Certificate No:
TAE00004T1

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Lightweight Electric Cable

with type designation(s)
RADOX OFL FR 300/500V (c) and RADOX OFL FR 300/500V (ic)

Issued to
Huber+Suhner AG
Pfäffikon, ZH, Switzerland

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

Application :

To be used in installations for electrical instrument, control alarm and communication systems.

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

Rated voltage (kV)	**0,3/0,5**
Temp. class (°C)	**90 or 130 (20.000 h)**

Issued at **Høvik** on **2023-09-27**
This Certificate is valid until **2028-09-26**.
DNV local unit: **Augsburg**

Approval Engineer: **Carsten Hunsalz**

for **DNV**

Frederik Tore Elter
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 AS, its parent companies and their subsidiaries as well as their officers, directors and employees ("DNV") 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.

Product description

RADOX OFL FR 300/500V (c) and RADOX OFL FR 300/500V (ic)

Conductor:	Tinned, stranded copper
Core insulation:	Mica Tape + RADOX EI 303
Collective screen (c) type:	Plastic laminated Al-tape with tinned copper drain wire
Individual / Collective screen (ic) type:	Plastic laminated Al-tape with tinned copper drain wire
Fillers (optional):	Halogen free compound
Inner covering:	Tape
Outer sheath:	RADOX Elastomer S FH (SHF2 MUD)

Collective screened (c)

No of pairs:	Cross sectional area [mm^2]
1, 2, 4, 5, 6, 10, 12, 15, 20, 24	0,5 BK or BU
1, 2, 4, 5, 6, 10, 12, 15, 20, 24	0,75 BK or BU
1, 2, 4, 5, 6, 10, 12, 15, 20, 24	1,0 BK or BU
1, 2, 4, 5, 6, 10, 12, 15, 20, 24	1,5 BK or BU
1, 2	2,5 BK or BU

Collective screened (c)

No of triple:	Cross sectional area [mm2]
1, 2, 4, 5, 6, 10	0,5 BK or BU
1, 2, 4, 5, 6, 10	0,75 BK or BU
1, 2, 4, 5, 6, 10	1,0 BK or BU
1, 2, 4, 5, 6, 10	1,5 BK or BU
1, 2	2,5 BK or BU

Individual / Collective screened (ic)

No of pairs:	Cross sectional area [mm^2]
2, 4, 5, 6, 10, 12, 15, 20, 24	0,5 BK or BU
2, 4, 5, 6, 10, 12, 15, 20, 24	0,75 BK or BU
2, 4, 5, 6, 10, 12, 15, 20, 24	1,0 BK or BU
2, 4, 5, 6, 10, 12, 15, 20, 24	1,5 BK or BU
2	2,5 BK or BU

Individual / Collective screened (ic)

No of triple:	Cross sectional area [mm2]
2, 4, 5, 6, 10	0,5 BK or BU
2, 4, 5, 6, 10	0,75 BK or BU
2, 4, 5, 6, 10	1,0 BK or BU
2, 4, 5, 6, 10	1,5 BK or BU
2	2,5 BK or BU

Application/Limitation

Lightweight Electric Cable. To be used in installations for electrical instrument, control alarm and communication systems.

This type of cable is fire resistant in accordance with IEC Publication 60331.

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.

Fire resistant. Flame retardant Cat. A. Halogen free. Low smoke. MUD resistant

Temperature-Index of Insulation Mica Tape + RADOX EI 303: 135°C (20.000 h)
Temperature-Index of Insulation RADOX EI 303: 135°C (20.000 h)
Temperature-Index of outer sheath SHF 2: 130°C (20.000 h)

Type Approval documentation

Tests carried out

Standard	Release	General description	Limitation
DNV-CP-0400	2021-09	Class programme, type approval, lightweight electric cables	
EN 50306-2	2020-03	Railway applications - Railway rolling stock cables having special fire performance - Thin wall - Part 2: Single core cables	
EN 50305	2020-03	Railway applications - Railway rolling stock cables having special fire performance - Test methods	
EN 50306-4	2019-09	Railway applications - Railway rolling stock cables having special fire performance - Thin wall - Part 4: Multicore and multipair screened or not screened sheathed cables	
IEC 60092-350	2020-01	General construction and test methods of power, control and instrumentation cables for shipboard and offshore applications	
IEC 60092-360	2021-01	Electrical installations in ships - Part 360: Insulating and sheathing materials for shipboard and offshore units, power, control, instrumentation and telecommunication cables.	partly
IEC 60332-1-2	2015-07	Tests on electric and optical fibre cables under fire conditions - Part 1-2: Test for vertical flame propagation for a single insulatedwire or cable - Procedure for 1 kW pre-mixed flame	50 < L ≤ 540mm
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	Charred portion of sample does not exceed 2,5m above bottom edge of burner.
IEC 60331-1	2018-03	Tests for electric cables under fire conditions - Circuit integrity - Part 1: Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV	For cables with an overall diameter exceeding 20 mm 120 min. test @830°C
IEC 60331-2	2018-03	Tests for electric cables under fire conditions - Circuit integrity - Part 2: Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV	For cables with an overall diameter not exceeding 20 mm 120 min. test @830°C

IEC 60754-1	2019-11	Test on gases evolved during combustion of materials from cables - Part 1: Determination of the halogen acid gas content	Low Halogen: <0,5% Halogen
IEC 60754-2	2019-11	Test on gases evolved during combustion of materials from cables - Part 2: Determination of acidity (by pH measurement) and conductivity	Halogen free: pH > 4,3 Conductivity < 10µS/mm
IEC 60684-2	2011-08	Clause 45.2 Methods of determination of low levels of fluorine	Fluorine content < 0,1%
IEC 61034-1/2	2019-11	Measurement of smoke density of cables burning under defined conditions – Test apparatus, procedure and requirements	Low smoke Light transmittance >60%
NEK TS 606	2022	Cables for offshore installations. Halogen-free and/or mud resistant. Technical specification. Mud	MUD sheath SHF 2: IRM 902 / 903 100°C 7d. Calcium Bromide 70°C 56d. EDC 95-11 base oil 70°C 56d.

Marking of product

HUBER+SUHNER RADOX OFL FR 300/500V (c) or RADOX OFL FR 300/500V (ic) - size - SHF MUD - IEC 60332-3-22 - IEC 60331-1/2 (part no.) - (batch no.) (date of manufacture) (production place)

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) checked (if not available tests according to 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