EVERYTHING YOU SHOULD KNOW ABOUT CABLE AND PIPE TRANSITS TO ENSURE A SAFE VESSEL

IMO RESOLUTION A.754(18) AND TYPE APPROVAL CERTIFICATES: A FIRE ON BOARD IS NOT AN EXPERIMENT - IT IS REALITY!

BEELE ENGINEERING

WE CARE

BEELE ENGINEERING – SAFETY, RELIABILITY, INVOLVEMENT

Every moment of the day, in every business and every situation, the threat of fire is present. For over three decades, BEELE Engineering has specialized in passive fire safety in the form of systems which prevent the spread of fire, smoke, water and gases via cable and pipe penetrations. With our superior sealing technologies, we have become the undisputed Number One in this particular field.

It is BEELE Engineering's philosophy that R&D exists to respond to market demands. Only then can research and development activities be classed as functional. Only then are innovative solutions generated for problems that have current or near-term relevance. Our policy is one of continuous active response to customers' demands, or to modified or new functional requirements. We listen, we observe and we interpret, and so we arrive at new product developments and bold innovations.

BEELE Engineering has built up an enormous body of specialized expertise and knowledge. Our company is the world market leader in sealing systems for state-of-the-art shipbuilding applications as well as civil and industrial applications. We do not follow trends, we set them.

Development of new products and technologies, as well as pioneering know-how, are present in every fibre of our organization. We are driven by passion for our specialization, and our customer involvement drives us to exceed the boundaries of what is technically feasible.

BEELE Engineering operates world-wide. From our agencies in virtually every industrialized country, our support and services are always somewhere nearby. We are there for you – also for on-site advice or in-house demonstrations, instructions and support at your location.

Our development, test and production facilities are among the most advanced in the world. The factory is equipped with state of the art machines, which are tailor made to the requirements of our company. We work to a high-level ISO system, with unmatched involvement. Continuous investment in design technologies, combined with highest quality polymers, is our guarantee for the safety of lives and equipment. That is why BEELE Engineering is internationally recognized by all relevant certification institutes and classification societies.

WE CARE

BEELE ENGINEERING

WHAT ARE THE PRINCIPLES BEHIND A-CLASS CABLE & PIPE PENETRATIONS?

It is mandatory under SOLAS regulations that penetration seals have to be tested according to IMO FTP code Annex 1 Part IV. The results of these tests are the basis for EC (MED) Type Examination Certificates and Type Approval Certificates issued by the recognized classification societies and Flag Authorities. The important criteria of the IMO Resolution A.754(18) regarding cable transits are:

1 GENERAL: cable penetrations may be tested uninsulated, partially insulated or fully insulated.

2.1 DIMENSIONS: the maximum and minimum sizes (in terms of both the height and the width) of each type of cable transit for which approval is sought should be tested in both vertical and horizontal orientation.

2.2.1 DESIGN: a bulkhead which includes the transit should be insulated to class A-60 on the stiffened face, which should be the face which is not exposed to the heating conditions; a deck should be insulated on the exposed face of the heating conditions.

2.2.2 DESIGN: the separation between adjacent transits should not be less than 200 mm except that this requirement does not apply to multi-transits which are intended to be positioned adjacent to each other.

2.2.6 DESIGN: the transits should be tested incorporating a range of different types of cables (e.g. in terms of conductor, type of sheathing, type of insulation material, size) and should provide an assembly which represents a practical situation which may be found on ships.

2.2.6 DESIGN: the test results obtained from a given configuration are generally valid for the tested type of cables of size equal to or smaller than tested.

2.2.7 Tests shall be conducted for the max. and min. fill based on the inside cross-sectional area at each transit. The distance between the adjacent cables shall be the minimum specified by the manufacturer.

4.2 INSULATION: since the cable transit is a local weakness in the division, it should be capable of preventing a temperature rise at any point on the surface not exceeding 180° C above initial temperature.

ANNEX 1

RESOLUTION MSC.307(88)
(adopted on 3 December 2010)

ADOPTION OF THE INTERNATIONAL CODE FOR APPLICATION OF FIRE TEST PROCEDURES, 2010 (2010 FTP CODE)

THE MARITIME SAFETY COMMITTEE,

RECALLING article 28(b) of the Convention on the International Maritime Organization concerning the function of the Committee,

NOTING the International Code for Application of Fire Test Procedures (FTP Code) and chapter II-2 of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, hereinafter referred to as "the Convention", which made the FTP Code mandatory under the Convention,

NOTING ALSO resolution MSC.57(67) by which it adopted amendments to chapter II-2 of the Convention to make the provisions of the International Code for Application of Fire Test Procedures (FTP Code) mandatory under the Convention for ships constructed on or after 1 July 1998,

NOTING FURTHER resolution MSC.97(73) by which it adopted the International Code of Safety for High-Speed Craft, 2000 (2000 HSC Code) providing for the application of fire test procedures for materials used in the construction of high-speed craft to which that Code applies, in accordance with the FTP Code,

RECOGNIZING that the continual development of materials for use in the construction of ships and improvement of marine safety standards since the adoption of the FTP Code necessitate the revision of the provisions of the fire test procedures in order to maintain the highest practical level of safety,

HAVING CONSIDERED, at its eighty-eighth session, the draft 2010 FTP Code which has been developed following a thorough revision of the FTP Code,

1. ADOPTS the International Code for Application of Fire Test Procedures, 2010 (2010 FTP Code), the text of which is set out in the Annex to the present resolution;

2. INVITES Contracting Governments to the Convention to note that the 2010 FTP Code will take effect on 1 July 2012 upon entry into force of the associated amendments to chapter II-2 of the Convention;

3. NOTES that under the amendments to chapter II-2 of the Convention, amendments to the 2010 FTP Code shall be adopted, brought into force and take effect in accordance with the provisions of Article VIII of the Convention, concerning the amendment procedure applicable to the annex to the Convention other than chapter I.

4. REQUESTS the Secretary-General of the Organization to transmit certified copies of the present resolution and the text of the 2010 FTP Code, contained in the Annex, to all Contracting Governments to the Convention;

5. FURTHER REQUESTS the Secretary-General of the Organization to transmit copies of the present resolution and the text of the Code contained in the Annex to all Members of the Organization which are not Contracting Governments to the SOLAS Convention.

.3 on the surface of any insulation or filling material used between the pipe and any coaming or spigot fixed to the division (provided that the gap between the pipe or any such coaming or spigot is greater than 30 mm), or on the surface of any collar or shroud used between the pipe and the division (e.g., vapour barrier).

3.1.2 For pipe penTetrations in bulkheads, for each of the positions indicated above, one of the thermocouples shall be fixed directly above the centre of the pipe and the other thermocouple shall be fixed directly below the centre of the pipe.

3.1.3 Additional thermocouples may be required to be fitted, dependent upon the complexity of the pipe penetration.

4 PERFORMANCE

4.1 General

4.1.1 The performance of pipe penetrations may be related to their ability to satisfy both the insulation and the integrity criteria or may be related only to the requirements for integrity, depending on the requirements of the Administration.

4.1.2 Duct penetrations shall meet both integrity and insulation criteria.

4.2 Insulation

Since the pipe penetration is a local weakness in the division it shall be capable of preventing a temperature rise exceeding l80°C above the initial temperature. The average temperature rise is not relevant.

A.IV – CABLE TRANSITS

1 GENERAL

"A" class divisions may have to be provided with apertures to allow them to be penetrated by cables, and it is necessary to reinstate the insulation and integrity performance of the division at the position where it has been penetrated. A cable transit consists of a metal frame, box or coaming, a sealant system or material and the cables, and it may be uninsulated, partially insulated or fully insulated.

2 NATURE OF THE TEST SPECIMEN

2.1 Dimensions

The maximum and minimum sizes (in terms of both the height and the width) of each type of cable transit for which approval is sought shall be tested in both vertical and horizontal orientation.

2.2 Design

2.2.1 A bulkhead which includes the cable transit shall be constructed in accordance with paragraph 2.1.1 of appendix 1 and shall be insulated to class "A-60" on the stiffened face, which shall be the face which is not exposed to the heating conditions of the test. A deck which includes the cable transit shall be constructed in accordance with paragraph 2.2.1 of

appendix 1 and shall be insulated to class "A-60" on the stiffened face, which shall be the face which is exposed to the heating conditions of the test.

"A-0" class cable transits are recommended to be performed in an uninsulated ("A-0") bulkhead/deck. If the cable transits are tested as "A-60" penetration, any insulation fitted on an exposed side (on the cable transits itself and 200 mm around) will be required to be fitted also for "A-0".

"A-0" cable transits shall not be approved without an "A-0" test although tested and approved as "A-60".

2.2.2 The cable transits shall be positioned only in the top half of a bulkhead but shall not be closer than 200 mm from the edges of a bulkhead or a deck. Where more than one cable transit is to be tested simultaneously in a division, the separation between adjacent transits shall not be less than 200 mm. Both measurements shall relate to the distance to the nearest part of the transit system, including any insulation which is part of the system.

2.2.3 Notwithstanding the above, the distance between transits shall be sufficient to ensure that the transits do not influence each other during the test, except that this requirement does not apply to multi-transits which are intended to be positioned adjacent to one another.

2.2.4 The cables shall project 500 ± 50 mm beyond the transit on the exposed side of the division and 500 ± 50 mm on the unexposed side.

Each cable shall be firmly supported and fixed independent of the bulkhead or deck on the unexposed side of the test specimen, e.g., by a framework mounted from the restraint frame. The support and fixing of the cables shall restrain them from movement during the test.

2.2.5 Cable transits shall be fitted to the bulkhead or deck in accordance with the manufacturer's specifications. The cables and sealing compounds or blocks shall be incorporated into the transits with the bulkhead and deck panels placed respectively in vertical and horizontal positions. Any insulation shall be applied to the cables and transits with the panels in the same respective positions.

2.2.6 The transit(s) shall be tested incorporating a range of different types of cables (e.g., in terms of number and type of conductor, type of sheathing, type of insulation material, size) and shall provide an assembly which represents a practical situation which may be found on ships. An individual Administration may have its own specification for a "standard" configuration of penetrating cables which it may use as a basis of its approvals.

The test results obtained from a given configuration are generally valid for the tested types of cables of size equal to or smaller than tested.

2.2.7 Tests shall be conducted for the maximum and minimum fill based on the inside cross-sectional area at each transit. The distance between the adjacent cables shall be the minimum specified by the manufacturer, and the cables should be placed close to the centre of the transit.

2.2.8 When the deck cable transit is fitted on an exposed side or is fitted symmetrically, general application will be given. When the deck cable transit is fitted on the unexposed side, the approval will limit the penetration to the tested orientation.

When the bulkhead cable transit is fitted symmetrically, approval would be given for general application. For bulkhead cable transit with exposed or unexposed fitted frame, one test for each fitting is required in order for obtaining approval for general application.

2.2.9 Sealing of cable transits shall have no visible openings before the start of the fire test.

3 INSTRUMENTATION

3.1 Positioning of thermocouples on the specimen

3.1.1 For each uninsulated cable transit, thermocouples shall be fixed on the unexposed face at each of the following locations:

.1 at two positions on the surface of the frame, box or coaming at a distance of 25 mm from the unexposed surface of the division. When the penetration does not extend a minimum of 25 mm beyond the bulkhead or deck plate on the unexposed side of the assembly, these thermocouples shall be placed at the end of the frame, box or coaming;

.2 at two positions at the end of the transit, on the face of the sealant system or material at a distance of 25 mm from a cable. If there is insufficient area to affix the thermocouples as described, one or both may be placed within a distance of 25 mm from a cable; and

.3 on the surface of each type of cable included in the cable transit, at a distance of 25 mm from the face of the sealant system or material. In case of a group or bunch of cables, the group shall be treated as a single cable. In case of horizontal cables, the thermocouples shall be mounted on the uppermost surface of the cables. These thermocouples may be excluded if the diameters of the cables are too small to effectively affix the thermocouples to the cables. This shall be at the discretion of the Administration.

3.1.2 For those thermocouples placed on the outer perimeter of the frame, box or coaming, one thermocouple shall be fixed on each of two opposite faces, which in the case of bulkheads shall be the top and bottom faces.

3.1.3 For each partially insulated or fully insulated cable transit, thermocouples shall be fixed on the unexposed face at equivalent positions to those specified for an uninsulated transit as illustrated in figure A2.

3.1.4 Additional thermocouples may be required to be fixed, dependent upon the complexity of the cable transit.

3.1.5 When fixing thermocouples to the unexposed surface of the cables, the copper disc and the insulating pad shall be formed over the surface to provide good contact with the surface of the cable. The copper disc and the pad shall be retained in position by some mechanical means, e.g., wiring or spring clips, such that they do not become detached during the test. The mechanical retention shall not provide any significant heat-sink effect to the unexposed face of the thermocouple.

4 PERFORMANCE CRITERIA

4.1 General

Cable transits shall meet both integrity and insulation criteria.

4.2 Insulation

Since the cable transit is a local weakness in the division it shall be capable of preventing a temperature rise at any point on the surface not exceeding l80°C above the initial temperature. The average temperature rise is not relevant.

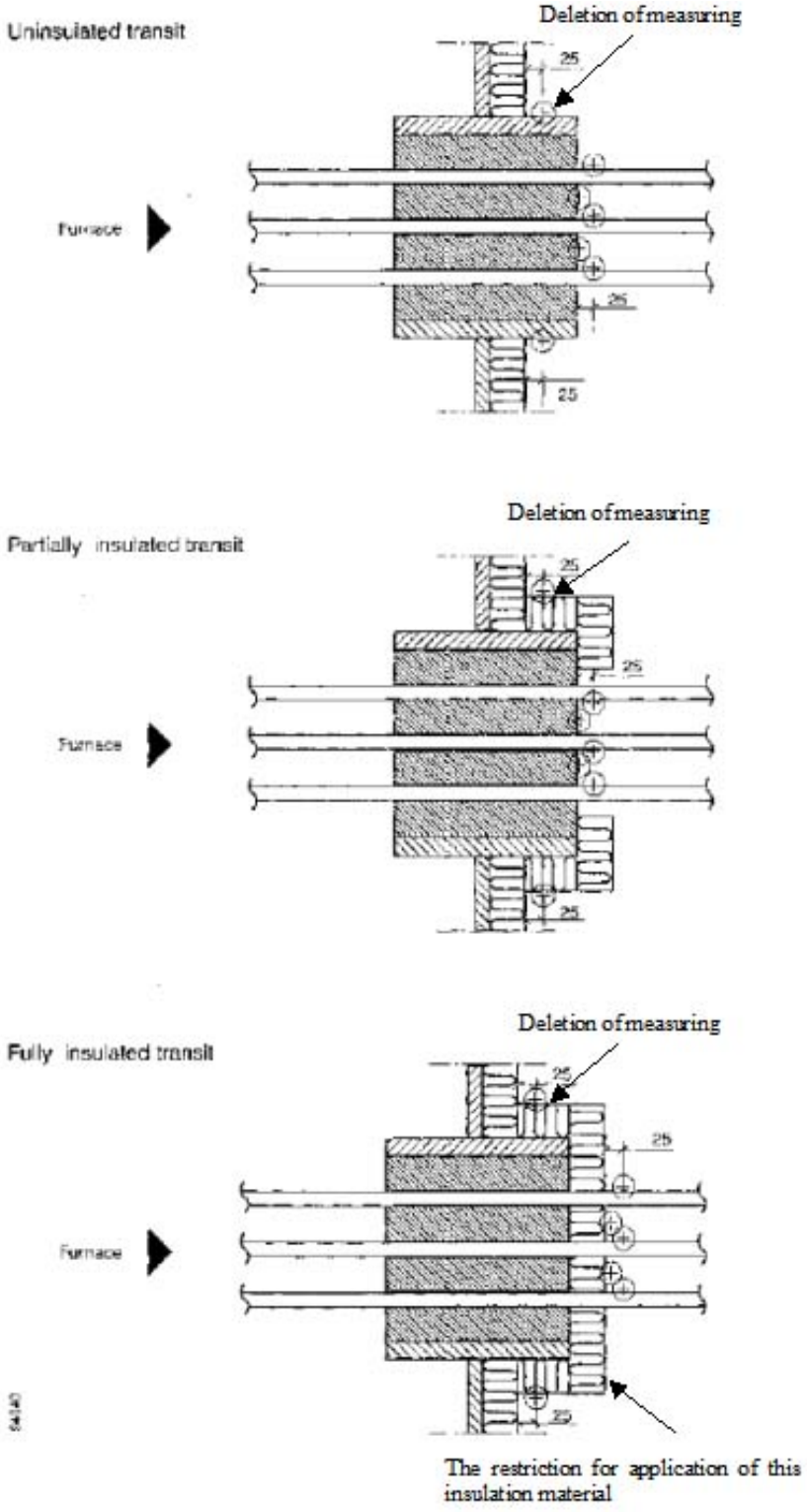


Figure A2 – Cable transits: position of unexposed-face thermocouples
(shown for bulkhead)

TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

For the sake of safety, the above data should in fact be identified in the relevant Type Approval Certificates. However, there are numerous certificates in circulation without these important restrictions or information. This means automatically that a designer or shipowner has to be aware that a certificate DOES NOT MEAN: THE PRODUCT IS SUITABLE FOR ALL APPLICATIONS and that the missing information must be obtained from the manufacturer or the society to be sure that the sealing system is applied in such a way that it will provide the required fire safety.

When choosing a fire safe sealing system the certificate should be checked for reference to:

a) the maximum aperture size of the penetration
It is not correct *to test a transit 100x100 mm and in practice to install units 400x400 mm on board of the vessel!*

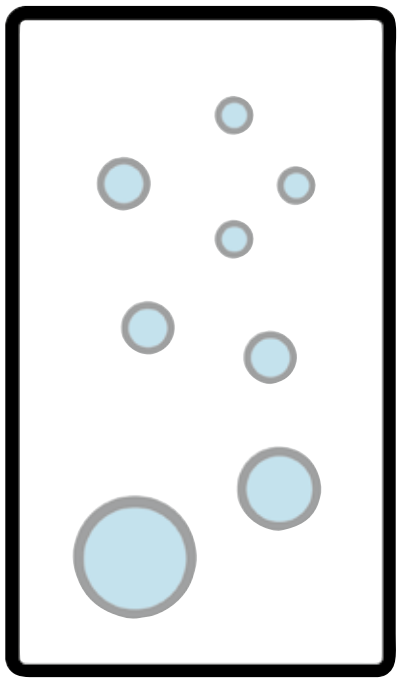
b) the maximum combination of transits
It is not correct *to test a transit consisting of two frames and at site to install units in large combinations! In this respect only the maximum size of the tested aperture counts according to IMO resolution A.754(18).*

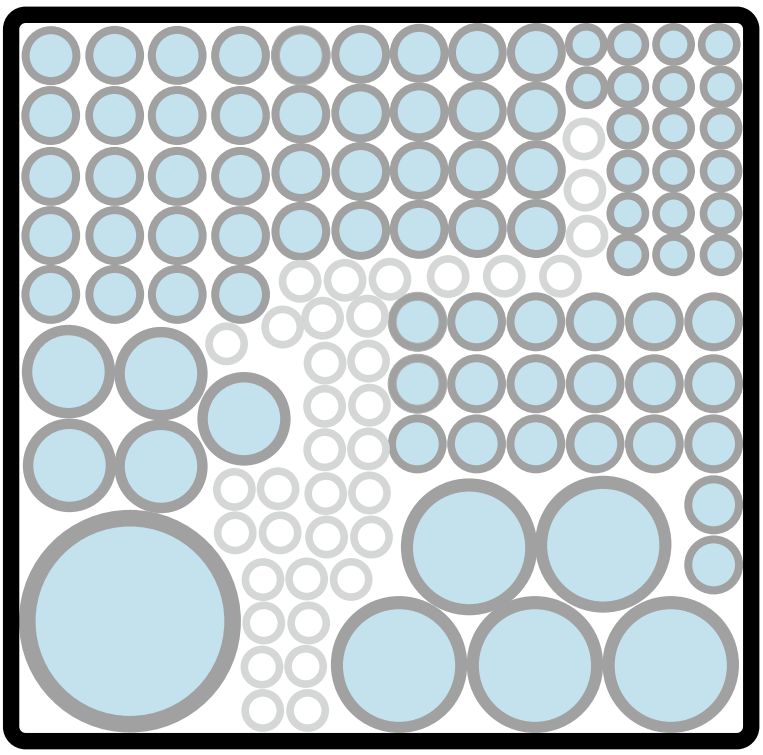
c) the maximum cable size
It is not correct *to test cable/pipe diameters up to 30 mm and in practice to duct cables up to 80 mm!*

d) cable fill ratio
It is not correct *to test only 8 cables and in the actual installation to duct up to 100 cables through a bulkhead or deck penetration!*

e) the spacing between the ducted cables
It is not correct *to test a couple of cables/pipes widely spaced in the transit and in practice bundles of cables or pipes tightly together to install in the installation!*

f) the distance of the ducted cables to the wall of the transit
It is not correct *to test in the centre of the transit and to install in practice cables or pipes close to the wall of the transit!*





TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

g) the position of the transit in the deck/bulkhead

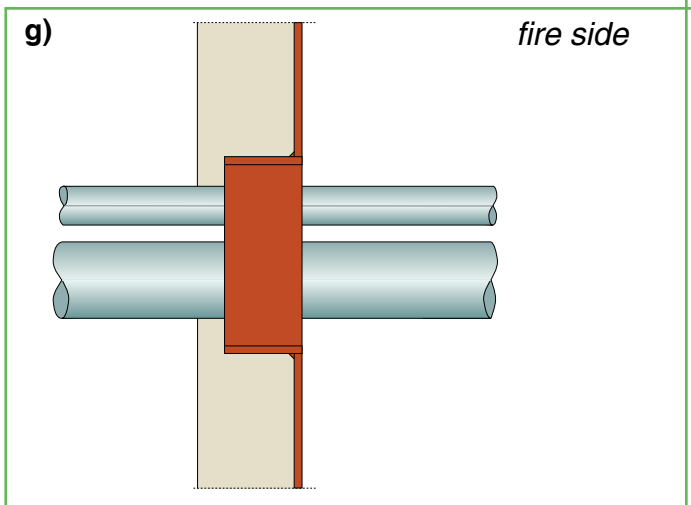
__It is not correct__ to test the transits only on the unexposed side of the division and on the vessel for these transits to be placed on the non-insulated side of a bulkhead!
A serious hazard arises if the transits are tested in a non-symmetrical way, particularly in the bulkheads, because in that case there is no certainty as to whether fire load can be withstood from both sides.
__It is not correct__ to test the transits only above deck fully insulated and on the vessel for these transits to be placed underneath the deck!

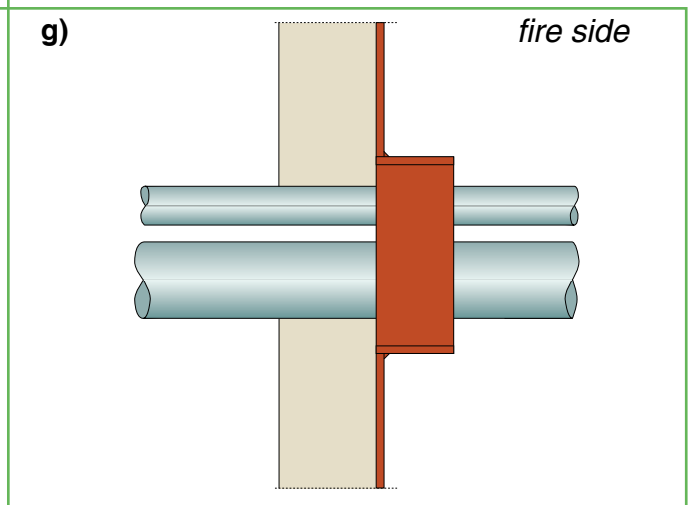
h) the specification and use of extra insulation

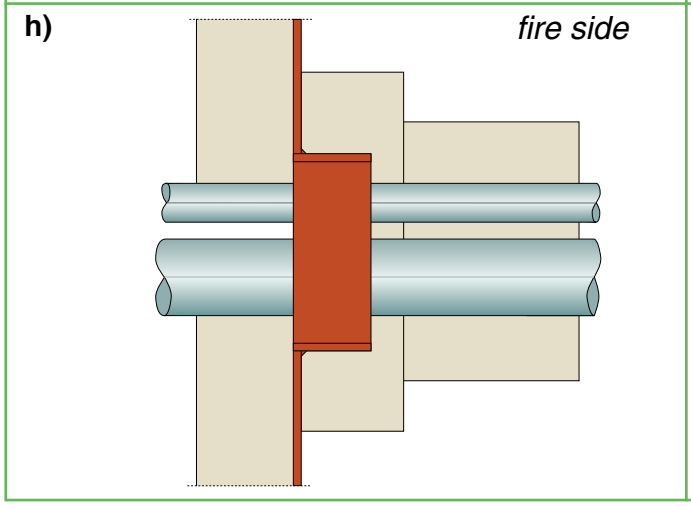
How about applying extra insulation on the exposed side of the bulkhead, in front of the transit and even around the bundle of cables and in between the cables during the fire test, but this extra insulation is __NOT__ applied in the installation? In such a fire test it is not even determined whether the sealing system is able to function as a fire stop! It is the insulation material performing as such.

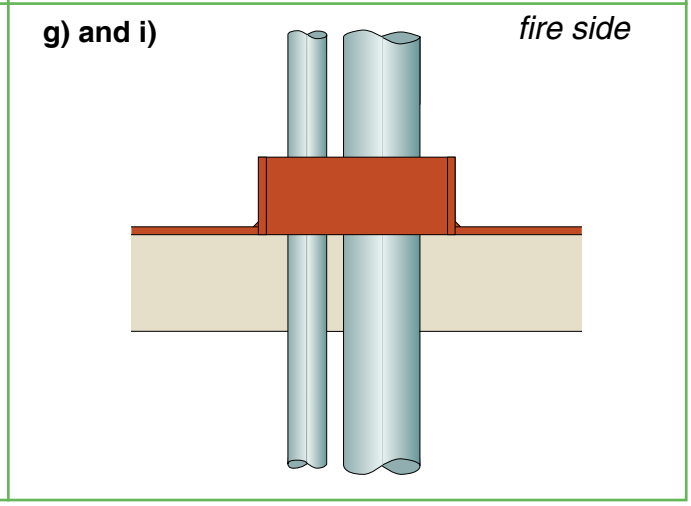
i) the transits have been tested both in a deck and a bulkhead, as required by the IMO Resolution, or for instance in a deck only

Where the transits are tested only in a deck (bulkhead and deck is required by the IMO Resolution) then the issued certificate is only applicable for __RESTRICTED APPLICATIONS__.
The fire test does not fully comply with IMO Resolution A.754(18)!
A deck test is much easier to pass than a bulkhead test because the insulation is placed underneath at the exposed side. How about installing these transits in a bulkhead at the exposed side?









TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

j) the bulkhead has been insulated at the unexposed side, as required by the IMO Resolution, or at the exposed side

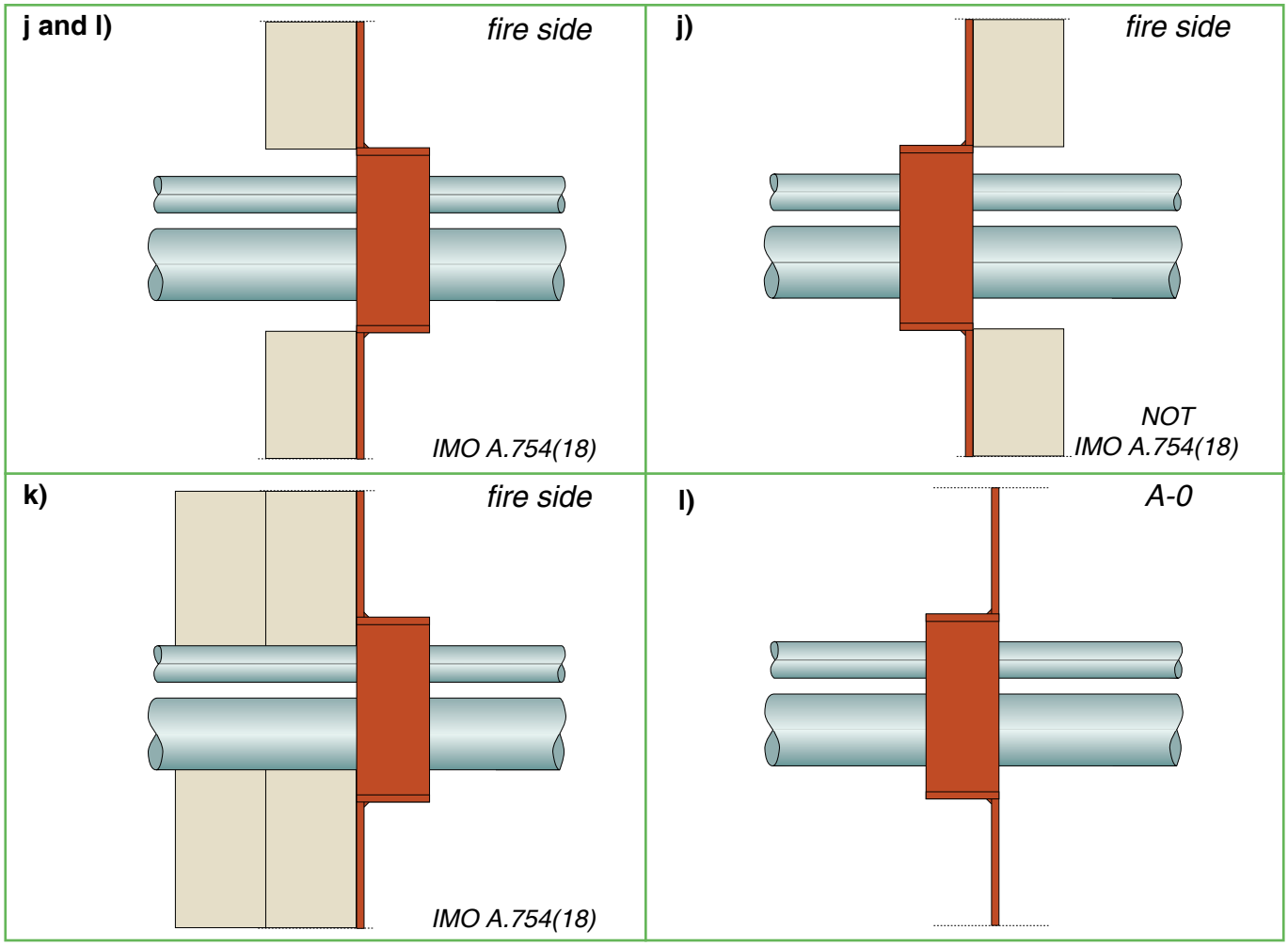
*Where the insulation is applied to the exposed side (not as required by the IMO Resolution) then the issued certificate is only applicable for **RESTRICTED APPLICATIONS**. The fire test does not comply with IMO Resolution A.754(18)! In practice the bulkhead has to be insulated at both sides in case of such a restricted application, because it is not possible to predict the risk side in an actual installation. It is unlikely that both sides will be insulated in practice, so how about the fire safety when this insulation is missing? This conflicts also with the requirement where it says that full scale tests are needed to simulate distortions occurring in actual fires. It is obvious that allowing insulation at the exposed side would inhibit this distortion.*

k) the thickness of bulkhead and deck insulation

How about carrying out a fire test with 120 mm thick insulation while in practice the average insulation with an average thickness of 50-75 mm is applied? Both might be A-60 class, but does the sealing system perform with a thinner insulation?

l) approved for A-0 up to A-60 class or approved for A-0 up to A-60 class with the specific addition: for A-0 class without insulation

*In case it is only A-0 up to A-60 without the remark that the system is approved for A-0 without insulation, it then means that for A-0 applications insulation has **TO BE APPLIED AS TESTED FOR A-60**. This might not be done in practice since A-0 partitions are generally not insulated at all. The fire integrity might be very doubtful in such a case. A-0 is more severe than A-60 due to the missing insulation.*



TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

m) approved for steel, steel and aluminum or for aluminum constructions

When the fire test has been carried out on aluminum constructions, the benefits in respect to the thermal insulation of the penetrations are obvious. The overall insulation of the deck and bulkhead is substantially more than for steel structures because aluminum loses its mechanical strength at 300 °C. For the fire test the insulation is for certain applied at the exposed side of the partition. How about installing these cable transits in a steel bulkhead with insulation only at the unexposed side? In fact it means: ***ONLY FOR ALUMINUM, NOT FOR STEEL!***

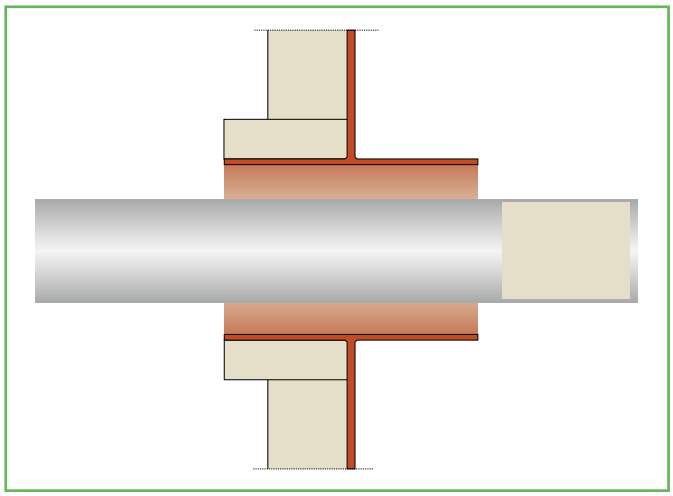
The reverse situation is less dangerous since a steel bulkhead should not be insulated at the exposed side for a fire test. In such a case the thermal load on the transit is much higher than is the case when the fire side has been insulated.

*Anyway, this issue is confusing (we tend to think that aluminum testing is more severe). Definitely extra attention has to be paid to the division, to assure that the application is in accordance with the required fire safety ratings***.**

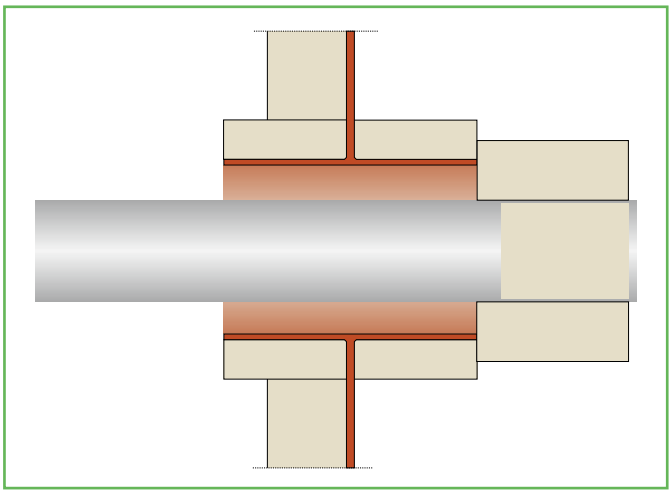
If the above data are missing in the Type Approval Certificates, IT DOES NOT MEAN THAT THERE ARE NO LIMITATIONS on the cable transits.
Reference is made to the listed criteria of the IMO Resolution on pages 2 and 3!
Anyone stating that there are no limitations is not correct. You should be aware of this! It will be obvious that all the criteria mentioned before for cable penetrations will be more or less valid for pipe penetrations as well.

TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

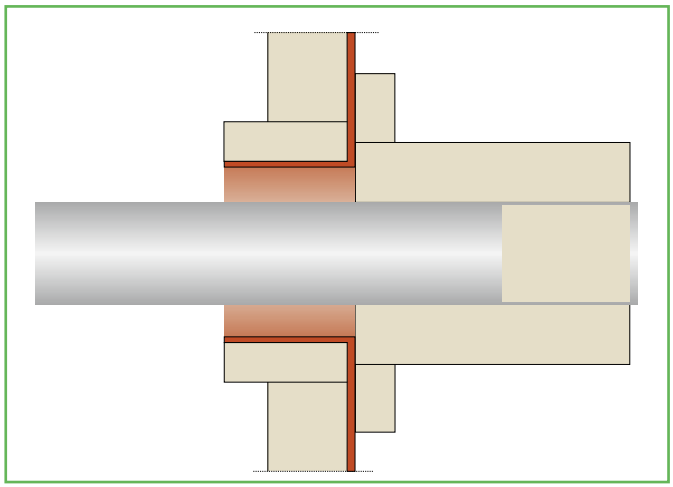
Specially article 2.2.3 should especially be more specific. Would we consider stuffing the ducted pipe full with insulation being an appropriate methodology for blanking off the open end? It will be for certain to manage the fire test! Would we consider to insulate the ducted pipe over its full length and covering the back of the pipe at the exposed side being an appropriate methodology?



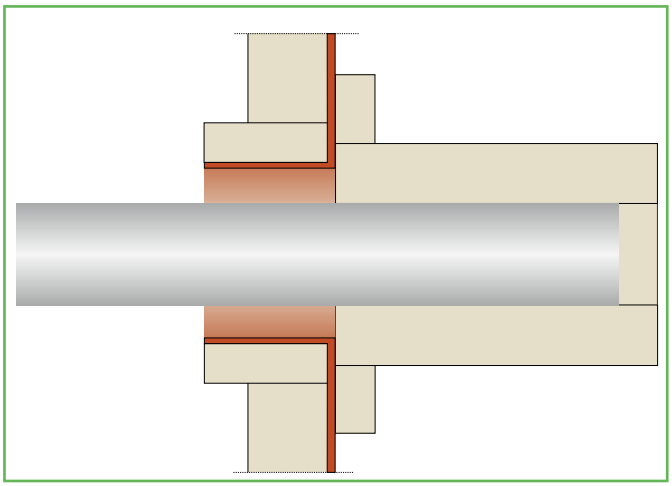
It will be obvious that any radiation heat to the inside of the ducted pipe will be prevented to quite some extent.



In this case no heat transmission will take place at all. The pipe penetration is also not exposed to the fire load.



Extra insulation around the penetration at the exposed side of the bulkhead would inhibit possible deformation of the bulkhead.



For sure the penetration will pass the fire test. However can we regard this as a practical installation?

When the article 2.2.3 is not more specific as it is at the moment, it will all lead to non-practical fire tests resulting in doubtful fire resistance in practical installations. Furthermore all the “it is not correct” as listed in this brochure for the cable penetrations are more or less also applicable for pipe penetrations. And ....

n) the wall thickness of ducted plastic pipes

It is not correct to test plastic pipes with a wall thickness of 3.2 mm and in practice use the sealing for plastic pipes with a wall thickness of 15 mm. When having tested plastic pipes with a 15 mm wall thickness proof is delivered that the sealing system is able to compress pipes up to this wall thickness. The opposite is questionable!

BEELE ENGINEERING

WE CARE

TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

FOR THE SAKE OF SAFETY:
HAS THE VESSEL BEEN PROVIDED WITH OPTIMUM FIRE SAFETY?

A-60 class penetrations should have a definite resistance against both the penetration of hot gases or flames and heat transfer; they should preferably be water and smoke tight and resistant against mechanical impact.

Items for consideration:

a) can one be sure that the installed penetrations will offer the required level of fire safety? A fire on board is not an experiment - it is reality!
b) Type Approval Certificates do NOT guarantee the required fire safety when the installation does not comply with what has been actually tested (see the IMO criteria).
c) installation in the field is a crucial factor.
d) the certificate needs to be audited as well as the installation.
e) can one be sure about system compliance when details are missing in the certificate?
f) where to obtain these missing details? Or even worse, who tells about it!
g) however, anybody will rely on the certificates as they are written (approved for A-60 class divisions)! Nobody is going to check for details!
h) do people care about the actual performance unless questions are asked?
i) finally it is the operators duty to ensure compliance with the certificate.
j) the auditing of cable and pipe penetrations by surveyors or flag authorities is not always carried out!
k) and even if they are, how can they check the limitations when these are not mentioned in a certificate?
l) who is going to reject cable or pipe transits once they are installed in a wrong way?

The above list addresses a lot of difficult issues that are easier to ignore than to deal with. However, for the sake of safety in one of the most hostile environments, the open sea, we have to address these issues.

YOU WANT TO BE SURE THAT FIRE SAFETY AND INTEGRITY ARE MAINTAINED DURING THE LIFE TIME OF THE VESSEL

a) has the sealing system been artificially aged to determine if the fire stopping properties will be maintained during service life?
b) has the sealing system been artificially aged to determine if the parts used for sealing will maintain their flexibility during service life of the vessel and will not harden excessively over time?
c) has the sealing system been exposed to thermal cycling tests to see if temperature changes might have an impact on sealing capacity?
d) has the sealing system been exposed to dynamic cycling tests to determine if the sealing capacity is maintained during long term mechanical exposure?
e) are the parts used for sealing weathering, UV and ozone resistant?

WE CARE

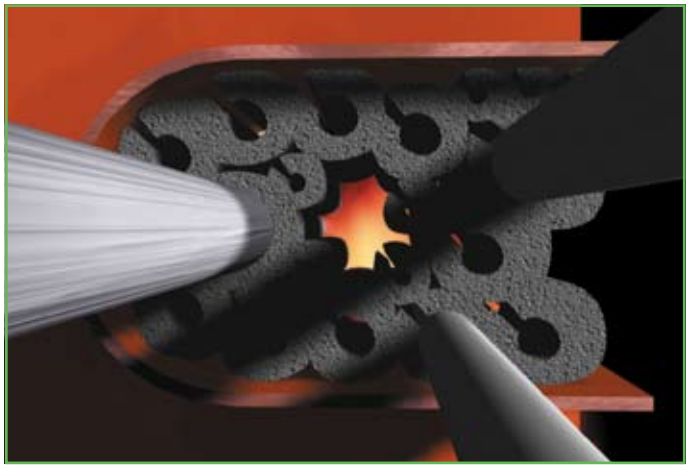
BEELE ENGINEERING

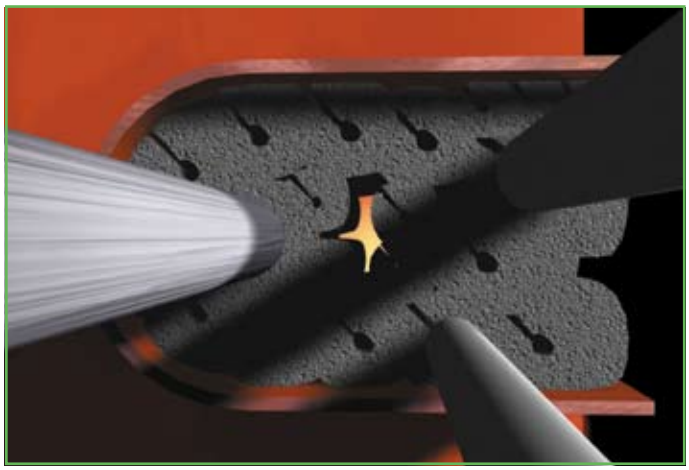
TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

TWO MAJOR ISSUES: THE OBTAINED FIRE SAFETY IN YOUR VESSEL AND THE MAINTENANCE DURING THE LIFE TIME OF THE VESSEL?

a) how to pull extra cables or duct extra pipes in a later stage through the installed penetrations or to remove cables or pipes?
b) how to remove and subsequently replace the extra insulation in front of the transit and in between the cables or (multi-) pipes? Can it be replaced in a proper way? Will it be done?
c) how to apply cable coating on newly ducted cables? You need a specialist company to do it!
d) how about drilling through casting compounds with powered cables in the transits? Or with plastic pipes in the transits? Damage the cables or pipes?

From the above it will be obvious that sealing systems can be vulnerable. For this reason we have developed special rubber compounds for the RISE® and NOFIRNO® multi-cable transits.
An important feature of these compounds is that they will be ACTIVE and/or NON-CONSUMABLE in case of fire.
Generally, rubbers used for cable transit systems are made of a more or less self-extinguishing compound. The drawback of these rubbers is that they will start charring under heat and will slowly but surely shrink due to loss of water content in the rubber. This means that they will not compensate for the cable sheathings which are burning or melting away.
Not the case with the RISE® rubber.
On contrary, the RISE® rubber starts vulcanizing when exposed to heat, thereby heavily expanding and forming a solid rubber mass inside the penetration. The RISE® system is forgiving, self-adjusting, and self-correcting, and will immediately compensate for any gaps or holes in the system. This means that a cable could be removed from the transit, never be replaced, the hole could remain, and RISE® would still stop the fire!





BEELE Engineering is dedicated to fire safety.
In a fire, it is of utmost importance that the cable and pipe penetration seals stop the spread of fire and smoke to adjacent areas. However, the degree of maintenance in installations is a determining factor. Sealing systems might not be properly resealed after maintenance work, or might be damaged. To address this problem, BEELE Engineering has developed the ACTIFIRE® technology. The objective is to activate the sealing system under fire load so that the system is “self-correcting” when exposed the fire. Small openings are immediately closed off.

BEELE ENGINEERING

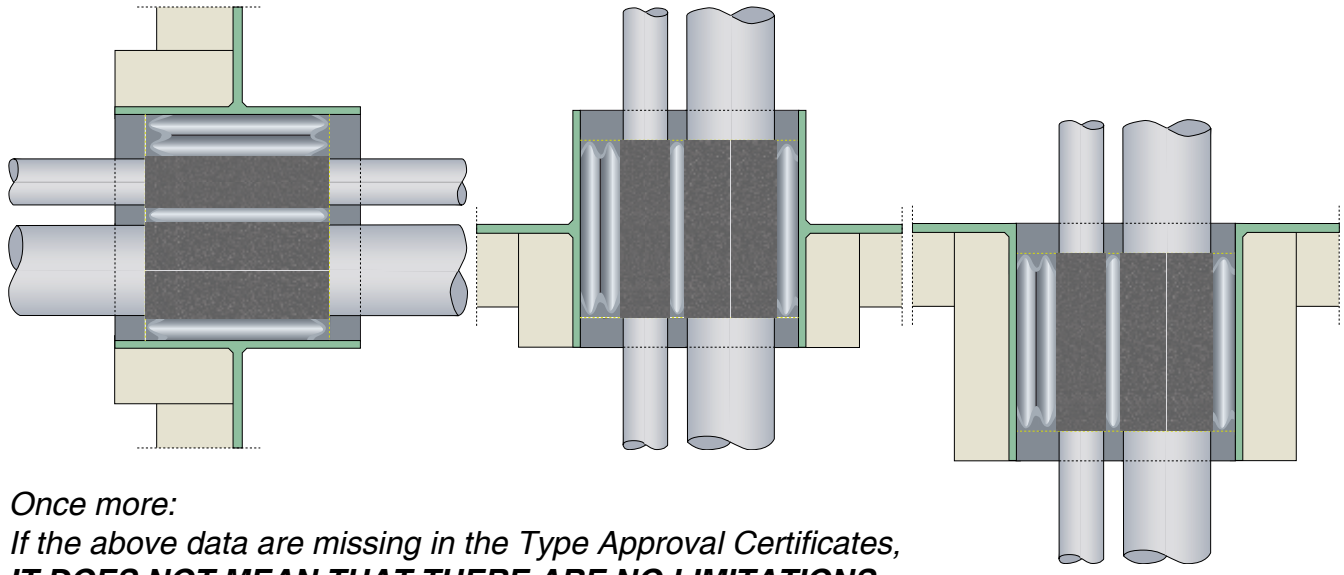
WE CARE

TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

TWO MAJOR ISSUES: THE OBTAINED FIRE SAFETY IN YOUR VESSEL AND THE MAINTENANCE DURING THE LIFE TIME OF THE VESSEL?

A lot of issues and questions arise. We have been involved in this business for more than 35 years and know that a lot of the above questions will not or cannot be answered properly. Based on our expertise in the field, we felt the need for developing cable and pipe sealing systems to overcome the above issues. We don't like to see that fire integrity with cable/pipe transits might be questionable - not when the newly built vessel is delivered to the owner and not during the service life of the vessel.

a) RISE®, RIACNOF® and NOFIRNO® have been successfully tested according to IMO Resolution A.754(18) with NO insulation at the exposed side of the bulkhead at all.
b) RISE®, RIACNOF® and NOFIRNO® have been successfully tested with cables (incl. CLX® and LAN) up to 105 mm diameter or 3x400 mm² copper conductors.
c) RISE®, RIACNOF® and NOFIRNO® have been successfully tested with bundled cable sets
d) RISE®, RIACNOF® and NOFIRNO® have been successfully tested with cable configurations of up to 170 cables of varying diameters, including armoured and non-armoured cables and CLX® and LAN cables.
e) RISE®, RIACNOF® and NOFIRNO® have been successfully tested without any extra insulation in front of the penetration and/or in between the cables.
f) NOFIRNO® has has been successfully tested with steel pipes up to 408 mm, CuNi pipes up to 419 mm, plastic pipes up to 160 mm and GRP pipes up to 408 mm.
g) NOFIRNO® has been successfully tested with coamings up to 1000x300 mm packed with cables and a variety of metallic, plastic and GRP pipes.
h) RISE®/ULTRA has been successfully tested with single plastic pipe penetrations and multi-mix penetrations in combination with NOFIRNO®.
i) all systems have been successfully tested symmetrically in the bulkhead having half of the transit exposed to the fire without any insulation and totally below deck.
j) RISE® has been successfully tested for A-0 cable penetrations without any insulation.
k) NOFIRNO® has been successfully tested for A-0 and H-0 class cable and pipe penetrations without the use of any insulation. NOFIRNO® has been successfully jet fire tested.
m) all systems have been successfully tested for all classes with average bulkhead and deck insulation (no specials).



Once more:
If the above data are missing in the Type Approval Certificates,
IT DOES NOT MEAN THAT THERE ARE NO LIMITATIONS
on the cable transits!

WE CARE

BEELE ENGINEERING

TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

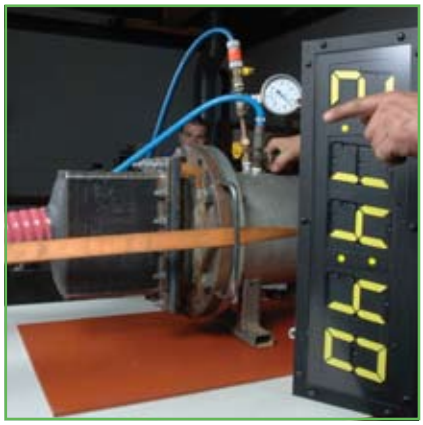
TWO MAJOR ISSUES: THE OBTAINED FIRE SAFETY IN YOUR VESSEL AND THE MAINTENANCE DURING THE LIFE TIME OF THE VESSEL?

In short, RISE® has been tested in worst case scenarios. Just as these situations might one day occur on board ships. We wanted to expose the above data as much as possible in our certificates making it clear for all parties that RISE® and NOFIRNO® can be applied with the reassuring feeling that the desired fire safety is really obtained:

a) the CE (MED) certificates for RISE®, RIACNOF® and NOFIRNO®, issued by Bureau Veritas and NOFIRNO® and RISE®/ULTRA, issued by Det Norske Veritas, are very detailed in this respect.
b) we provide detailed installation drawings with the certificates, all stamped by the classification societies.
c) we provide the necessary functional data:
   1. the maximum aperture size
   2. the positioning of the transits
   3. the insulation of deck and bulkhead
   4. approval for A-0/H-0 penetrations without the need of insulation
   5. approval for steel and aluminum structures

Furthermore, we have carried out a lot of additional tests to prove the quality of our high tech sealing systems.

a) components have been artificially aged up to 50 years to determine the fire safety properties during a very long service life.
   Result: *guaranteed fire safety in your installation for decades.*
b) components have been tested to determine smoke density and toxicity when exposed to fires.
   Result: *no additional toxic and dense smoke in fire conditions*
c) flame spread tests have been carried out and non-fire consumable rubber grades have been developed.
   Result: *no flame spread on the surface of the larger penetrations.*
d) components have been tested to determine the oxygen index.
   Result: *the extremely high oxygen index is another proof of the outstanding fire retardant qualities.*
e) systems have been exposed to heavy shock and vibration tests.
   Result: *full proof of impact resistance, whereby even proof has been delivered that tightness is maintained after this mechanical exposure.*
f) systems have been exposed to thermal cycling tests, ranging from -40° C to ambient to +120° C and reverse.
   Result: *tightness is maintained even under extreme temperature changes. The system can be used in arctic conditions.*
g) systems have been tested on sound damping properties up to 70 dB.
   Result: *no noise transmission.*
h) available in an A-60 class certified EMC version up to 85 dB damping.
   Result: *fire safety, gas and water tightness, EMC damping for your electronic equipment – all in one system.*

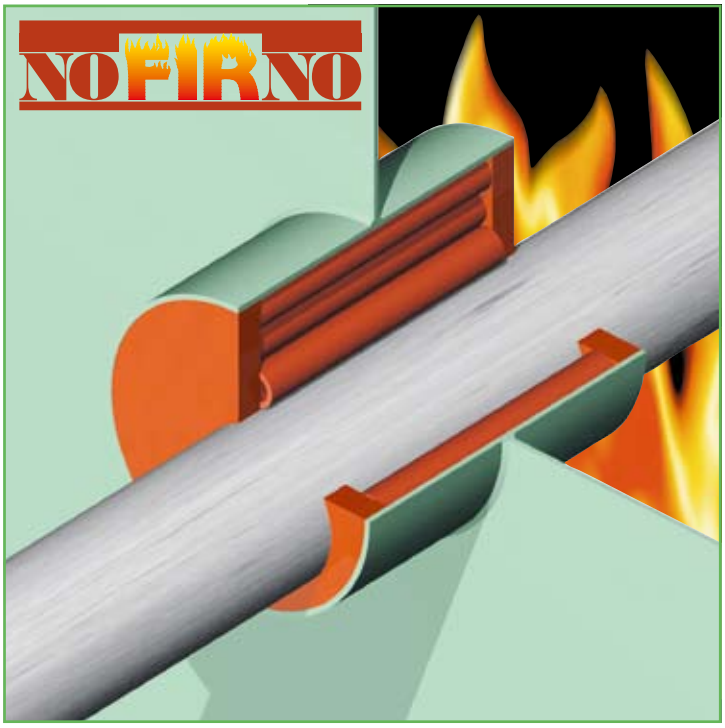


TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

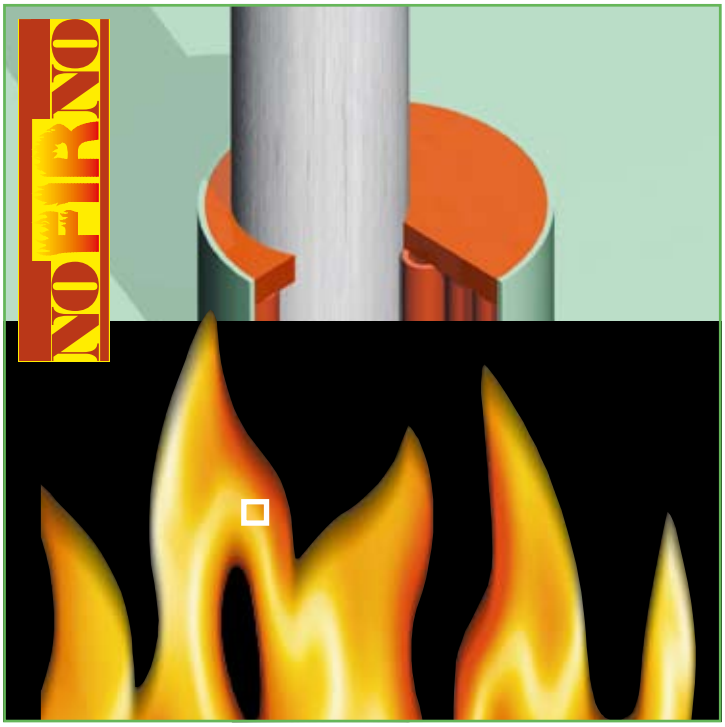
TWO MAJOR ISSUES: THE OBTAINED FIRE SAFETY IN YOUR VESSEL AND THE MAINTENANCE DURING THE LIFE TIME OF THE VESSEL?

As mentioned before, A-0 and H-0 class divisions are generally not insulated in practice. In case cable/pipe penetrations are tested with the use of insulation (as for instance for A-60 class) they are in fact not suitable to be used in such divisions. First of all, the insulation might not be applied and secondly, if applied, the insulation might disappear over time. Fire safety is then very doubtful and safety is at stake! See page 24.

Non-insulated steel partitions (A-0) are most dangerous in fire conditions.
Generally, certificates for use on board ships and offshore constructions are issued on the basis of a successful A-60 test for A-0 up to A-60 class. However, if the approval is for A-0 up to A-60 without the remark that the system is approved for steel partitions without insulation, this means that for these applications, insulation has to be applied (insulated) as tested for A-60 class.
This may not be observed in practice since such partitions are generally not insulated at all. The fire integrity may then be very doubtful in such a case.
The marketplace tends to think that A-0 is less severe than A-60. This is not the case!
Due to the missing insulation it is just the opposite. The intense heat of the construction will cause all materials in the direct vicinity to ignite spontaneously. The radiation heat can be so immense that ignition might occur even at several meters distance.



Especially with A-0 decks, the rising radiation heat of the deck, reaching temperatures of more than 700 °C, contributes to even more severe conditions. It will be obvious that the impact on sealing systems will be extreme.
Based on “no insulation”, the development of the NOFIRNO® sealing system was started. As proven with the SLIPSIL® plugs, the NOFIRNO® rubber will not be consumed by fire. For A-0 class it is of utmost importance to keep the sealing system inside the penetration. In contrast to the regular RISE® system, only a limited expansion of the rubber will take place. No material will fall off during fire exposure at the unexposed side.
The NOFIRNO® sealant will follow any deformation of the division. The thermal insulation of the transit is maintained and no excessive temperatures will arise on the NOFIRNO® rubber/sealant.
Furthermore, no smoke emission will occur, also limiting any ignition possibilities at the unexposed side.



WE CARE

BEELE ENGINEERING

TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

YOU WANT TO BE SURE THAT MAINTENANCE OF THE
TRANSITS IS COST EFFECTIVE AND OFFERS
OPTIMUM FIRE SAFETY IN THE LONG RUN

a) with RISE®, RIACNOF® and NOFIRNO®, no extra insulation has to be applied in front of the penetration or in between the cables and/or the cables don't have to be treated with intumescent coatings.
   This means that there is no need to remove or replace any extras when new cables have to be ducted, thereby excluding the risk of an incomplete transit (replacement of the extras) after pulling extra cables.

b) the FIWA® or NOFIRNO® sealant layer of the RISE®, RIACNOF® and NOFIRNO® systems is easily removed to allow addition of extra cables through the transit. The opening(s) in the sealant layer have only to be resealed with the sealant.
   This means that there is no need to disassemble transits and no need for drilling with powered cables around (how about possible accidents?).

c) the tightness of the RISE®, RIACNOF® and NOFIRNO® penetration is obtained by the FIWA® or NOFIRNO® sealant which can easily be applied after the new cable(s) have been ducted.
   How about resealing the openings made in the casting compounds and how about the refitting of sometimes totally deformed rubber parts on cable sheathings that may have suffered creep?

WITH RISE® AND NOFIRNO® YOU'LL GET
OPTIMUM FIRE SAFETY IN THE LONG RUN
WITHOUT A LOT OF MAINTENANCE COSTS INVOLVED

SIMPLE ENLARGEMENT OF FIRESAFE CABLE DUCTING SYSTEM ON BOARD OF CSO DEEP BLUE

On board of the vessel CSO Deep Blue, which was built specifically for laying oil and gas pipes on the sea-bed, a substantial enlargement has been implemented in the number of cables ducted through firesafe RISE penetrations. The enlargement was necessary because the vessel, which was originally supplied partly fitted-out, was subsequently equipped by Huisman-Itrec at Schiedam (the Netherlands) with a large-capacity installation for the laying of oil and gas pipes. The CSO Deep Blue was built in Korea by Hyundai.

BEELE ENGINEERING

WE CARE

TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

YOU WANT TO BE SURE THAT THE PENETRATIONS ARE WATERTIGHT
NOT ONLY AT DELIVERY OF THE VESSEL BUT ALSO IN THE LONG RUN

In most of the Type Approval Certificates, the degree of water tightness of the systems is listed. The rules for obtaining this value in the certificates differ per society. Generally it is required that the pressure must be maintained for half an hour without showing any leakage and during the next half an hour an acceptable leaking rate of a certain amount of water is allowed. The results are based on a laboratory test with new materials under selected conditions.

a) WHAT YOU SHOULD KNOW ABOUT RUBBERS

1. rubber is incompressible and cannot be reduced in volume. When rubbers are exposed to mechanical loads, the same happens as when you put pressure on a bag filled with water. We all know how the water will move then. Without a proper all sided enclosure, the compressive forces will direct the rubber into the not enclosed direction.
2. the more load on rubber, the more permanent deformation.
3. the higher the rubbers are filled with inorganic additives to obtain the fire retardant properties, the more permanent deformation can be expected.
4. once deformation has taken place, the flexibility of the rubber is minimized.
5. solid rubbers cannot cover wide tolerances without appropriate profiling and design. If not, only heavy compressive loads can correct to some extent.
6. certain rubber grades harden under the influence of time.
7. the thermal insulating properties of solid rubbers are poor (this is the reason for using extra insulation for fire rated transits with a short depth!).

b) WHAT YOU SHOULD KNOW ABOUT CABLE DIAMETERS

1. the cables are seldom perfectly round and sometimes even oval shaped.
2. cable diameters can have tolerances exceeding 2 mm easily.
3. some cable sheathings can be compressed to correct the non-round shape, but armoured cables certainly cannot.
4. heavy load on the cable sheathings causes creep.
5. fiber optic cables should not be compressed at all to compensate for a non-round shape or tolerances to make the system tight.
6. non-flexible cables which are ducted in a bent, curved or oblique way can not be readjusted by compression of rubber parts around them.

WE CARE

BEELE ENGINEERING

TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

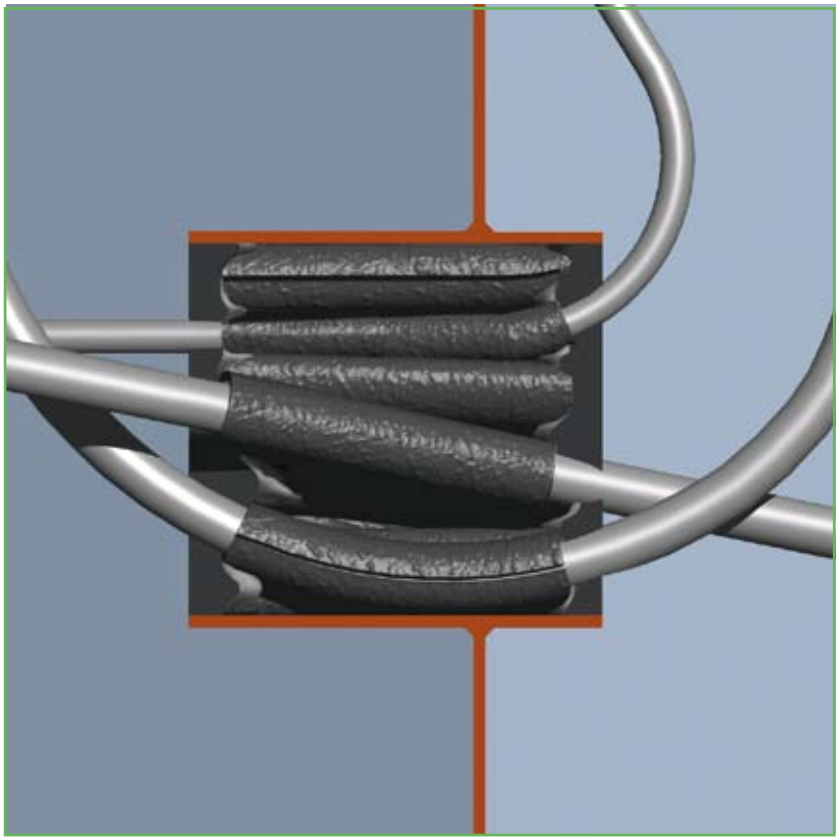
ANOTHER ISSUE: DOES TIGHTNESS MEASURED IN A LABORATORY TEST AUTOMATICALLY GUARANTEE TIGHTNESS AT SITE?

Take a look on the cable routing and the amount of cables in cable trays or on cable ladders - tightly bundled together. It is obvious that the cables have to be spread out once they pass through a fire safe or watertight penetration to be able to bring rubbers or compounds around them. Cables might have to be bent upwards to pass the penetration and bent downwards beyond the penetration. In case of less flexible cables, this automatically means that the cables are passing through the transit in a bent or oblique way (the transit is sometimes only 60 mm deep!). This will also be the case when the cable tray is re-directed after passing a bulkhead. Cables are then already curved inside the penetration.
It is not easy in such cases to make even a compression type cable transit tight!

These are all reasons for the development of the RISE® and NOFIRNO® systems. Since no compressive forces are necessary to obtain water tightness (the adhesive strength of the sealant takes care of this), it just does not matter how the cables are passed through the transit.
Besides, there is no need to compensate for any non-round shape of the cables or for the cables with larger tolerances. By sleeving all cables with the RISE® insert sleeves, sufficient interspacing is obtained to be able to apply sealant in between the cables.

The FIWA® and NOFIRNO® sealant have excellent weathering properties, UV and ozone resistance and long term behaviour. Service life of the sealant (and other components) easily exceeds 20 years under normal environmental conditions. The sealant can cope with temperatures ranging from -40° C up to +180° C, ensuring that temperature changes have no influence on the sealing capacity.
The RISE® and NOFIRNO® systems can be used in arctic conditions. Even at low temperatures down to -50° C the sealant layer stays flexible.

The flame retardant properties of rubber type multi-cable transit systems are obtained by a more or less high content of inorganic material. The drawback of filling rubbers with large amounts of additives is that the mechanical properties might suffer. The hardness of the vulcanized products of such compounds might be reasonably high. Both features have an impact on the sealing capacity and the long term behaviour. With the RISE® and NOFIRNO® systems the elastic and bonding properties of the FIWA® and NOFIRNO® sealant are maintained even during long term service. FIWA® and NOFIRNO® are not exposed to any compressive forces. Nor are the rubber insert sleeves exposed to excessive loads (they are only functioning as the separating elements).



The systems have been artificially aged up to 50 years and have been shock tested up to 850 g without showing any loss of adhesion. The systems have been exposed to a displacement of 10 mm during 100,000 cycles at one cycle every two seconds without showing any damages.

BEELE ENGINEERING

WE CARE

TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

ANOTHER ISSUE:
YOU DON'T WANT TO PAY MORE FOR A BETTER SYSTEM!

Not a problem. Many of our customers have made their own time studies before they decided to change over to the RISE® system. On all these occasions the substantial time savings and the ease of installation with RISE® multi-cable transits have been proven.
Just to give one example: ONE MAN installed a vertical deck penetration, measuring 450x150 mm, carrying 78 cables in a range from 6 mm to 44 mm, IN JUST ONE HOUR. Such an installation will take substantially more time with the block type systems. By the way, try ducting the same amount and sizes of cables in an equally sized transit opening of a block type system!

Since no extra insulation is needed with RISE® in front of the penetration or in between the cables, the cost savings are even greater. Besides, there is no need for making cable lay-outs of the transits as is the case with the prefabricated block transit systems to be sure that the blocks will fit. There is no need to measure each and every cable exactly at site to be able to select fitting rubber parts. RISE® is not "a millimeter job".
More overall time savings.
This counts also for the RIACNOF® and NOFIRNO® multi-cable transits.

Plus: systems are more compact than the average cable transits. *This means a lot of space (and thus weight) savings on board.*

Plus: system consists of a very limited amount of components: insert sleeves, fillers and sealant. *This means that material management on site is very simple.*

Plus: no metal parts are used in the BEELE technology. *This means no corrosion problems.*

Plus: also certified for cables, metallic and plastic pipe penetrations and even multi-all-mix penetrations for ducting pipes and cables through the same penetration. *This means one system for all your on board pipe and cable transits!*

Plus: conduits are certified for welding and bolting to the divisions. *This means no welding needed in case of extensions.*

Plus: all rubber parts used for the sealing systems offer an extremely long service life.

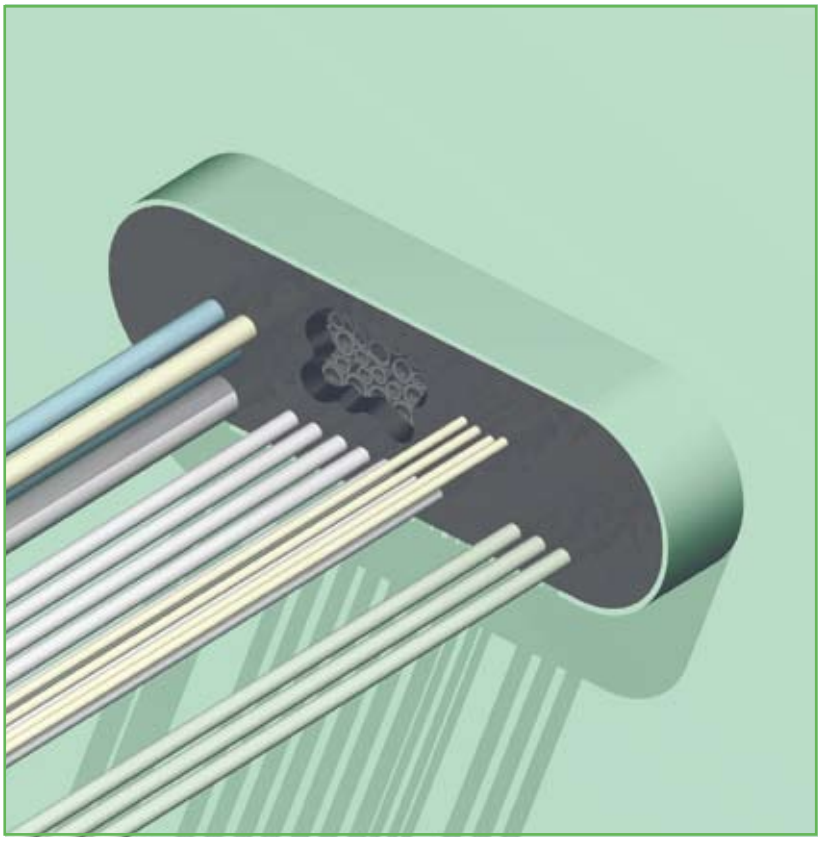
WE CARE

BEELE ENGINEERING

TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

YOU WANT TO BE SURE THAT ADDING EXTRA CABLES/PIPES IS FEASIBLE WITHOUT HAVING TO DISMANTLE THE SYSTEM?

Proper maintenance on cable and pipe penetrations is a must. If not regarded, there is a real danger that the systems will not function for what they are intended in case of a sudden fire. Flames and smoke can then spread freely from one compartment to another. Systems, which have to be partly dismantled and of which the installation is complicated and time-consuming are more vulnerable in this respect.



The FIWA® or NOFIRNO® sealant layer of the RISE®, RIACNOF® and NO-FIRNO® systems is easily removed to allow addition of extra cables through the transit. The opening(s) in the sealant layer have only to be resealed with the sealant.
This means that there is no need to disassemble transits and no need for drilling with powered cables around (how about possible accidents?).

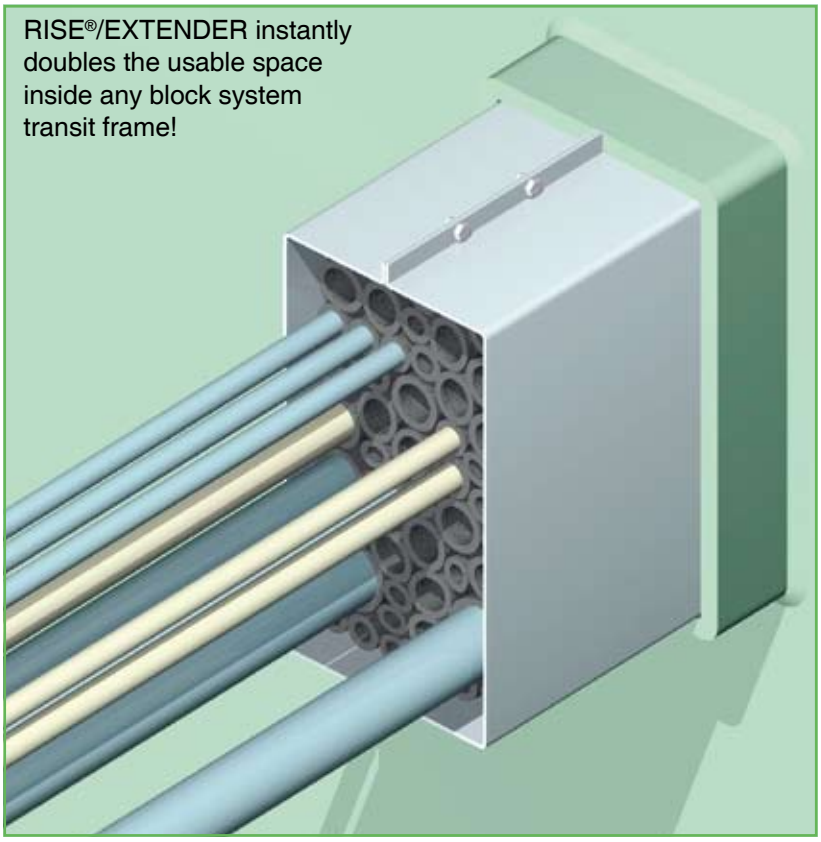
BEELE ENGINEERING

WE CARE

TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

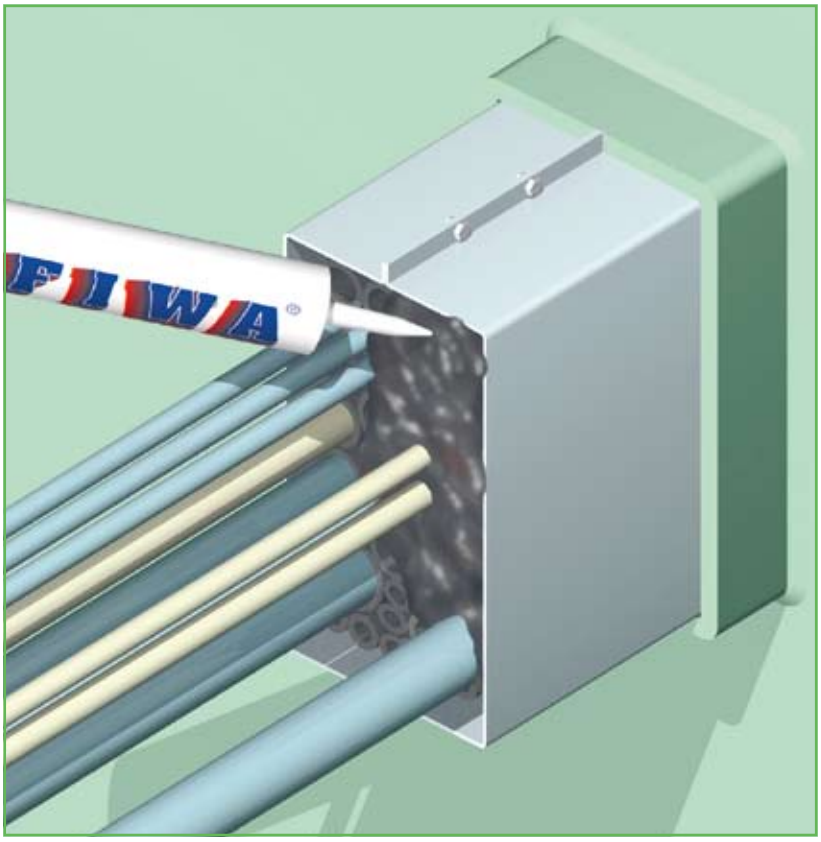
YOU WANT TO BE SURE THAT UPGRADING OF EXISTING INSTALLATIONS IS FEASIBLE WITH NEWEST TECHNOLOGY?

Existing installations can easily be upgraded to the RISE® or NOFIRNO® sealing system using extension frames. Generally the depth of the transit frames is too short to offer the required thermal insulation during a fire. To fulfil this criterion for all types of cables, a minimum depth of 180 mm is an absolute must. Otherwise the transit and the front side of the penetration have to be totally insulated. By making use of extension frames the required depth can easily be obtained. The advantage of upgrading with RISE® is not only an improvement of the fire rating, but it also gives the option to acquire more available space for ducting extra cables.



RISE®/EXTENDER instantly doubles the usable space inside any block system transit frame!

To allow for upgrading, the so-called EXTEND-A-FRAME, can be used. This is a split steel frame which can be placed around the set of cables. Eliminates the need for cutting new penetrations in valuable bulkhead/deck space!
For optimum stability, the EXTEND-A-FRAME can be spot welded or bolted to the existing frame. For larger frame configurations, an option is to install a frame around the existing transit frames, spot welded to the deck or bulkhead.
The EXTEND-A-FRAME is positioned in the transit frame, leaving 20 mm free at the back of the transit frame for the bonding of the FIWA® or NOFIRNO® sealant to the transit frame. This is necessary to obtain a tight seal.
Then the RISE® or NOFIRNO® sealing system is applied, offering the A-class fire ratings without any extra insulation.



WE CARE

BEELE ENGINEERING

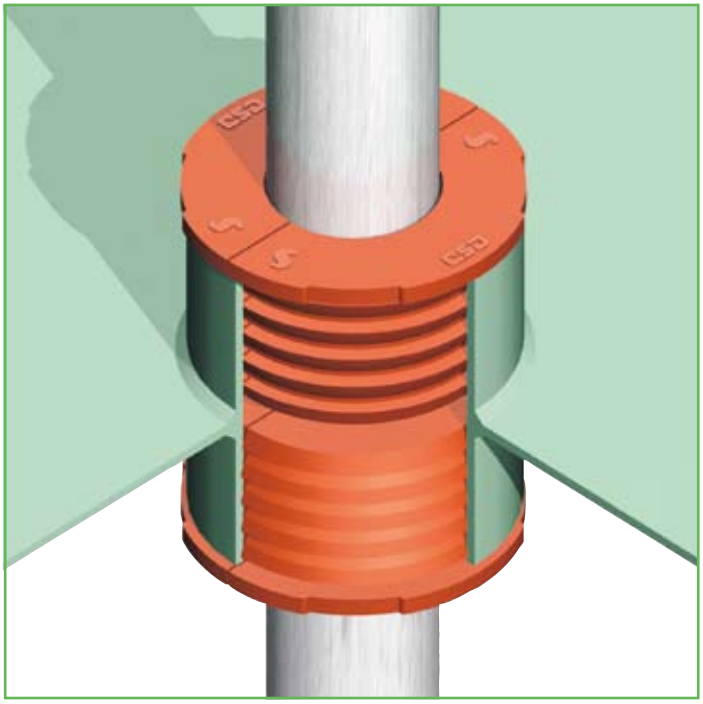
TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

FOR MAINTENANCE REASONS, A LONG LASTING, FLEXIBLE SEALING SYSTEM IS NEEDED FOR PIPE CONDUITS TO AVOID ANY FATIGUE

A lot of operational issues are not covered by Type Approval Certificates. Generally it is only the fire rating what is of importance, since the all certificates are based upon IMO Resolution A.754(18). Sometimes water and gas tightness ratings are included in the certificates. Operational performance is not a part of certification. Especially with pipe penetrations, flexibility of the sealing system is of utmost importance; not just for new installations but also during the service life of the installation. Not a problem for well designed system technology based on hi-tech rubber grades. BEELE Engineering has developed such a rubber grade which is used now for the SLIPSIL® and DYNATITE® sealing plugs and the NOFIRNO® sealing system for pipe transits.

Rubber engineering expertise and more than 35 years practical experience with sealing systems have contributed to an excellent sealing product. In view of the incompressibility of rubbers, the design work focused on finding an ideal solution to allow rubber to move in the right directions under mechanical loads. This excludes the use of nuts and bolts to compress the rubber and therefore minimizes permanent deformation. We refer to page 16 of this booklet to underline the fact that the general features of rubber polymers work contrary when heavy loads are applied on the rubber to obtain a certain degree of tightness. With such compressive systems the bolts have to be retightened regularly to maintain a certain degree of tightness.
For decades we have been involved with (fire resistant) rubbers. The drawbacks of certain types are halogen content, hardness of the highly filled rubbers, hardening during lifetime and high permanent deformation sets. All these features will have an impact on performance in the long run. NOFIRNO® rubber does not have the above drawbacks.

Because the plugs prevent direct contact between the service pipe and the sleeve, different types of pipes can be passed through steel or aluminium constructions without the problems of joints and electric couples.
Pipe penetrations sealed with plugs can be shorter in length than the common methods, in this way saving weight. With the use of SLIPSIL® sealing plugs, vibrations and noise transmission will be easily absorbed. Another advantage of the SLIPSIL® sealing plugs is that mechanical tensions between the bulkhead/deck and the service pipes are avoided. SLIPSIL® offers the possibility of using various pipe materials!
The design of the SLIPSIL® plugs is based on the LEAXEAL® technology, developed by BEELE Engineering, to obtain longest service life and highest tightness ratings.



LEAXEAL

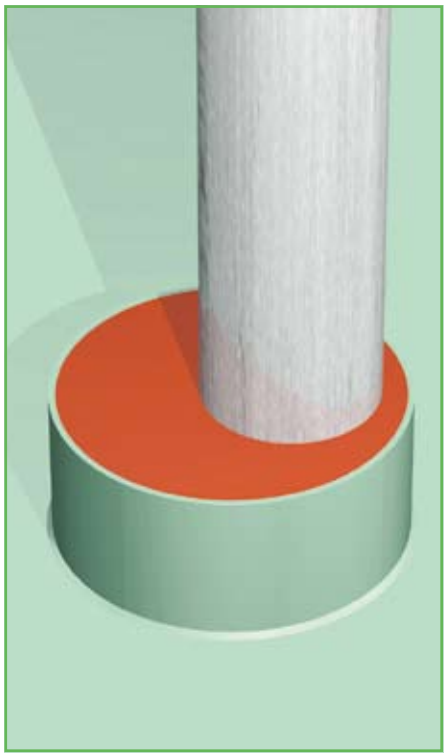
BEELE ENGINEERING

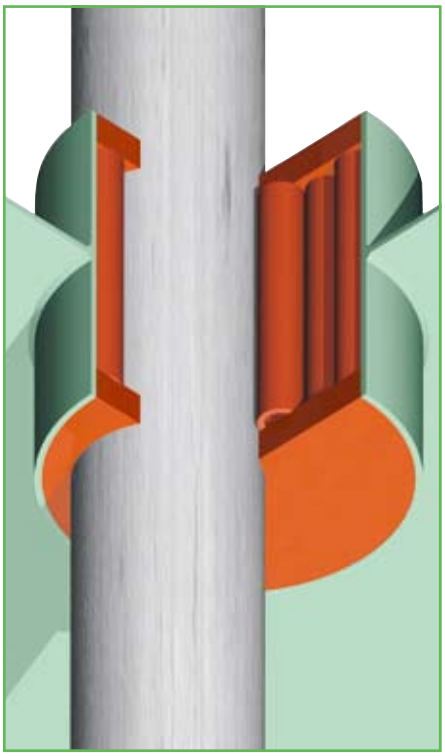
WE CARE

TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

FOR MAINTENANCE REASONS, A LONG LASTING, FLEXIBLE SEALING SYSTEM IS NEEDED FOR PIPE CONDUITS TO AVOID ANY FATIGUE

The SLIPSIL® sealing plugs allow for limited longitudinal movement of the ducted pipe and also for pipes ducted under an angle exceeding not more than 3-5°. In certain cases, the pipe installations are designed for larger movements or displacements in various directions. For these type of applications the SLIPSIL® plugs cannot be used. BEELE Engineering designed for this reason the NOFIRNO sealing system, consisting of filler sleeves to fill the open spaces around the ducted pipe and sealant to be applied on both sides of the penetration. The NOFIRNO system allows also for off centre ducted pipes, pipes ducted under an angle and for multi-pipe penetrations.





NOFIRNO

- Proven – simple and effective.
  Photograph showing 50 mm displacement of the ducted pipe relative to the conduit sleeve.
- NOFIRNO displays the best mechanical properties of our high-performance sealants.
- Tested with just a single 20 mm layer of NOFIRNO sealant.
- Conduit pipe 120 mm ID, ducted pipe 60 mm OD. Width of compound layer 30 mm.
- Force required for 50 mm stretch 3200 N. Stretch of sealant layer 94%!
- Tensile force removed – sealant layer regains smoothness.
- Flexibility and adhesiveness – optimized sealing.

WE CARE

BEELE ENGINEERING

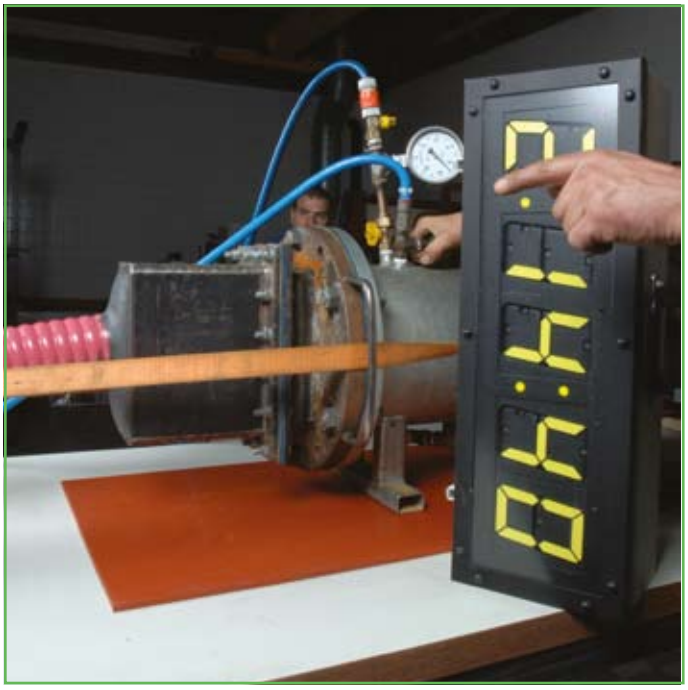
TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

YOU WANT TO BE SURE THAT FIRE SAFETY AND INTEGRITY ARE MAINTAINED DURING THE LIFE TIME OF THE VESSEL

For optimum tightness in the long term, the design of the sealing system is a determining factor. Also the quality of the used polymer, the flexibility, the hardness and the elongation at break of the rubber is most important. In case sealing systems have to be heavily compressed to obtain a certain degree of tightness, stress relaxation and permanent deformation of the rubber polymer are factors which can cause failures of tightness ratings in a very short time. Especially when products have no profiling, compression of the rubber will be substantial, contributing to an even faster permanent deformation and loss of flexibility.

The designers of the SLIPSIL® plug have been focusing on this issue. An appropriate profiling design and the use of a rubber grade with a proper flexibility, hardness and compression set offer excellent long term behaviour. The leveled outside profiles of the plug secure a proper surface contact inside the conduit and finally the inner ribs have a “sliding” design, not only for ease of installation, but also to create sufficient grip. SLIPSIL® plugs can be exposed to fairly high pressure loads directly after installation.
An average pressure rating has to be determined since it makes quite a difference whether a plug is tested with a small diameter pipe or with a large diameter pipe; or with a narrow or a wide conduit. Ratings are also different when pressurizing at the bottom side or on the flanged side.
For optimum tightness in the long term, the design and position of the profiles on the plugs is a determining factor.
One single pressure test will for sure not be sufficient to guarantee tightness in a wide variety of configurations.

After the flooding and resulting tilting of the Thunder Horse platform, existing systems had to be replaced with the RISE® system. To obtain the approval for use on this project, the RISE® system has been subjected to numerous pressure tests.
Tightness with the RISE® system is achieved by means of the very adhesive sealants with high flexibility and stretch performance.
The sealing system was subjected to pressure ratings in steps of 1 bar hold for 30 minutes up to 4 bar. After the pressure was hold for 10 minutes at 5 bar a big step was made to raise the pressure to 7 bar. At this load the FIWA® layer bulged out ca. 40-50 mm.
The pressure tests have been carried out with transits with low, medium and high filling rate.
Not only the high bonding strength, but also the resistance to environmental attacks of the FIWA® and NOFIRNO® sealants are contributing to sealing capacity on the long run. Sealing capacity secured for decades.
As is the case with fire safety, transits also have a limitation matrix with regard to tightness ratings.



BEELE ENGINEERING

WE CARE

TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

YOU WANT TO BE SURE THAT THE PENETRATIONS WILL STAY IN PLACE AND ARE WATERTIGHT WHEN A SUDDEN DISASTER OCCURS

When pressure exposure is constantly present, a water leak will be noticed rapidly. But how about the fact that exposure to pressure might suddenly occur after many years of operation? DYNATITE® has been developed specially for those applications where a high degree of (instantaneous) tightness is required and, for all, maintained on long term. The basics of the LEAXEAL®, NOFIRNO® and SLIPSIL® technology have been combined in the development of a single and multi-cable/pipe transit system which is less vulnerable than any comparable system and without showing any degradation during service life. Stress relaxation and permanent deformation are minimized by an engineered design.

DYNATITE® stands for dynamic tightness. The system is primarily suitable for all situations in which a sudden pressure exposure will occur. The objective is not only to hold multi-cable and pipe transits in situ, but also completely tight. Reference is made to the Thunder Horse accident on which compressive sealing type systems dramatically failed during water ingress. There are numerous other occasions where disasters as flooding and explosions easily could create substantial damage when sealing systems would fail. In such “explosive” situations, the sealing system will be exposed to an instantaneous pressure load and should therefore be able to settle itself rather quick. DYNATITE® is such a dynamic sealing system. Since rubber is incompressible, only an optimized profiling of the rubber parts can fulfil this requirement. A further objective of the development is to avoid large numbers of contact surfaces between rubber parts. The used rubber polymer should be able to reset itself when the pressure load disappears.
Specially developed for application in the columns of semi-submersible rigs, the system can be used in quite some other hazardous areas.
To name some: partitions between hazardous and non-hazardous area, blast walls, explosion proof areas, tsunami areas and all those situations where a sudden pressure might arise.

DYNATITE

WE CARE

BEELE ENGINEERING

TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

YOU NEED TO KNOW THAT A-0 CLASS DIVISIONS ARE MOST HAZARDOUS IN FIRE CONDITIONS

Unlike A-15, A-30 and A-60 divisions, the A-0 divisions are not insulated at all. This means that for cable and pipe transits in such divisions, not only the fire integrity is much more difficult to maintain, but also that the radiation heat released by the red glowing steel parts will have a substantial impact on the ducted cables and pipes (see the pictures at the bottom of this page). The radiation heat will cause the cable sheathings and the surface of plastic and GRP pipes to char and melt. Approaching these hot partitions is impossible since the temperatures are reaching 700 °C easily. Any combustible material in the vicinity of such divisions will spontaneously ignite. The NOFIRNO® rubber can withstand this harsh environment.

BEELE ENGINEERING

WE CARE

TYPE APPROVAL CERTIFICATES AND THE LIMITATION MATRIX

YOU NEED TO KNOW THAT ONCE SUCCESSFULLY TESTED FOR JET FIRES, SYSTEMS CAN COPE WITH THE MOST SEVERE FIRE CONDITIONS

Article 6.5 of ISO/CD 22899-2 mentions: There are concerns regarding the application and performance of passive fire protection materials and products when subjected to extreme fire events. Limited information is available how passive fire protection materials and products (developed for buildings only to withstand relatively slow build up fire tests such as ISO 834) perform if subjected to a fire exposure significantly more severe. A fire protection material or system intended to withstand a conventional building fire for a specified period may not perform adequately in an extreme event scenario. Products that have demonstrated the ability to withstand a jet fire can be used to protect buildings more sensitive to extreme fires.

An uncontrolled discharge of combustible gas or liquid under pressure, due to leaks or damage (for example) poses a serious fire hazard, especially in areas such as petrochemical plants and on offshore drilling and processing rigs. This hazard is also present in many production processes, in tunnels, parking garages and environments that are sensitive to extreme fires. If high-pressure flammable gas, pressurized liquefied gas or fuels are emitted and ignited, the result will be a jet fire. The jet flames created in the process cause an extremely heavy thermal and mechanical load.
The NOFIRNO system, which is already used for fireproof sealing of cable and pipe transits in the highest fire classes, recently passed a two-hour jet fire test conforming to ISO 22899-1:2007 / CD 22899-2. The positive test results emphasize the unique properties of the fireproofing system.
The Jet Fire test was performed by the Health & Safety Laboratory at Buxton (England), with a cable transit of 600 x 300 mm using armored and non-armored cables, CLX cables (105 mm OD) up to 3 x 400 mm² and bundled LAN data cables, as well as a pipe transit with an ID of 406.4 mm and a steel pipe with an OD of 273 mm. In some spots in the jet flames, temperatures of 1200 °C are reached in a very short time. The most significant challenges to which sealing systems are exposed during a jet fire, however, are the high convection and radiation heat, the mechanical load and the erosive forces combined.

From a time/temperature perspective, Jet Fire tests are similar to Hydrocarbon (H-Class) Fire tests. During the Hydrocarbon test, an instantaneous temperature rise up to 800 °C (1472 °F) takes place, with the overall exposure temperature rising to 1150 °C (2102 °F). However, during the Hydrocarbon test, there are no extreme conditions imparted to the penetration seal, such as thermal and mechanical loads or severe erosive forces, as is the case with the Jet Fire Test.

Jet fire tests simulate the most onerous conditions of a hydrocarbon fueled fire on an offshore oil rig, or a missile strike on a military warship.

WE CARE

BEELE ENGINEERING

NOFIRNO® MULTI-CABLE AND PIPE TRANSIT SEALING SYSTEM

Cutting Edge NOFIRNO® technology for optimum performance under harshest conditions:

- SYSTEM WILL NOT BE CONSUMED WHEN EXPOSED TO FIRE
- ALL COMPONENTS ARE MADE OF INERT SILICONE RUBBER
- IN CASE OF FIRE: NON-TOXIC, LOW SMOKE INDEX
- CE (MED) CERTIFICATES FOR A-0 UP TO A-60
- CERTIFIED FOR H-0 UP TO H-120 AND JET FIRE TESTED
- APPROVED WATERTIGHT UP TO 2.5 - 4 BAR
- APPROVED GAS TIGHT UP TO 1 BAR
- CAN BE USED IN ARCTIC CONDITIONS
- HIGH LEVEL OF SOUND DAMPING/EMC ATTENUATION
- SHOCK AND VIBRATION PROOF
- UP TO 50 YEARS SERVICE LIFE
- CAPABLE OF ABSORBING TEMPERATURE CHANGES
- WEATHERING, UV AND OZONE RESISTANT
- NO PRE-ENGINEERING NEEDED
- NO SPECIAL CONDUIT FRAMES
- MINIMIZED NUMBER OF STRUCTURAL COMPONENTS
- MOST COMPACT INSTALLATION
- EXTREMELY SIMPLE TO INSTALL
- NO INSULATION IN FRONT OF THE PENETRATION
- SHORTEST POSSIBLE CONDUIT LENGTH
- APPROVED FOR HEAVY CONDUCTOR CABLES
- APPROVED FOR BUNDLED LAN CABLES
- APPROVED FOR STEEL AND ALUMINIUM PARTITIONS
- MAINTENANCE FRIENDLY

WE CARE

NOFIRNO® MULTI-CABLE AND PIPE TRANSIT SEALING SYSTEM

Cutting Edge ACTIFIRE® and LEAXEAL® technology for optimum physical performance:

* Naval Engineering Standard 711: Issue 2: Determination of the smoke index	passed
* Naval Engineering Standard 713: Issue 3: Determination of the toxicity index	passed
* ISO 4589 - 2 : 1996 Determination of the oxygen index	passed
* ISO 4589 - 3 : 1996 Determination of the temperature index	passed
* IMO Resolution A.653(16) Determination of low flame spread characteristics	passed
* Artificial ageing test Determination of properties after 25-50 years	passed
* Thermal cycling test Determination of adhesion at +120 °C / ambient / -40 °C (+212 °F / ambient / -40°F)	passed
* Naval Engineering Standard 510: Issue 2, Draft B: Shock (100 g_n) and vibration test (5-350 Hz) combined with 1 bar leak test afterwards	passed
* Naval Engineering Standard 814: Shock test, acceleration level 8378/s/s in two directions combined with 6.9 bar leak test afterwards	passed
* Naval Engineering Standard 510: Issue 2, Draft B: Leak test after a one hour fire test	passed
* General classification Helium gas leak test up to 1 bar	passed
* Nordtest method NT ELEC 030, modified for conducted attenuation	20-100 dB
* Sound damping test According to EN ISO 717-1:1996	70 dB
* Rapid rise fire test, shock, vibration and water pressure According to Mil-P-24705 of the US Navy	passed
* Dynamic cycling test Displacement 10 mm, 100,000 cycles, frequency 0.5 Hz	passed
* Shock and vibration tests in 3 axis and pressure tests According to standards of the German Navy	passed

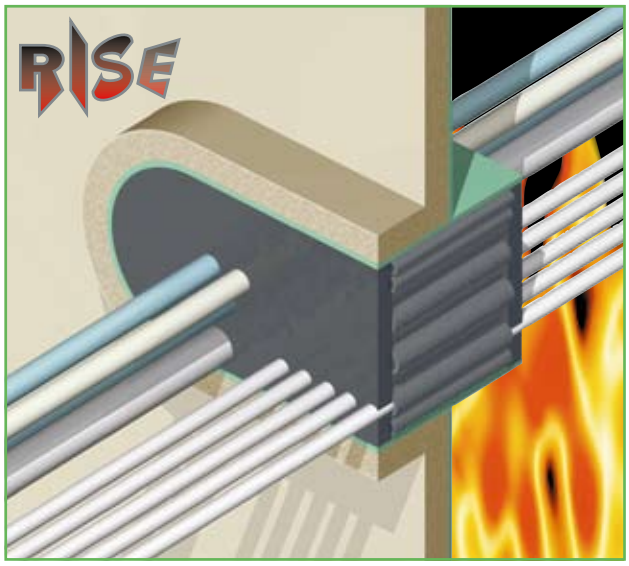
Initially some of these tests have been carried out with the regular RISE® system. The sealant is a determining factor for successful mechanical testing. NOFIRNO® sealant has improved mechanical properties so that NOFIRNO® can also be classed for these tests as well. TNO report TQS/RAP/07/335-idl.

To prove the outstanding quality and safety of the RISE® cable and pipe penetrations, the basic materials (FIWA® sealant and RISE® rubber) have been subjected to additional tests.
These tests have been carried out by official institutes: Warrington Fire Research and RAPRA Technologies in the United Kingdom, the Fire Technology Institute of the University of Ghent in Belgium and TNO Laboratories in The Netherlands.
The RISE® cable and pipe penetrations have also been subjected to additional tests at official institutes such as DELTA Danish Electronics, Light and Acoustics Testing in Denmark, QinetiQ in England, South West Research Institute in USA and in-house under survey of the classification societies. To name some: sound tests, shock and vibration tests, rapid temperature rise tests, leak tests after a one hour fire test, EMC tests, A-0 test without insulation, dynamic cycling test, several configurations on watertightness and a helium gas leak test.

WE CARE

BEELE ENGINEERING

BEELE PRODUCT OVERVIEW
MARINE APPLICATIONS - ELECTRICAL



RISE®

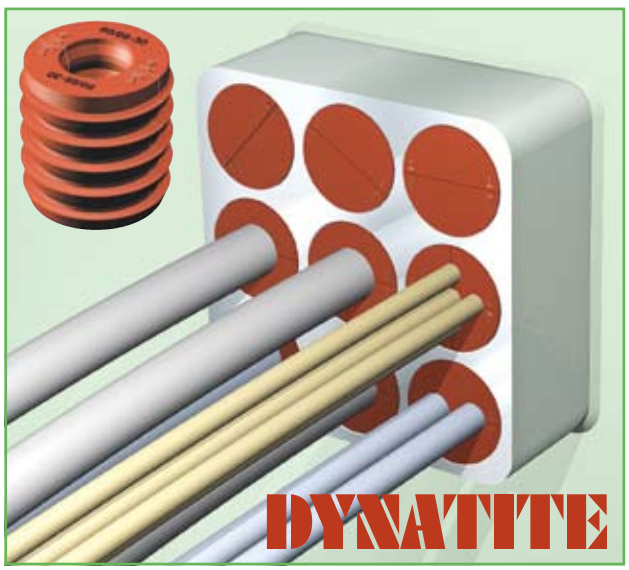
PROVEN TECHNOLOGY

- For fire, gas, smoke and watertight sealing of multi-cable penetrations.
- Compact system. No precise fitting parts.
- No metal parts, no corrosion.
- Most cost-effective way of installation.
- No pre-engineering or special conduit frames.
- No restrictions on cable types and sizes, no insulation in front of the penetration needed.
- Adding or removing cables an easy matter.
- RISE-EXTEND-A-FRAME applicable for upgrading block systems - doubles the usable space!
- Proven - for new and upgraded installations
- The system of choice in shipyards worldwide for almost 20 years!

NOFIRNO®

NEW TECHNOLOGY

- For fire, gas, smoke and watertight sealing of multi-cable penetrations.
- Compact system. No precise fitting parts.
- No metal parts, no corrosion.
- Most cost-effective way of installation.
- No pre-engineering or special conduit frames.
- No restrictions on cable types and sizes, no insulation in front of the penetration needed.
- Jet Fire tested for harshest applications.
- A-0 and H-0 tested without the use of any insulation.
- Breakthrough - bundled cable sets approved
- The system of choice for highest fire ratings and harshest environment!



DYNATITE®

NEW TECHNOLOGY

- For applications where a high degree of (instantaneous) tightness is required.
- Dynamic sealing when a disaster occurs.
- Plugs are compressible and will return to their original shape after shock pressure.
- Easily withstands shock pressure loads of more than 10 bar (150 psi).
- Ideal solution for the columns of offshore rigs and collision bulkheads.
- Breakthrough - dynamic compression
- Based on high-tech rubber grade and engineered profiling, the DYNATITE® plugs can be substantially compressed and gets tighter with excessive pressure.

BEELE ENGINEERING

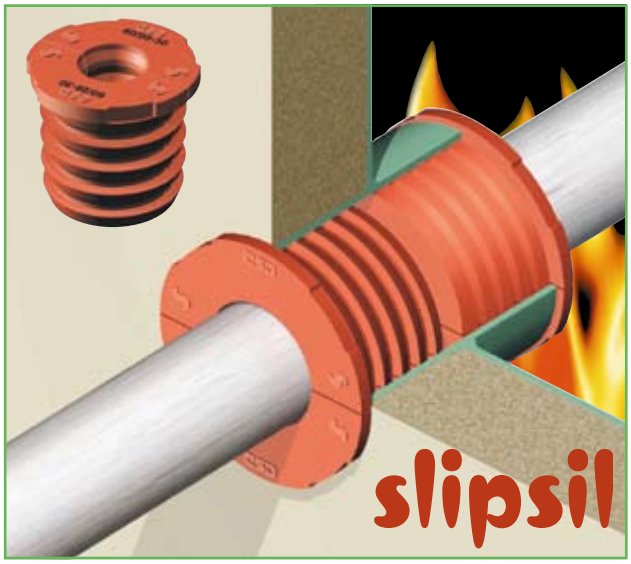
WE CARE

BEELE PRODUCT OVERVIEW
MARINE APPLICATIONS - MECHANICAL

SLIPSIL®

PROVEN TECHNOLOGY

- Designed to provide fire safe, gas and watertight seals for pipe penetrations.
- For transits carrying single or multiple metal pipes with the same diameter (hydraulic and pneumatic lines).
- Installs in a couple of minutes. Lubricate and push - that is it!
- No bolting or other mechanical devices required.
- Absorbs mechanical stresses, vibration and prevents galvanic corrosion problems.
- Wide temperature range: -50 °C up to +180 °C.
- Proven - simple, shortest conduit length
- The system of choice in shipyards worldwide for more than 2 decades!



NOFIRNO®

NEW TECHNOLOGY

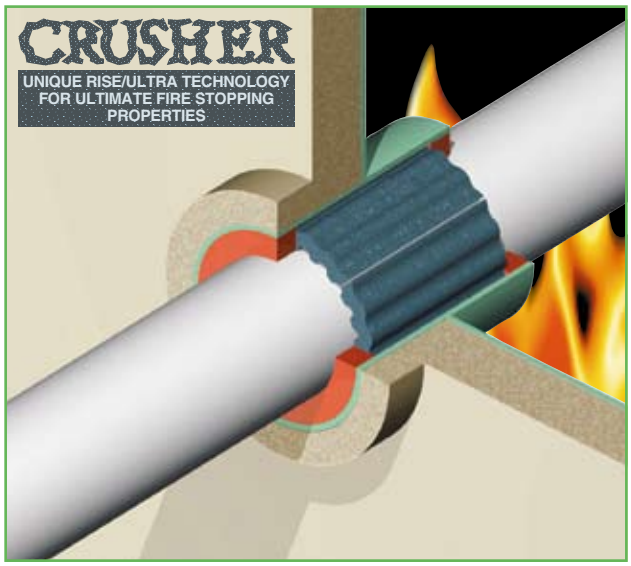
- Approved for harshest fire ratings for pipe penetrations (A, H and Jet Fire class).
- Allows substantial movement of the ducted pipe within the conduit.
- High pressure ratings - designed for gas and/or watertight penetrations.
- Prevents corrosion inside the penetration.
- Longest service life and best Total Cost of Ownership on the market.
- NOFIRNO® rubber sleeves and sealant will remain stable and not be consumed by fire.
- Breakthrough - MULTI-ALL-MIX® SYSTEM
- Approved for any combination of cable and/or metallic, GRP or plastic pipes!

MULTI-ALL-MIX®
(left to right):
CLX cable, steel pipe, bundled LAN cables, plastic pipe, thermally insulated metallic pipe, copper and GRP pipe

CRUSHER®

NEW TECHNOLOGY

- Most simple and effective system for all plastic pipe penetrations.
- RISE®/ULTRA C-FIT crushers squeeze down and seal opening during a fire.
- RISE®/ULTRA wraps to be used for oversized conduit sleeves.
- NOFIRNO® sleeves for filling larger spaces.
- NOFIRNO® sealant adheres well to plastics: high degree of water tightness feasible.
- Breakthrough - adhesion under fire load
- RISE®/ULTRA compound forms an adhesive mass during fire exposure!
- Approved for a multiple mixture of all kinds of plastic pipes.



WE CARE

BEELE ENGINEERING:
A COMPANY DEDICATED TO SAFETY FOR OVER 35 YEARS

For more information, please contact CSD Sealing System, North America, LLC

www.csd.us.com E: info@csd.us.com Tel. 603-293-0100

Rev. February 2022