BizLink

Marine productreport

DATA CABLES WITH FUNCTIONAL INTEGRITY FOR USE ON SHIPS AND MARITIME PLANTS

› Copper data cable that maintains integrity in the event of fire for up to 180 minutes

Everywhere in the world, fires present a big threat to human life, but also to major assets. What also needs to be considered particularly in maritime environments is that escape from the danger areas is often not as easy as on land. That is why, for many years now, the legal requirements for fire protection on ships and similar maritime structures are continually reviewed, improved and usually also tightened.

This is exemplified by a range of internationally recognised documents from various issuers; for example, the IMO (International Maritime Organization) and classification companies. These documents are aimed at two principal aspects. On the one hand, the intention is to enable ship and maritime plant to continue operating for as long as possible in the event of a fire while the fire is simultaneously being fought; on the other hand, evacuation of the people concerned must function smoothly. The IMO requires in its 'Safe return to port' policy that technical safety systems remain able to function for 180 minutes. It is, in other words, a matter of preventing a fire from occurring and its spread, or at least of minimising this eventuality. This includes both direct energy release due to the fire and the smoke resulting from a fire, as well as the corresponding toxic and corrosive gases. This is generally described as reaction to fire. However, in the event of a fire, critical power and data connections must also be maintained to ensure signalling contact to all the people affected by the fire for as long as possible, as well as to ensure the maritime plant's continuing ability to function. This is described as resistance to fire.

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Fire protection requirements on ships

The following refers exclusively to ships ›
Yet what must also be considered is that there are equivalent requirements for maritime structures of all kinds; i.e. offshore platforms, floating production storage and offloading (FPSO) units as well as the turbines of offshore wind farms.

In line with the requirements of the classification companies for the fire safety of ships, these must be designed and built in such a way that, in the event of a fire,

a) its generation and spread as well as smoke is limited to the smallest possible area, or at least that it is guided in predetermined directions;
b) the spread of fire and smoke into other areas of the ship is avoided or at least reduced;
c) passengers are alerted to the fire immediately and are safely guided from the fire-affected area to the rescue areas;
d) the safety of rescuers and fire-fighters is ensured at all times;
e) physical damage due to the fire is kept to a minimum;
f) the ship can, despite the fire damage, if possible reach the nearest port under its own power.

To ensure this, all the safety-related equipment on board must continue to function for a sufficiently long time.

This concerns, for example:

- Fire detection, alarm and information systems for evacuation
- Emergency call equipment
- Emergency and safety lighting systems
- Activation of safety doors
- Camera systems
- Smoke and heat extraction equipment
- Fire extinguishers and systems to supply water for firefighting
- Systems for controlling the lowering of life boats
- Ship control and automation systems
- Fire extinguishers and systems to supply water for firefighting
- Systems for controlling the lowering of life boats
- Ship control and automation systems

Reaction to fire & fire resistance of cables

The specifications concerning cables' reaction to fire are contained in the international standards and stipulations of the classification companies, also known as roles. The reason special attention is paid in these documents to the choice and routing of cables is that much of the power and data on board is transmitted via these cables. On the other hand, cables contain, for inherent reasons, a substantial proportion of such flammable materials as insulation and jacket materials.

This is of particular importance with respect to the international standards and stipulations of the IEC 60092 Part 350 and Part 376 series of standards because this is where the standards for cables on ships and offshore units are defined.

In particular, these include the following stipulations (the corresponding sections of the IEC 60092.350 standard are stated in brackets):

- Flame propagation on single insulated cables (section 8.17.1)
- Flame propagation on cable bundles (section 8.17.2)
- Smoke density test (section 8.17.3)
- Test of fume corrosiveness (section 8.17.4)
- Test of the pH value and the conductivity of fumes dissolved in water (section 8.17.5)
- Test of the fluoride content (section 8.17.6)
- Test for the cables' system and insulation integrity (section 8.17.6)

All the above-mentioned tests contain references to other international standards in which the testing apparatus as well as the test procedures are described. The limits to be met in the tests are partly contained in the testing standards themselves or also, if it concerns shipbuilding-relevant stipulations, in the corresponding component standards.

In the following sections we take a closer look exclusively at the functional integrity of copper data cables – i.e. data transmission cables whose electrical conductors consist of copper.

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Definition of functional integrity of copper data cables

In the case of power cables, fire resistance and functional integrity are defined by preservation of the insulation during a defined timeframe. The insulation integrity ensures that the power cable maintains the voltage and current supply even during the fire. Alongside insulation integrity (dielectric strength), data cables must also ensure defined transmission properties pursuant to EN 50289-4-16. The functional integrity of data cables pursuant to EN 50289-4-16 (see Table 2) is specified and classified based on the permitted changes for attenuation, return loss and NEXT at the specified maximum frequency. However, the authors of the standard said it is important to note that this cannot cover all fire scenarios and that additional agreements between the buyer and the manufacturer will be needed if system requirements call for other limits in the properties.

EN 50289-4-16 provides for two different fire apparatus to assess and classify functional integrity:

a) **pursuant to EN 50200 ›**
PH cable classification (see Table 1) or
b) **pursuant to EN 50577 ›**
P cable classification in reference cable routing systems.

While the fire impacts, the parameters listed in Table 2 must be monitored and recorded at regular intervals. Functional integrity at high frequency is maintained if the transmission properties at the maximum frequency in Table 2 remain within the stated limits. Consequently, a data cable with PH-120 classification is a data cable that has met the EN 50200 fire testing requirements over at least 120 minutes.

Advantages of copper data cables with functional integrity

Many functions on ships are already secured by means of systems that maintain integrity. Yet this is done mostly by laying redundant cables. It means that safety-relevant systems are connected via several cables that are laid as far from one another as possible and there is consequently, in the event of a fire, a high probability that not all parallel cables become unusable due to the fire.

The use of copper data cables with functional integrity in the event of fire versus standard copper data cables has a range of advantages, for example

- the overall weight of the installed cables is reduced
- installation space on the tracks is saved
- installation work is saved because of the smaller cable quantity
- space is saved on such connection points as control cabinets

However, as copper data cables with functional integrity are costlier to produce than standard copper data cables, the choice of cable type must be examined in every single case.

Tab. 1 › Classes for functional integrity when applying EN 50200

Classes of EN 50200 system integrity	Maintaining system integrity up to
PH15	15 minutes or more
PH30	30 minutes or more
PH60	60 minutes or more
PH90	90 minutes or more
PH120	120 minutes or more

Tab. 2 › Requirements for insulation and functional integrity of data cables (extract from EN 50289-4-16)

Maximum frequency	High-frequency properties	Requirements for functional integrity
< 100 KHz	Dielectric strength Capacity	No short circuit, DC 100 V AC 70 V Max. difference < 30 %
> 100 KHz < 100 MHz	Dielectric strength Capacity NEXT	No short circuit, DC 100 V AC 70 V Max. difference < 12,5 % > 26-15 Log10 (f/10) dB, 1 up to 10 MHz
> 100 MHz < 1000 MHz	Dielectric strength Attenuation Return loss NEXT	No short circuit, DC 100 V AC 70 V Max. difference < 12,5 % > 8 dB > 26-15 Log10 (f/10) dB, 1 up to 10 MHz

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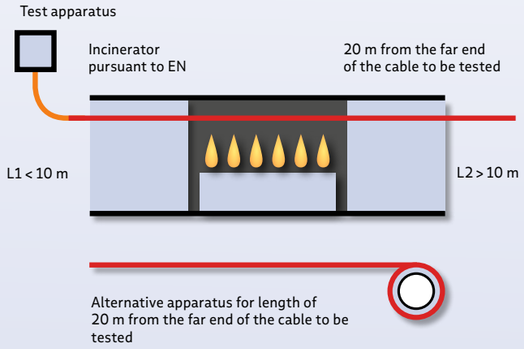
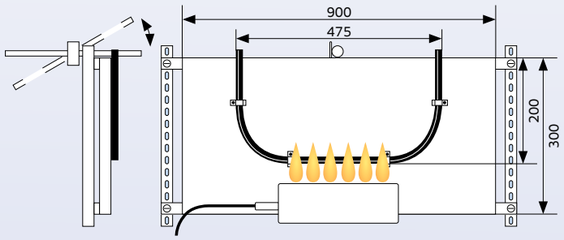


Test apparatus pursuant to EN 50200



EN 50200, EN 50362, VDE 0482 Part 200

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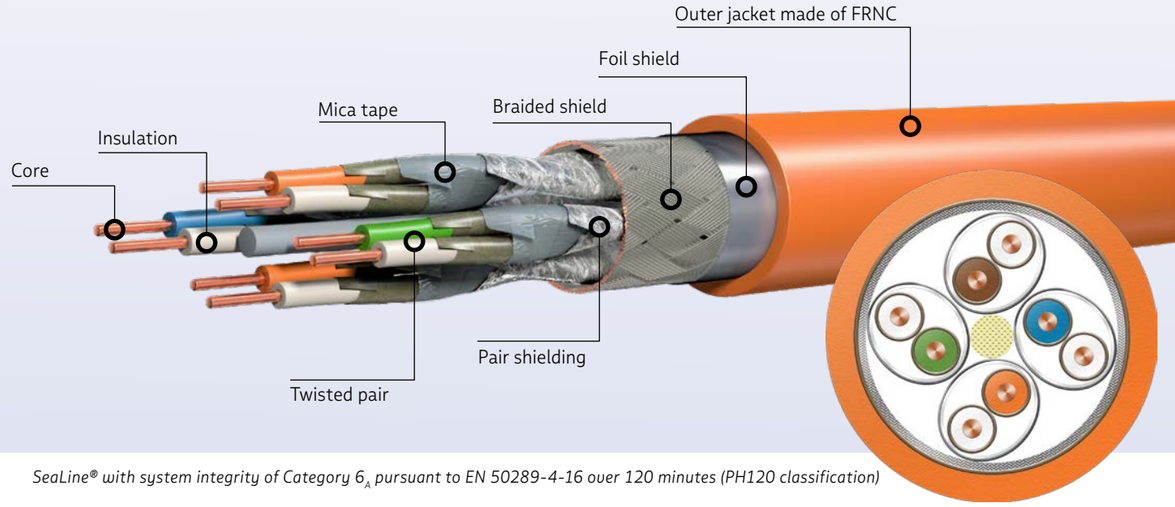

SeaLine® with system integrity of Category 6_A pursuant to EN 50289-4-16 over 120 minutes (PH120 classification)

BizLink SeaLine® data cables *with functional integrity in the event of fire*

BizLink has developed a complete system of copper data cables that meet all the requirements of the IEC 60092-350 through to IEC 60092-376 standard and can also, according to the requirements of the EN 50289-4-16 standard, continue to transmit data in the event of a fire. This was proven in a range of tests and certified by the DNV-GL classification company.

The data transmission properties of these cables, tested to the EN 50200 standard, correspond to the table below:

DATA TRANSMISSION RATE	
without exposure to fire	with up to 180 min. fire exposure
Cat 5e	**Cat 5e**
Cat 6	**Cat 6**
Cat 6_A	**Cat 6_A**
Cat 7	**Cat 6_A**

SeaLine® pursuant to EN 50399, Class $B2_{ca}$ *with max. burn-off length of 1.5 m*

The cable's ability to function is thus also ensured beyond the limit of 120 minutes currently stipulated in the EN 50200 standard.

Before exposure to fire, these data cables consequently conform to the requirements of the IEC 61156-5 and EN 50288-4-1 standards. During exposure to fire of up to 180 minutes the measured transmission properties of attenuation, return loss as well as near-end crosstalk (NEXT) are within the limits permitted by EN 50289-4-16. It goes without saying that requirements concerning insulation integrity, i.e. short-circuit resistance, are upheld.

A wide range of BizLink SeaLine® data cables are available, for example

- in the conductor gauges of AWG 22/1, AWG 22/7, AWG 23/1, AWG 23/7, AWG 24/1, AWG 24/7, AWG 26/7
- with transmission properties pursuant to Category 5e, 6, 6A and 7 (pursuant to IEC 61156-5)
- with armouring made of galvanised or stainless-steel braid (SWB)
- with steel wire armouring (SWA)
- with jacket materials SHF1, SHF2 or SHF2 mud (pursuant to IEC 60092-360) as well as mud resistant (pursuant to NEK 606)

Depending on the international or national requirements, the cable jacket can be supplied in orange, black or another colour. For all cable solutions, BizLink can also supply a matching RJ45 connector including the necessary assembly tools. An assembly video is available on the internet.

Find out more in our assembly animation ›

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Transmission properties

after exposure to fire of 120 minutes

Length (m), limit 100.0	[Pair 36]	89.9
Time (ns), limit 555	[Pair 12]	442
Deviation (ns), limit 50	[Pair 12]	1
Resistance (Ohm)	[Pair 45]	11.4
Insertion loss Reserve (dB)	[Pair 78]	3.2
Frequency (MHz)	[Pair 78]	500.0
Limit (dB)	[Pair 78]	49.3

	min. distance		min. value	
PASS	**MAIN**	**SR**	**MAIN**	**SR**
Poorest pair	12-78	12-78	36-45	36-45
NEXT (dB)	8.7	9.4	20.1	23.1
Freq. (MHz)	3.0	2.9	490.0	493.0
Limit (dB)	65.0	65.0	26.3	26.3
Poorest pair	12	12	36	36
PS NEXT (dB)	8.2	9.3	22.5	25.5
Freq. (MHz)	3.3	3.3	490.0	493.0
Limit (dB)	62.0	62.0	23.5	23.4

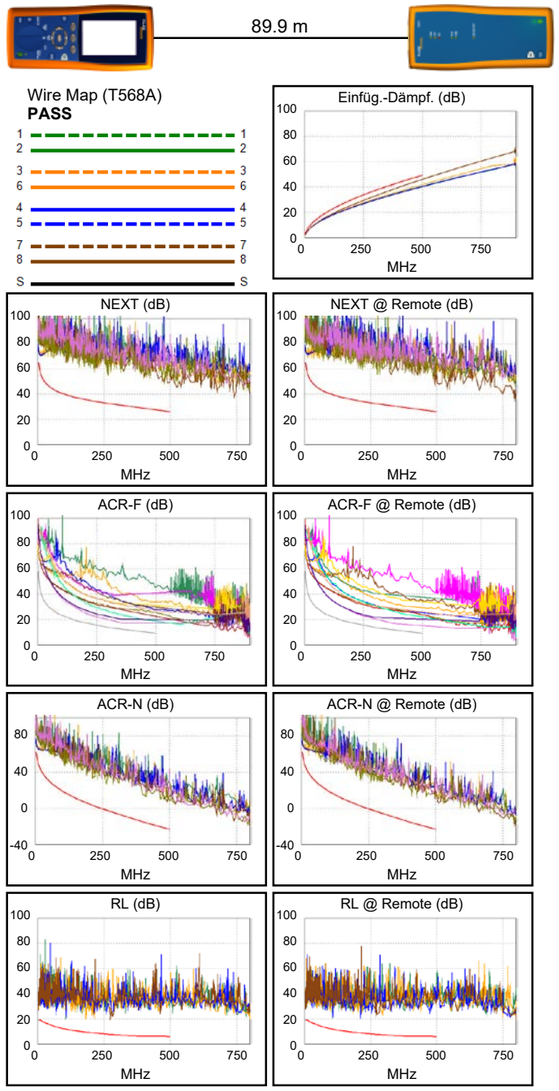
PASS	**MAIN**	**SR**	**MAIN**	**SR**
Poorest pair	36-78	36-78	36-78	36-78
ACR-F (dB)	4.0	4.6	4.1	4.9
Freq. (MHz)	467.0	417.0	497.0	491.0
Limit (dB)	9.9	10.9	9.3	9.4
Poorest pair	78	36	78	36
PS ACR-F (dB)	5.8	6.6	5.8	6.7
Freq. (MHz)	467.0	486.0	500.0	500.0
Limit (dB)	6.9	6.5	6.3	6.3

N.A.	**MAIN**	**SR**	**MAIN**	**SR**
Poorest pair	12-78	12-78	36-45	36-78
ACR-N (dB)	9.6	10.3	29.0	30.7
Freq. (MHz)	3.0	2.9	490.0	486.0
Limit (dB)	61.4	61.4	-22.4	-22.1
Poorest pair	12	12	36	36
PS ACR-N (dB)	9.2	10.2	30.0	32.9
Freq. (MHz)	3.3	3.4	490.0	493.0
Limit (dB)	58.2	57.9	-25.3	-25.5

PASS	MAIN	SR	MAIN	SR
Poorest pair	12	12	78	78
RL (dB)	11.4	12.0	14.7	15.5
Freq. (MHz)	105.5	105.5	282.0	274.0
Limit (dB)	11.8	11.8	7.5	7.6

Fulfilled network standards

10BASE-T	100BASE-TX	100BASE-TX
1000BASE-T	10GBASE-T	ATM-25
ATM-51	ATM-155	100VG-AnyLan
TR-4	TR-16 Active	TR-16 Passive



Extract from the test report No. 20150889 of MPA Dresden.

BizLink offers an adapted ***RJ-45 connector system*** *including the tools needed for assembly for these new cables*

Conclusion ›

BizLink SeaLine® data cables with functional integrity boast excellent data transmission during normal shipboard operation, but simultaneously ensure reliable, continued data transfer in the event of a fire for a period of at least 180 minutes. These cables are on principle halogen free and, in the event of fire, generate low smoke density as well as low corrosiveness of the fumes.

BizLink thereby makes an important contribution to increasing personal safety and ensuring effective emergency operation on board ships and other maritime structures.

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Technical changes excepted.

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