 x 50	3 x 95 + E
1 x 150	3 x 70	3 x 120 + E
1 x 185	3 x 95	3 x 150 + E
1 x 240	3 x 120	3 x 185 + E
1 x 300	3 x 150	3 x 240 + E

* marked: Class 2 only (No Class 5)

8.7/15 kV

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)
1 x 25	1 x 120	1 x 400*
1 x 35	1 x 150	1 x 500*
1 x 50	1 x 185	1 x 630*
1 x 70	1 x 240	3 x 25
1 x 95	1 x 300	3 x 35

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Number of cores x conductor cross-section (mm ²)
3 x 50
3 x 70
3 x 95
3 x 120
3 x 150
3 x 185

Number of cores x conductor cross-section (mm ²)
3 x 240
3 x 25 + E
3 x 35 + E
3 x 50 + E
3 x 70 + E
3 x 95 + E

Number of cores x conductor cross-section (mm ²)
3 x 120 + E
3 x 150 + E
3 x 185 + E
3 x 240 + E

Application/Limitation

The requirements of SOLAS Amendments Chapter II-1, Part D, Reg.45, 5.2 (provision to be taken 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 60092-350	2014	General construction and test methods of power, control and instrumentation cables for shipboard and offshore applications	
IEC 60092-354	2014	Single- and three-core power cables with extruded solid insulation for rated voltages 6 kV(U _m =7,2 kV) up to 30 kV(U _m =36 kV)	
IEC 60092-360	2014	Insulating and sheathing materials for shipboard and offshore units, power, control, instrumentation and telocommunication cables	
IEC 60332-3-22	2009-02	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 Category 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%
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 ≥4,3pH, ≤10µS/mm
IEC 60684-2	2011	Flexible insulating sleeving – Part 2: Methods of test.	Fluorine content <0.1%
IEC 61034-1/2	2013-06	Measurement of smoke density of cables burning under defined conditions – Test apparatus, procedure and requirements	Low smoke >60%
CSA C22.2 No.0.3	2010	Test methods for electrical wires and cables	Cold bend (-40°C) Cold impact (-35°C)
ASTM D 2863	2009	Oxygen index	Min. 32
UL 1581	2013	Sunlight resistant	
NEK TS 606	2016	Cables for offshore installations – Halogen-free low smoke and flame-retardant / fire-resistant (HFFR-LS)	Oil & Mud resistant – Category a/b/c/d

Marking of product

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

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Periodical assessment

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

The main elements of the survey are:

- Inspection on factory samples, selected at random from the production line (where practicable)
- Results from Production Sample Tests (PST) and Routines (RT) checked (if not available tests according to PST and RT to be carried out)
- Review of type approval documentation
- Review of possible change in design, materials and performance
- Ensuring traceability between manufacturer's product type marking and Type Approval Certificate.

Periodical assessment is to be performed after 2 years and after 3.5 years. A renewal assessment will be performed at renewal of the certificate.

END OF CERTIFICATE