DNV·GL

Certificate No:
TAE000042D

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Low Voltage Cable

with type designation(s)
FX-RFOU(c) & FX-RFOU(i) & FX-RFOU(i&c) & FX-RFCU(c) & FX-RFCU(i) & FX-RFCU(i&c) & FX-RFBU(c) & FX-RFBU(i) & FX-RFBU(i&c) 250V

Issued to
LS Cable & System Ltd (Donghae Plant)
Donghae-si, Gangwon-do, Republic of Korea

is found to comply with
DNV GL rules for classification – Ships, offshore units, and high speed and light craft

Application :

Control and instrumentation. Flame retardant Cat.A. Halogen free. Low smoke. Mud resistance.

Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.
Rated voltage (V) 250
Temp. class (°C) 90

Issued at **Busan** on **2021-01-29**
This Certificate is valid until **2024-06-30**.
DNV GL local station: **Seoul**

Approval Engineer: **Dong Ho Park**

for **DNV GL**

Andreas Kristoffersen
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.

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV GL AS, its parent companies and subsidiaries as well as their officers, directors and employees ("DNV GL") arising from or in connection with the services rendered for the purpose of the issuance of this document or reliance thereon, whether in contract or in tort (including negligence), shall be limited to direct losses and under any circumstance be limited to 300,000 USD.

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Job Id: **262.1-014910-2**
Certificate No: **TAE000042D**

Product description

Type: FX-RFOU(c) & FX-RFOU(i) & FX-RFOU(i&c) & FX-RFCU(c) & FX-RFCU(i) & FX-RFCU(i&c) & FX-RFBU(c) & FX-RFBU(i) & FX-RFBU(i&c) 250V

Conductors:	Flexible tinned annealed copper, class 5
Insulation:	HF EPR
Screen:	CU/PS or AL/PS tape with drain wire
Inner covering:	Halogen free compound
Metal covering:	Tinned copper wire braid (OU), Galv. steel wire braid (CU), Bronze wire braid (BU)
Outer sheath:	SHF2

*Sheath code according to NEK 606 (2016)
"no marking": category a
E: category b
M: category b & c
H: category b & d
H-M: category b & c & d

Category a – Minimum required oil resistance
Category b – Enhanced Oil resistant
Category c – Mud resistant
Category d – Hydraulic / gear Oil resistant

Number of cores x conductor cross-section mm²	Number of cores x conductor cross-section mm²	Number of cores x conductor cross-section mm²	Number of cores x conductor cross-section mm²
FX-RFOU(c) (i) (i&c)	24 x 3 x 0.75	32 x 3 x 1.0	2 x 2 x 2.5
FX-RFCU(c) (i) (i&c)	32 x 3 x 0.75	1 x 2 x 1.5	3 x 2 x 2.5
FX-RFBU(c) (i) (i&c)	1 x 2 x 1.0	2 x 2 x 1.5	4 x 2 x 2.5
1 x 2 x 0.75	2 x 2 x 1.0	3 x 2 x 1.5	6 x 2 x 2.5
2 x 2 x 0.75	3 x 2 x 1.0	4 x 2 x 1.5	7 x 2 x 2.5
3 x 2 x 0.75	4 x 2 x 1.0	6 x 2 x 1.5	8 x 2 x 2.5
4 x 2 x 0.75	6 x 2 x 1.0	7 x 2 x 1.5	10 x 2 x 2.5
6 x 2 x 0.75	7 x 2 x 1.0	8 x 2 x 1.5	12 x 2 x 2.5
7 x 2 x 0.75	8 x 2 x 1.0	10 x 2 x 1.5	14 x 2 x 2.5
8 x 2 x 0.75	10 x 2 x 1.0	12 x 2 x 1.5	16 x 2 x 2.5
10 x 2 x 0.75	12 x 2 x 1.0	14 x 2 x 1.5	19 x 2 x 2.5
12 x 2 x 0.75	14 x 2 x 1.0	16 x 2 x 1.5	24 x 2 x 2.5
14 x 2 x 0.75	16 x 2 x 1.0	19 x 2 x 1.5	32 x 2 x 2.5
16 x 2 x 0.75	19 x 2 x 1.0	24 x 2 x 1.5	1 x 3 x 2.5
19 x 2 x 0.75	24 x 2 x 1.0	32 x 2 x 1.5	2 x 3 x 2.5
24 x 2 x 0.75	27 x 2 x 1.0	1 x 3 x 1.5	3 x 3 x 2.5
27 x 2 x 0.75	32 x 2 x 1.0	2 x 3 x 1.5	4 x 3 x 2.5
32 x 2 x 0.75	1 x 3 x 1.0	3 x 3 x 1.5	6 x 3 x 2.5
1 x 3 x 0.75	2 x 3 x 1.0	4 x 3 x 1.5	7 x 3 x 2.5
2 x 3 x 0.75	3 x 3 x 1.0	6 x 3 x 1.5	8 x 3 x 2.5
3 x 3 x 0.75	4 x 3 x 1.0	7 x 3 x 1.5	10 x 3 x 2.5
4 x 3 x 0.75	6 x 3 x 1.0	8 x 3 x 1.5	12 x 3 x 2.5
6 x 3 x 0.75	7 x 3 x 1.0	10 x 3 x 1.5	14 x 3 x 2.5
7 x 3 x 0.75	8 x 3 x 1.0	12 x 3 x 1.5	16 x 3 x 2.5
8 x 3 x 0.75	10 x 3 x 1.0	14 x 3 x 1.5	19 x 3 x 2.5
10 x 3 x 0.75	12 x 3 x 1.0	16 x 3 x 1.5	24 x 3 x 2.5
12 x 3 x 0.75	14 x 3 x 1.0	19 x 3 x 1.5	32 x 3 x 2.5
14 x 3 x 0.75	16 x 3 x 1.0	24 x 3 x 1.5	FX-RFOU(c)
16 x 3 x 0.75	19 x 3 x 1.0	32 x 3 x 1.5	FX-RFCU(c)
19 x 3 x 0.75	24 x 3 x 1.0	1 x 2 x 2.5	FX-RFBU(c)

Number of cores x conductor cross-section mm²
2 x 1.0
3 x 1.0
4 x 1.0
5 x 1.0
6 x 1.0
7 x 1.0
8 x 1.0
9 x 1.0
10 x 1.0
12 x 1.0
13 x 1.0
14 x 1.0
15 x 1.0
16 x 1.0
18 x 1.0
19 x 1.0
20 x 1.0
21 x 1.0
23 x 1.0
24 x 1.0

Number of cores x conductor cross-section mm²
27 x 1.0
28 x 1.0
30 x 1.0
34 x 1.0
37 x 1.0
44 x 1.0
2 x 1.5
3 x 1.5
4 x 1.5
5 x 1.5
6 x 1.5
7 x 1.5
8 x 1.5
9 x 1.5
10 x 1.5
12 x 1.5
13 x 1.5
14 x 1.5
15 x 1.5
16 x 1.5

Number of cores x conductor cross-section mm²
18 x 1.5
19 x 1.5
20 x 1.5
21 x 1.5
23 x 1.5
24 x 1.5
27 x 1.5
28 x 1.5
30 x 1.5
34 x 1.5
37 x 1.5
44 x 1.5
2 x 2.5
3 x 2.5
4 x 2.5
5 x 2.5
6 x 2.5
7 x 2.5
8 x 2.5
9 x 2.5

Number of cores x conductor cross-section mm²
10 x 2.5
12 x 2.5
13 x 2.5
14 x 2.5
15 x 2.5
16 x 2.5
18 x 2.5
19 x 2.5
20 x 2.5
21 x 2.5
23 x 2.5
24 x 2.5
27 x 2.5
28 x 2.5
30 x 2.5
34 x 2.5
37 x 2.5
44 x 2.5

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 60092-350	2020-01	General construction and test methods of power, control and instrumentation cables for shipboard and offshore applications	
IEC 60092-376	2017-05	Cables for control and instrumentation circuits 150/250V(300V)	
IEC 60332-3-22	2018-07	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	2019-11	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	2019-11	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 61034-1/2	2019-11	Measurement of smoke density of cables burning under defined conditions – Test apparatus, procedure and requirements	Low smoke >60%

Standard	Release	General description	Limitation
IEC 60092-350, Annex E	2020-01	Cold bend test and impact test for low temperature behaviour	Cold bend (-40°C) Cold impact (-35°C)
UL 1581	2015	Sunlight resistant -Section 1200	720 hrs, only for sheath
NEK TS 606	2016	Cables for offshore installations	Oil & mud resistance

Marking of product

Voltage rating – Type designation – Sheath code – Size – LS CABLE – Year of manufacture – Applicable standard – Length

Ex) 250V S101 FX-RFOU(i) E 7P x 1.0SQMM LS CABLE 2020 IEC60332-3A 0001M

Periodical assessment

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

The main elements of the assessment are:

- Inspection on factory samples, selected at random from the production line (where practicable)
- Results from Routine tests (RT) and selected type tests (ref. to applicable class programs) checked (if not available these tests shall 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