

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Fiber optical cable

with type designation(s)

**TKSEA SINGLE or MULTI LOOSETUBE QFOI or QFOU or QFOU M,
TKSEA SINGLE or MULTI LOOSETUBE QFCI or QFCU or QFCU M,
TKSEA SINGLE or MULTI LOOSETUBE QFAI or QFAU or QFAU M**

Issued to

**TecniKabel S.p.A.
Volpiano TO, Italy**

is found to comply with

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

Application :

Fire resistant Fiber optic cable. Loose tube.

Products approved by this certificate are accepted for installation on all vessels classed by DNV.

Issued at **Høvik** on **2022-05-04**

This Certificate is valid until **2027-05-03**.

for **DNV**

DNV local station: **Italy/Malta CMC**

Approval Engineer: **Ivar Bull**

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**Trond Sjøvåg
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

TKSEA SINGLE or MULTI LOOSETUBE QFOI or QFOU or QFOU M. Optional: Arctic grade -65 °C,
TKSEA SINGLE or MULTI LOOSETUBE QFCI or QFCU or QFCU M. Optional: Arctic grade -65 °C,

Fiber type	See tables below
Fire resistance layer	Mica tape
Type	Loose tube
Central strength element	Galvanized steel rope or thermoplastic coated glassline
Inner sheath	SHF1
Metal covering	GSWB (Galvanised steel wire braid=C) or TCWB (Tinned copper wire braid=O) BWB (Bronze wire braid)
Outer sheath	SHF1 or SHF2 or SHF2 MUD resistant

TKSEA SINGLE or MULTI LOOSETUBE QFAI or QFAU or QFAU M. Optional: Arctic grade -65 °C
See tables below

Fiber type	
Fire resistance layer	Mica tape
Type	Loose tube
Central strength element	-

Armour	Longitudal glass yarns or aramidic yarns
Inner sheath	SHF1 on types QFAU and QFAU M only
Outer sheath	SHF1 or SHF2 or SHF2 MUD resistant

TKSEA MULTI LOOSETUBE QFAI or QFAU or QFAU M, Optional for QFAU: Arctic grade -65 °C,

Fiber type	See tables below
Fire resistance layer	Mica tape
Type	Loose tube
Central strength element	thermoplastic coated glassline
Inner sheath	SHF1
Armour	Glass- or aramidic yarns
Outer sheath	SHF1 or SHF2 or SHF2 MUD resistant

Available fiber types:

Single Mode fibers	Multi Mode fibers
SM-LWP ITU-T G.652.D	MM62.5 OM1 and OM1+
SM ITU-T G.657.A1	MM50 OM2
SM ITU-T G.657.A2	MM50 OM3
SM 200µm ITU-T G.657.A2	MM50 OM4
SM NZD ITU-T G.655.D	

Application/Limitation

This type of cable is fire resistant in accordance with IEC Publication 60331-25.

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.

Operation Temperature Window	-40°C + 70°C (SHF1) -40°C + 90°C (SHF2 & SHF2 MUD resistant) -65°C + 90°C (arctic SHF2)
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Note regarding Safe Return to Port for passenger vessels: When DNV Rules Part 6.2.11 items 3.3.4.2 and 5.3.2.1 require fire resistant cables, these have to be tested according to IEC 60331-1/2.

Type Approval documentation

Tests carried out

Standard/ req. reference	Year of release	Description	
DNV-CP-0402	2021-09	Class Programme DNVGL-CP-0402 Type approval of optical fibre cables	Includes attenuation test, tensile strength test, crush test, impact test, torsion test, kink test and cable bend test.
IEC 60811-202	2017-07	Electric and optical fibre cables - Test methods for non-metallic materials - Part 202: General tests - Measurement of thickness of non-metallic sheath	
IEC 60793-1-40	2019-03	Optical fibres - Part 1-40: Attenuation measurement methods	
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.	
NEK 606 Ed. 5	2016	Cables for offshore installations - halogen-free low smoke flame-retardant / fire-resistant (HFFR-LS). Technical specification.	Mud resistance test: Max variations $\pm$: <u>IRM902 & 903 100°C 7d.</u> TS & E@B, weight & vol.: $\pm 30\%$ <u>Calc. Bromide 70°C 56d.</u> TS & E@B: $\pm 25\%$, weight: $\pm 15\%$, vol.: $\pm 20\%$ <u>Oil based mud:</u> <u>EDC 95/11 70°C 56d</u> TS & E@B $\pm 30\%$, weight & vol.: $\pm 25\%$
IEC 60794-1-21	2015-03	Optical fibre cables - Part 1-21: Generic specification - Basic optical cable test procedures - Mechanical tests methods, selected test E1, E3, E4, E7, E10, E11	
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 60794-1-23	2012-08	Optical fibre cables - Part 1-23: Generic specification - Basic optical cable test procedures - Cable element test methods, selected test G1	
IEC 60794-1-24	2014-05	Optical fibre cables - Part 1-24: Generic specification - Basic optical cable test procedures - Electrical test methods, selected test H3	
IEC 60794-1-22	2017-10	Optical fibre cables - Part 1-22: Generic specification - Basic optical cable test procedures - Environmental test methods, selected test F1	
IEC 60811-403	2012-03	Electric and optical fibre cables - Test methods for non-metallic materials - Part 403:	

Standard/ req. reference	Year of release	Description	
		Miscellaneous tests - Ozone resistance test on cross-linked compounds	
IEC 60332-3-22	2018-07	Tests on electric cables under fire conditions - Part 3-22: Test for vertical flame spread of vertically mounted bunched wires or cables - Category A	
IEC 60331-25	1999	Tests for fibre optic cables under fire conditions - Circuit integrity - Fire alone at a flame temperature of at least 750 °C. Optional Fire Tests at elevated temperature 1000°C.	@750°C 3hours Attenuation increase ≤ than 1 dB/fiber @1000°C 3hours Attenuation increase ≤ than 1,5 dB/fiber
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	
IEC 61034-2	2019-11	Measurement of smoke density of cables burning under defined conditions - Part 2: Test procedure and requirements	Low smoke Light transmittance ≥60%
ASTM-D2565	2016	Standard Practice for Xenon-Arc Exposure of Plastics Intended for Outdoor Applications	720 hours, cycle 1. Maximum change allowed in elongation after the test ±40 %
CEI EN 50305:2003 - 9.2	2003-06	Railway applications - Railway rolling stock cables having special fire performance - Test methods - Toxicity	In accordance with specification (toxicity of evolved gas ≤3)
CAN/CSA-C22.2 No. 210.2-M90:2005 CAN/CSA-C22.2 No. 0.3-01:2014	2005 2014	Appliance Wiring Material Products Test methods for electrical wires and cables. Cold bend.	In accordance with specification (-40 °C)
IEC 60092-350	2020-01	Electrical installations in ships - Part 350: General construction and test methods of power, control and instrumentation cables for shipboard and offshore applications Annex E: Cold bend test and impact test for low temperature behaviour	Cold bend: -65°C Cold impact: -55°C

Marking of product

TECHNIKABEL (V*) – ITALY - month/year - TKSEA FIRE RESISTANT OPTICAL CABLE - Cable type (**) G n° and type of fibres SHF1 or SHF2 or SHF2 MUD RESISTANT - Approval marks – IEC 60331-25 (180+15min) @750° C – IEC 60332-3-22 - metric marking or

TECHNIKABEL (V*) – ITALY - month/year - TKSEA FIRE RESISTANT OPTICAL CABLE - Cable type (**) G n° and type of fibres SHF1 or SHF2 or SHF2 MUD RESISTANT - Approval marks – IEC 60331-25 (180+15min) @1000° C – IEC 60332-3-22 - metric marking or

Arctic grade:

TECHNIKABEL (V*) – ITALY - month/year – TKSEA ARCTIC FIRE RESISTANT OPTICAL CABLE - Cable type (**) G n° and type of fibres SHF2 -65°C/+90°C - approval marks – IEC 60331-25 (180+15min) @750° C – IEC 60332-3-22 - metric marking or

TECNIKABEL (V*) – ITALY - month/year - TKSEA ARCTIC FIRE RESISTANT OPTICAL CABLE - Cable type (**) G n° and type of fibres SHF2 -65°C/+90°C - approval marks – IEC 60331-25 (180+15min) @1000° C – IEC 60332-3-22 - metric marking

(*) place of manufacture:
(V) = Volpiano

(**) cable type:
QFOI, QFOU, QUOU M (tinned copper wire braid)
QFCI, QFCU, QFCU M (galvanized steel wire braid)
QFAI, QFAU, QFAU M (strength member of yarn)
QFBWBI, QFBWBU, QFBWBU M (bronze wire braid)

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