

TYPE APPROVAL CERTIFICATE

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

with type designation(s)

**3.6/6 kV RFOU/RFCU/RFBU, 6/10 kV RFOU/RFCU/RFBU, 8.7/15 kV RFOU/RFCU/RFBU,
12/20 kV RFOU/RFCU/RFBU**

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
IEC 60092-354 (2014-08)
NEK TS 606 (2016)****Application :****Power. Flame retardant Cat.A. Halogen free. Low smoke. 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)
3.6/6 kV RFOU/RFCU/RFBU	3.6/6	90
6/10 kV RFOU/RFCU/RFBU	6/10	90
8.7/15 kV RFOU/RFCU/RFBU	8.7/15	90
12/20 kV RFOU/RFCU/RFBU	12/20	90

Issued at **Busan** on **2019-02-12**This Certificate is valid until **2022-12-31**.for **DNV GL**DNV GL local station: **Seoul**Approval Engineer: **Eun Jin Lee**

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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.



Product description

Type : 3.6/6 kV RFOU & RFCU & RFBU
6/10 kV RFOU & RFCU & RFBU
8.7/15 kV RFOU & RFCU & RFBU
12/20 kV RFOU & RFCU & RFBU

Conductors: Tinned stranded copper class 2
Core insulation: EPR
Inner covering: Halogen free compound
Metal covering: Tinned copper wire braid (O) or galvanized steel wire (C) or bronze wire braid (B)
Outer sheath: SHF2

3.6/6kV

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
RFOU & RFBU	1 x 150	3 x 35	3 x 16 + E
1 x 10	1 x 185	3 x 50	3 x 25 + E
1 x 16	1 x 240	3 x 70	3 x 35 + E
1 x 25	1 x 300	3 x 95	3 x 50 + E
1 x 35	RFOU & RFCU & RFBU	3 x 120	3 x 70 + E
1 x 50	3 x 10	3 x 150	3 x 95 + E
1 x 70	3 x 16	3 x 185	3 x 120 + E
1 x 95	3 x 25		3 x 150 + E
1 x 120		3 x 10 + E	3 x 185 + E

6/10kV

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
RFOU & RFBU	1 x 185	3 x 50	3 x 25 + E
1 x 16	1 x 240	3 x 70	3 x 35 + E
1 x 25	1 x 300	3 x 95	3 x 50 + E
1 x 35	RFOU & RFCU & RFBU	3 x 120	3 x 70 + E
1 x 50	3 x 16	3 x 150	3 x 95 + E
1 x 70	3 x 25	3 x 185	3 x 120 + E
1 x 95	3 x 35		3 x 150 + E
1 x 120		3 x 16 + E	3 x 185 + E
1 x 150			

8.7/15kV

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
RFOU & RFBU	1 x 120	& RFBU	3 x 120
1 x 25	1 x 150	3 x 25	3 x 150
1 x 35	1 x 185	3 x 35	3 x 185
1 x 50	1 x 240	3 x 50	
1 x 70	1 x 300	3 x 70	3 x 25 + E
1 x 95	RFOU & RFCU	3 x 95	3 x 35 + E

Number of cores x conductor cross-section mm ²
3 x 50 + E
3 x 70 + E

12/20kV

Number of cores x conductor cross-section mm ²
RFOU & RFBU
1 x 35
1 x 50
1 x 70
1 x 95
1 x 120
1 x 150

Number of cores x conductor cross-section mm ²
3 x 95 + E
3 x 120 + E

Number of cores x conductor cross-section mm ²
1 x 185
1 x 240
1 x 300
RFOU & RFCU & RFBU
3 x 35
3 x 50

Number of cores x conductor cross-section mm ²
3 x 150 + E
3 x 185 + E

Number of cores x conductor cross-section mm ²
3 x 70
3 x 95
3 x 120
3 x 150
3 x 185
3 x 35 + E

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

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	2014-08	General construction and test methods of power, control and instrumentation cables for shipboard and offshore applications	
IEC 60092-354	2014-08	Single- and three-core power cables with extruded solid insulation for rated voltages 6kV(U _m =7.2kV) up to 30kV(U _m =36kV)	
IEC 60092-360	2014-04	Insulating and sheathing materials for shipboard and offshore units, power, control, instrumentation, telecommunication cables	
IEC 60332-1	2015-07	Test for vertical flame propagation for a single insulated wire or cable	
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	2014-05	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	2014-05	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	2011-08	Flexible insulating sleeving – Part 2: Methods of test.	Fluorine content <0,1%

Job Id: **262.1-011415-3**
Certificate No: **TAE0000300**

Standard	Release	General description	Limitation
IEC 61034-1/2	2005-04	Measurement of smoke density of cables burning under defined conditions – Test apparatus, procedure and requirements	Low smoke >60%
UL 1581	2015	Sunlight resistant -Section 1200	720 hrs
NEK 606	2016	Cables for offshore installations	Oil & Mud resistant – Category a/b/c/d

Marking of product

Voltage rating – Type designation – Size – LS cable – Year of manufacture – IEC60332-3A – 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 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.

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