Certificate no.:
TAE000054W

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Fiber optical cable

with type designation(s)
QFAI/U/B-FR or QFCI/U/B-FR or QFOI/U/B-FR or QFNI/U/B-FR Multi loose tube, AFAI/U/B-FR or AFCI/U/B-FR or AFOI/U/B-FR or AFNI/U/B-FR Multi tube tight buffered, AIAI/U/B-FR or AICI/U/B-FR or AIOI/U/B-FR or AINI/U/B-FR tight buffered

issued to
Wuhan Hysin Ship Technology Co., Ltd.
Wuhan, Hubei Province, China

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 **Hamburg** on **2025-09-29**
This Certificate is valid until **2030-09-28**.
DNV local unit: **Nanjing NB & CMC**

for **DNV**

Approval Engineer: **Carsten Hunsalz**

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 USD 300 000.

Product description

Type: QFAI/U/B-FR or QFCI/U/B-FR or QFOI/U/B-FR or QFNI/U/B-FR Multi loose tube,

Cable construction:
No. of tubes x fibers: up to 96 fibers with 8 tubes in maximum (Fiber in loose tube)
Fire resistant layer: Mica Tape around tubes
Inner sheath: SHF1 (thickness ≥ 1.0 mm)
Armor: A= Aramid Strength member of yarn
C= Galvanized steel wire braiding (GSWB)
O= Tinned copper wire braiding (TCWB)
N= Corrugated Steel Tape (CST)
Outer sheath: I=SHF1, U=SHF2, B=SHF-MUD (thickness ≥ 1 mm)

Type: AFAI/U/B-FR or AFCI/U/B-FR or AFOI/U/B-FR or AFNI/U/B-FR Multi tube tight buffered

Cable construction:
No. of tubes x fibers: up to 96 fibers with 8 tubes in maximum (Fiber tight buffered)
Fire resistant layer: Mica Tape around tubes
Inner sheath: SHF1 (thickness ≥ 1.0 mm)
Armor: A= Aramid Strength member of yarn
C= Galvanized steel wire braiding (GSWB)
O= Tinned copper wire braiding (TCWB)
N= Corrugated Steel Tape (CST)
Outer sheath: I=SHF1, U=SHF2, B=SHF-MUD (thickness ≥ 1 mm)

Type: AIAI/U/B-FR or AICI/U/B-FR or AIOI/U/B-FR or AINI/U/B-FR tight buffered

Cable construction:
No. of fibers: up to 24 fibers (tight buffered)
Inner sheath: SHF1 (thickness ≥ 1.0 mm)
Fire resistant layer: Mica Tape
Armor: A= Aramid Strength member of yarn
C= Galvanized steel wire braiding (GSWB)
O= Tinned copper wire braiding (TCWB)
N= Corrugated Steel Tape (CST)
Outer sheath: I=SHF1, U=SHF2, B=SHF-MUD (thickness ≥ 1 mm)

Type of fibres:

Type	Definition in IEC	Definition in ISO/IEC 11801-1	Definition in ITU-T
E9/125	B1.3 IEC 60793-2-50:2025	OS2	G.652D
G62.5/125	A1b IEC 60793-2-10:2022	OM1	-
G50/125	A1a.1 IEC 60793-2-10:2022	OM2	G.651.1
G50/125	A1a.2 IEC 60793-2-10:2022	OM3	G.651.1
G50/125	A1a.3 IEC 60793-2-10:2022	OM4	G.651.1
G50/125	A1a.4 IEC 60793-2-10:2022	OM5	G.651.1

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.

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

Fire resistance test carried out according to:

-IEC 60331-2 (120 minutes, 830°C, with shock) Changes in attenuation ≤ 1,5 dB during test.

-IEC 60331-25 (180 minutes, 750°C). Changes in attenuation ≤ 1,5 dB during test.

Fiber optical cable
Fire resistant. Flame retardant in bunch Cat. A. Halogen free. Low smoke. MUD resistant. UV resistant

Temperature range: -52°C to +90°C

Other technical data according to manufacturer's instruction and test report.

The cable designation is partly based on the "Table 8 - Cable code designation" of NEK TS 606.

Type Approval documentation

Tests carried out

Standard	Release	General description	Limitation
DNV-CP-0402	2021-09	DNV Type approval program for optical fibre cables	
IEC 60794-1-21 IEC 60794-1-22 IEC 60794-1-23 IEC 60794-1-24	2020-03 2017-10 2020-01 2014-05	Optical fibre cables - Part 1-21/22/23/24: 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 F5 Water penetration G1 Bend test of cable element H3 Electrical continuity
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.	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 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	Charred portion of sample does not exceed 2,5m above bottom edge of burner.
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	120 minutes, 830°C with shock. Changes in attenuation ≤ 1,5 dB during test.

Standard	Release	General description	Limitation
IEC 60331-25	1999-04	Tests for electric cables under fire conditions - Circuit integrity - Part 25: Procedures and requirements – Optical fibre cables	180 minutes, 750°C Changes in attenuation ≤ 1,5 dB during 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	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%
UL 1581	2023-11	UL Standard for Safety Reference Standard for Electrical Wires, Cables, and Flexible Cords	SHF1, SHF2, SHF-MUD UV resistant acc. UL 1581 Cl.1200 min. 80% after 720h in the tensile strength and elongation
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 aging in IRM 902 70°C 4h SHF2 aging in IRM 902 100°C 24h tensile strength and elongation max +- 40%
NEK TS 606	2022	Cables for offshore installations. Halogen-free and/or mud resistant. Technical specification.	SHF-MUD resistance test: IRM902+IRM903 100°C 7d. Calcium Bromide 70°C 56d. Oil based mud: EDC 95/11 70°C 56d
IEC 60079-14	2024-08	Explosive atmospheres - Part 14: Electrical installations design, selection and erection	Test acc. to Annex C
ASTM D2863	2023	Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)	Oxygen index test for outer sheath ≥30%
NES 713	2000-04	Naval Engineering Standard (NES) 713	Toxicity Index ≤5

Marking of product

Example:

Hysin - MARINE-Cable - QFAI-FR - (No of fibers) - (model of optical fiber) - IEC 60331-2 - IEC 60332-3-22 - meter mark - Lot No.

Place of Production

Building 2, Pharmaceutical Industry Park, JiangxiaAvenue,Jiangxia Economic Development District, Wuhan

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