

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Fiber optical cable

with type designation(s)

Multi-fiber Loose Tube Glassarmoured Cable RADOX 24-.../W(ZNG)R-...85 RADOX

Multi-fiber Loose Tube Steelarmoured Cable RADOX 24-.../W(ZN)HAR-...82 RADOX

Issued to

Huber + Suhner AG

Herisau, AR, Switzerland

is found to comply with

DNV rules for classification – Ships, offshore units, and high speed and light craft

Application :

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

Issued at **Høvik** on **2023-09-04**

This Certificate is valid until **2028-09-03**.

DNV local unit: **Augsburg**

for **DNV**

Approval Engineer: **Carsten Hunsalz**

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

Fire resistant, low smoke, halogen free and self-extinguishing fiber optic cable with multi-fiber loose tube and SHF2 sheath.

Multi-fiber Loose Tube Glassarmoured Cable RADOX 24-.../W(ZNG)R-...85 RADOX

Cable construction:
Number of fibers: up to 24
Number of loose tubes: 1
Loose tube outer diameter [mm]: 2,8
Strength member: Glass roving
Outer cable diameter [mm]: 8,5
Outer sheath material type: SHF2

Multi-fiber Loose Tube Steelarmoured Cable RADOX 24-.../W(ZN)HAR-...82 RADOX

Cable construction:
Number of fibers: up to 24
Number of loose tubes: 1
Loose tube outer diameter [mm]: 2,8
Strength member: Aramid
Inner sheath material type: SHF1
Inner sheath diameter [mm]: 5,0
Armoring: Steel
Outer cable diameter [mm]: 8,2
Outer sheath material type: SHF2

Type of fibres:

Type	Definition in IEC	Definition in ISO 11801	Definition ITU-T
E9/125	60793-2-50 Typ B1.3	-	G.652.D
E9/125A2	60793-2-50 Typ B6 a2	-	G.657.A2
G62.5/125-OM1	60793-2-10 A1-OM1	OM1	G.651 BendOptimized
G50/125-OM2	60793-2-10 A1b-OM2	OM2	G.651 BendOptimized
G50/125-OM3	60793-2-10 A1b-OM3	OM3	G.651 BendOptimized
G50/125-OM4	60793-2-10 A1b-OM4	OM4	G.651 BendOptimized
G50/125-OM5	60793-2-10 A1b-OM5	OM5	G.651 BendOptimized

Order numbers/ Items

Multi-fiber Loose Tube Glassarmoured Cable RADOX 24-.../W(ZNG)R-...85 RADOX

Construction	Number of fibers and fiber type	Cable colour	Cable type	Item number
Glass-armoured MLT Cables with Single Mode Fibers acc. G.652.D	4 x E9/125 SMF	black	04-4E9/W(ZNG)R-G85-DNV	85209689
	8 x E9/125 SMF	black	08-8E9/W(ZNG)R-G85-DNV	85209690
	12 x E9/125 SMF	black	12-12E9/W(ZNG)R-G85-DNV	85209691
	24 x E9/125 SMF	black	24-24E9/W(ZNG)R-G85-DNV	85209692
Glass-armoured MLT Cables with Single Mode Fibers acc. G.657.A2	4 x E9A2/125 SMF	black	04-4E9A2/W(ZNG)R-G85-DNV	85209693
	8 x E9A2/125 SMF	black	08-8E9A2/W(ZNG)R-G85-DNV	85209694
	12 x E9A2/125 SMF	black	12-12E9A2/W(ZNG)R-G85-DNV	85209695
	24 x E9A2/125 SMF	black	24-24E9A2/W(ZNG)R-G85-DNV	85209696
Glass-armoured MLT Cables with Multi Mode Fibers G50-OM2	4 x G50/125-OM2	black	04-4G50/W(ZNG)R-G85-DNV	85209697
	8 x G50/125-OM2	black	08-8G50/W(ZNG)R-G85-DNV	85209698
	12 x G50/125-OM2	black	12-12G50/W(ZNG)R-G85-DNV	85209699
	24 x G50/125-OM2	black	24-24G50/W(ZNG)R-G85-DNV	85209700
	4 x G50/125-OM3	black	04-4G50/W(ZNG)R-G85-F-DNV	85209701

Glass-armoured MLT Cables with Multi Mode Fibers G50-OM3	8 x G50/125-OM3	black	08-8G50/W(ZNG)R-G85-F-DNV	85209702
	12 x G50/125-OM3	black	12-12G50/W(ZNG)R-G85-F-DNV	85209703
	24 x G50/125-OM3	black	24-24G50/W(ZNG)R-G85-F-DNV	85209704
Glass-armoured MLT Cables with Multi Mode Fibers G50-OM4	4 x G50/125-OM4	black	04-4G50/W(ZNG)R-G85-G-DNV	85209705
	8 x G50/125-OM4	black	08-8G50/W(ZNG)R-G85-G-DNV	85209706
	12 x G50/125-OM4	black	12-12G50/W(ZNG)R-G85-G-DNV	85209707
	24 x G50/125-OM4	black	24-24G50/W(ZNG)R-G85-G-DNV	85209708
Glass-armoured MLT Cables with Multi Mode Fibers G62.5-OM1	4 x G62.5/125-OM1	black	04-4G62/W(ZNG)R-G85-DNV	85209709
	8 x G62.5/125-OM1	black	08-8G62/W(ZNG)R-G85-DNV	85209710
	12 x G62.5/125-OM1	black	12-12G62/W(ZNG)R-G85-DNV	85209711
	24 x G62.5/125-OM1	black	24-24G62/W(ZNG)R-G85-DNV	85209712

Order numbers/ Items

Multi-fiber Loose Tube Steelarmoured Cable RADOX 24-.../W(ZN)HAR-...82 RADOX

Construction	Number of fibers and fiber type	Cable colour	Cable type	Item number
Steel-armoured MLT Cables with Single Mode Fibers acc. G.652.D	4 x E9/125 SMF	black	04-4E9/W(ZN)HAR-G82-DNV	85080629
	8 x E9/125 SMF	black	08-8E9/W(ZN)HAR-G82-DNV	85080630
	12 x E9/125 SMF	black	12-12E9/W(ZN)HAR-G82-DNV	85080631
	24 x E9/125 SMF	black	24-24E9/W(ZN)HAR-G82-DNV	85080632
Steel-armoured MLT Cables with Single Mode Fibers acc. G.657.A2	4 x E9A2/125 SMF	black	04-4E9A2/W(ZN)HAR-G82-DNV	85080658
	8 x E9A2/125 SMF	black	08-8E9A2/W(ZN)HAR-G82-DNV	85080659
	12 x E9A2/125 SMF	black	12-12E9A2/W(ZN)HAR-G82-DNV	85080660
	24 x E9A2/125 SMF	black	24-24E9A2/W(ZN)HAR-G82-DNV	85080661
Steel-armoured MLT Cables with Multi Mode Fibers G50-OM2	4 x G50/125-OM2	black	04-4G50/W(ZN)HAR-G82-DNV	85080662
	8 x G50/125-OM2	black	08-8G50/W(ZN)HAR-G82-DNV	85080663
	12 x G50/125-OM2	black	12-12G50/W(ZN)HAR-G82-DNV	85080664
	24 x G50/125-OM2	black	24-24G50/W(ZN)HAR-G82-DNV	85080665
Steel-armoured MLT Cables with Multi Mode Fibers G50-OM3	4 x G50/125-OM3	black	04-4G50/W(ZN)HAR-G82-F-DNV	85080667
	8 x G50/125-OM3	black	08-8G50/W(ZN)HAR-G82-F-DNV	85080668
	12 x G50/125-OM3	black	12-12G50/W(ZN)HAR-G82-F-DNV	85080669
	24 x G50/125-OM3	black	24-24G50/W(ZN)HAR-G82-F-DNV	85080670
Steel-armoured MLT Cables with Multi Mode Fibers G50-OM4	4 x G50/125-OM4	black	04-4G50/W(ZN)HAR-G82-G-DNV	85080671
	8 x G50/125-OM4	black	08-8G50/W(ZN)HAR-G82-G-DNV	85080672
	12 x G50/125-OM4	black	12-12G50/W(ZN)HAR-G82-G-DNV	85080673
	24 x G50/125-OM4	black	24-24G50/W(ZN)HAR-G82-G-DNV	85080674
Steel-armoured MLT Cables with Multi Mode Fibers G62.5-OM1	4 x G62.5/125-OM1	black	04-4G62/W(ZN)HAR-G82-DNV	85080675
	8 x G62.5/125-OM1	black	08-8G62/W(ZN)HAR-G82-DNV	85080687
	12 x G62.5/125-OM1	black	12-12G62/W(ZN)HAR-G82-DNV	85080688
	24 x G62.5/125-OM1	black	24-24G62/W(ZN)HAR-G82-DNV	85080689

Application/Limitation

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 Bundles of Cables or Wires) are fulfilled without any additional measures.

Mechanical data :	During installation	In service
Min. bend radius:	130 mm / 120mm steel-armoured type	80 mm /
Tensile strength:	3000 N / 3750 N steel-armoured type	1500 N / 2000 N steel-armoured type
Temperature range:	-20 up to +70°C	-50 up to +85°C

Type Approval documentation

Tests carried out

Standard	Release	General description	Limitation
DNV-CP-0402	2021-09	DNV Type approval program for optical fiber cables	
IEC 60794-1-21 IEC 60794-1-22 IEC 60794-1-23	2020-03 2017-10 2020-01	Optical fibre cables - Part 1-21/22/23: Generic specification - Basic optical cable test procedures	E1 Tensile strength E3 Crush E4 Impact E6 Repeated bending E7 Torsion E10 Kink E11 Cable bend E11 Cold bend F1 Temperature cycling G1 Bend test for elements
IEC 60793-1-40	2019-03	Optical fibres - Part 1-40: - Attenuation	
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.	SHF1 + SHF2 sheath
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 insulated wire or cable – Procedure for 1 kW pre-mixed flame	
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	
IEC 60332-3-24	2018-07	Tests on electric and optical fibre cables under fire conditions – Part 3-24: Test for vertical flame spread of vertically-mounted bunched wires or cables – Category 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	Changes in attenuation ≤1,5 dB (during 180 min. Fire Test)
IEC 60331-25	1999-04	Tests for electric cables under fire conditions - Circuit integrity - Part 25: Procedures and requirements - Optical fibre cables	Changes in attenuation ≤1,5 dB (during 180 min. Fire Test)
IEC 60754-1	2019-11	Test on gases evolved during combustion of materials from cables - Part 1: Determination of the halogen acid gas content	SHF1 + SHF2 sheath Low Halogen: <0,5% Halogen

Standard	Release	General description	Limitation
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	SHF1 + SHF2 sheath Halogen free: pH > 4,3 Conductivity < 10µS/mm
IEC 60684-2	2011-08	Clause 45.2 Methods of determination of low levels of fluorine	SHF1 + SHF2 sheath 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.	Sheath SHF2 Category c Mud resistance IRM902+IRM903 100°C 7d. Calcium Bromide 70°C 56d. Oil based mud: EDC 95/11 70°C 56d

Marking of product

Item no. • • Batch no. /Year • • HUBER+SUHNER • RADOX • FIBEROPTIC • • Fiber count x Fiber type SHF2 jacket material fire resistance • IEC 60332-3-22/24 / IEC 60331-2/25 FE180 • DNV Type approved TAE00004ST • m meter marking •

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