SAFETY SEALING SYSTEMS

BEELE WE CARE

FISSIC® FIRE PROOF COATING GAS TIGHT SURFACE, NO WATER ABSORPTION SALT WATER RESISTANT

FISSIC

TECHNOLOGY DEVELOPED BY BEELE ENGINEERING BV
COMPOUNDING AND PRODUCTION IN THE ULTRA-MODERN MANUFACTURING FACILITIES IN AALTEN/THE NETHERLANDS
UNDER A STRINGENT ISO 9001:2008 QUALITY SYSTEM
MORE THAN 40 YEARS R&D ON QUALITY, DURABILITY & FUNCTIONALITY

Edition : November 2015

Research & Development : BEELE Engineering BV, Aalten, the Netherlands.

Note : The manufacturer reserves the right to make dimensional and design modifications without prior notification.

brochure code : FISSIC properties

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FISSIC®

a product developed and manufactured
by BEELE Engineering bv/Netherlands
website: www.fissiccoating.com

FISSIC® is a fire retardant coating on the basis of an APEO-free water-based polymer emulsion without the addition of VOC containing solvents.

FISSIC® has been tested successfully on flame spread characteristics and toxicity and is classed as ”not capable of producing excessive quantity of smoke or toxic product”.
MED certificate 39278/A0 EC issued by Bureau Veritas.

FISSIC® is fire proof and salt water resistance (even after fire).
KIWA Netherlands report 20150421HN/01.

FISSIC® is gas tight 30 mBar.

FISSIC® is water impermeable.

FISSIC® prevents “CUI - corrosion underneath insulation”

FISSIC® COATING OFFICIALLY TESTED AND CERTIFIED

Page 1 / 2

BUREAU VERITAS

Marine & Offshore Division

Certificate number: 39278/A0 EC
File number: ACI 1330/088/001
Annex A1 Item number: A.1/3.18b
USCG Module B number: 164.112 / EC0062

This certificate is not valid when presented without the full attached schedule composed of 7 sections

www.veristar.com

Notified Body 0062 - MARINE EQUIPMENT DIRECTIVE 96/98/EC

EC TYPE EXAMINATION CERTIFICATE

as per Module B of European Union Council Directive 96/98/EC on marine equipment
as amended by Commission Directive 2012/32/EU

This certificate is issued to

BEELE ENGINEERING
Aalten - NETHERLANDS

for the type of product

SURFACE MATERIALS AND FLOOR COVERINGS WITH LOW FLAME-SPREAD CHARACTERISTICS: PAINT SYSTEMS
Fissic fire resistant, water resistant coating

Requirements:
SOLAS 74 convention as amended, Regulations II-2/3, II-2/5, II-2/6, II-2/9, X/3
IMO Resolution MSC.97(73) - (2000 HSC Code) 7
IMO MSC.307(88) (2010 FTP Code) Annex 1 Part 2 and Part 5
IMO MSC/Circ.1120
ISO 1716 (2010)

This certificate is issued under the French Maritime Authority to attest that BUREAU VERITAS did undertake the relevant type-examination procedures for the product identified above which was found to comply with the relevant requirements of the Council Directive 96/98/EC of 20 December 1996 as amended.

This certificate will expire on: 26 Sep 2019

For BUREAU VERITAS Notified Body 0062,
At BV GRONINGEN, on 26 Sep 2014,
John Mondt

BUREAU VERITAS SURVEYORS AT PARIS 1828 GRONINGEN INTERNATIONAL REGISTER

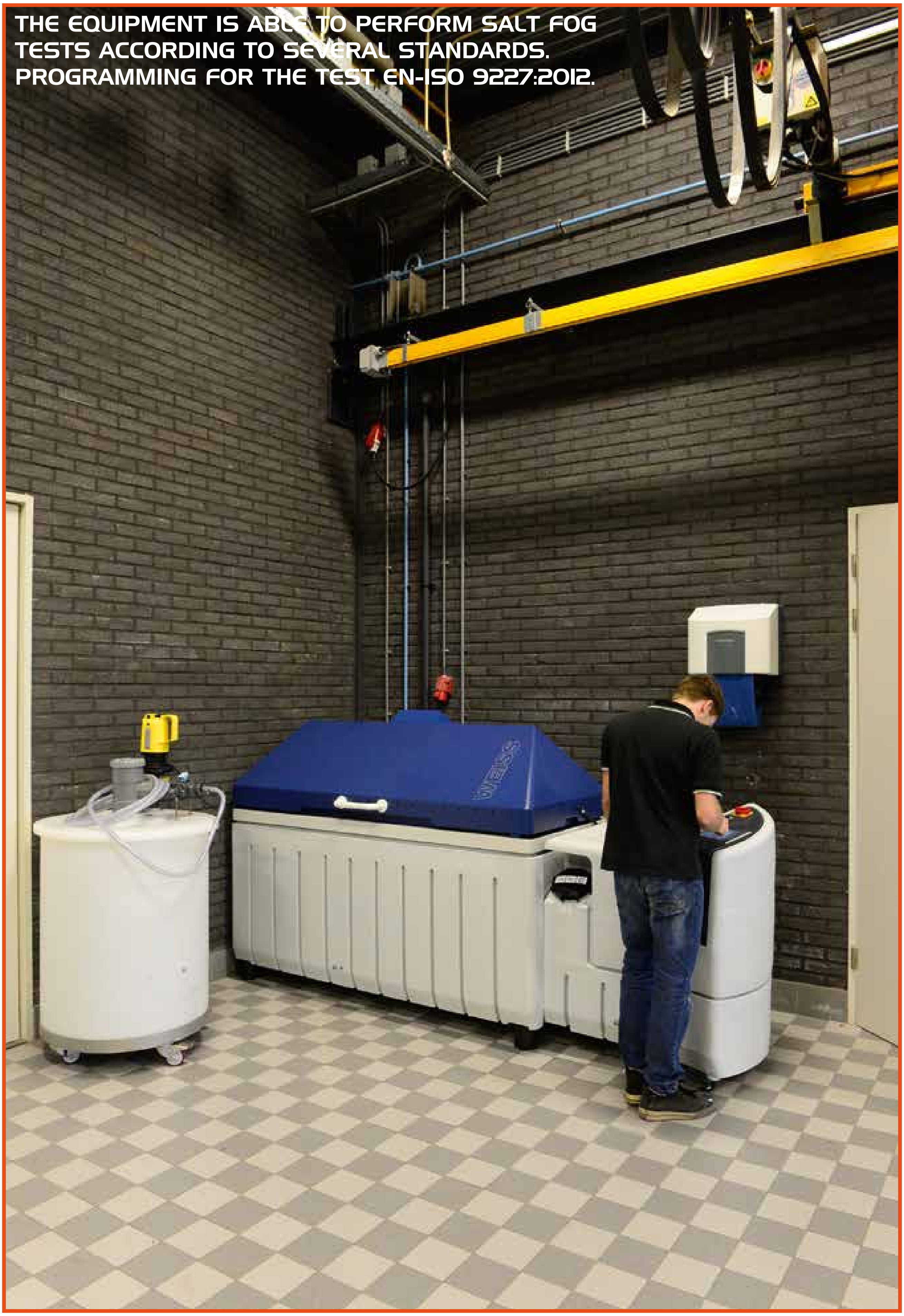
This certificate does not allow to issue the Declaration of Conformity and to affix the mark of conformity (wheelmark) to the products corresponding to this type. To this end, the production-control phase module (D, E or F) of Annex B of the Directive is to be complied with and controlled by a written inspection agreement with a notified body.
This certificate remains valid until the date stated above, unless cancelled or revoked, provided the conditions indicated in the subsequent page(s) are complied with and the product remains satisfactory in service. This certificate will not be valid if the applicant makes any changes or modifications to the approved product, which have not been notified to, and agreed in writing with BUREAU VERITAS. Should the specified regulations or standards be amended during the validity of this certificate, the product(s) is/are to be re-approved prior to it/they being placed on board vessels to which the amended regulations or standards apply. BUREAU VERITAS is designated by the French Maritime Authority as a "notified body" under the terms of the French Regulations Division 140 Chapter 140-2. This certificate is issued within the scope of the General Conditions of BUREAU VERITAS Marine & Offshore Division available on the internet site www.veristar.com. Any Person not a party to the contract pursuant to which this document is delivered may not assert a claim against BUREAU VERITAS for any liability arising out of errors or omissions which may be contained in said document, or for errors of judgement, fault or negligence committed by personnel of the Society or of its Agents in establishment or issuance of this document, and in connection with any activities for which it may provide.

The electronic version is available at: http://www.veristarpm.com/veristarnb/jsp/viewPublicPdfTypec.jsp?id=dm7drovez6

BV Mod. Ad.E 536 May 2009 — This certificate consists of 2 page(s)

SALT FOG SPRAY TESTING EQUIPMENT IN THE R&D LABORATORIES OF BEELE ENGINEERING.

STEEL PIPE PARTLY COATED WITH FISSIC® AND WITH FISSIC® ENCAPSULATED MINERAL WOOL



THE EQUIPMENT IS ABLE TO PERFORM SALT FOG TESTS ACCORDING TO SEVERAL STANDARDS. PROGRAMMING FOR THE TEST EN-ISO 9227:2012.

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THE TEST SPECIMEN EXPOSED FOR 24 HOURS AT A TEMPERATURE OF 35 °C TO A 5% SODIUM CHLORIDE SOLUTION WITH A pH of 6.8.

THE NON-TREATED PART OF THE STEEL PIPE CORRODED, THE FISSIC® COATING NOT AFFECTED

THE WITH FISSIC® COATING ENCAPSULATED MINERAL WOOL AFTER EXPOSURE TO THE SALT FOG TEST

THE EN 10216-1/10210 - DIN (2448) St. 52-3N
STEEL PIPE AFTER EXPOSURE

SALT FOG SPRAY TEST EXPOSURE TO A STEEL PIPE COATED WITH FISSIC® AFTER A 60 MINUTES A-60 FIRE TEST. OFFICIAL TEST REPORT.

kiwa
Partner for progress

20150421HN/01
21 April 2015

FISSIC coating:

Resistance to neutral salt spray test (NSS)

after a A60 fire test

GAS TIGHTNESS TEST ON A FISSIC® LAYER APPLIED ON MINERAL WOOL. OFFICIAL REPORT WILL BE ISSUED.


TEST CARRIED OUT AT 38 mBAR
38.0
mbar

A FISSIC® LAYER APPLIED ON MINERAL WOOL EXPOSED FOR ALMOST 2 YEARS TO WATER. OFFICIAL REPORT WILL BE ISSUED.

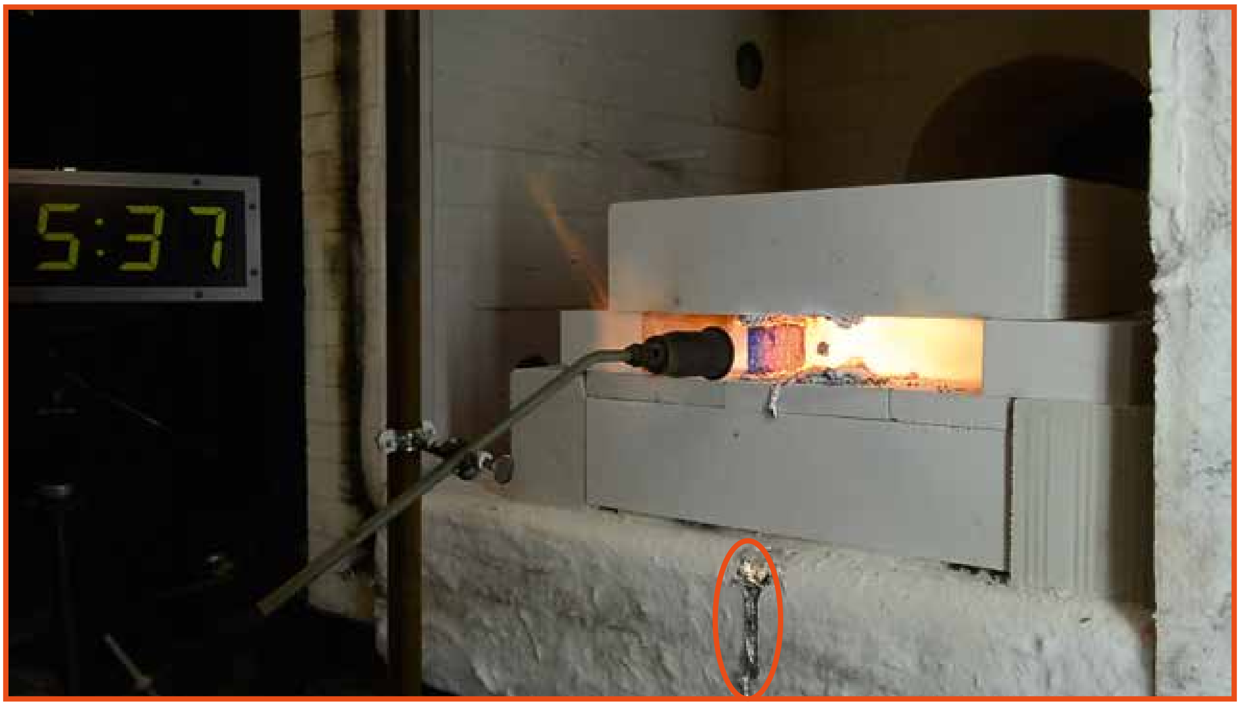
Preliminary investigation of the feasibility to determine thermal insulation properties of the FISSIC® coating. Jet fire test carried out May 29, 2015 on two aluminum pipes 65x55 mm with a length of 80 mm. At the left side the aluminum pipe with a 4 mm thick FISSIC® coating and at the right side the non-treated aluminum pipe.

The pipe ends are sealed top/bottom with NOFIRNO® sealant to create tightness between the concrete blocks and the edges of the aluminum pipes. Inside the pipes a thermocouple is fixed against the wall at the spot of the flame exposure to measure temperature rise during fire exposure.

To maximize the heat flux and flame erosion the test was carried out in a small re-circulation chamber. Shortly after 3 minutes the non-treated aluminum pipe started to deform, increasing the flaming inside the chamber and releasing fumes. At 3:40 minutes the aluminum started to melt.

The FISSIC® charred to form its protective layer. After almost 5 minutes the non-treated aluminum pipe lost mechanical stability and started sagging. Flaming intensified as can be seen on this picture.

At 5:03 minutes the melted aluminum dripped of the bottom of the re-circulation chamber.



At 5:37 minutes dripping of the aluminum stopped. Flaming and fuming reduced and stopped in the following seconds.

The thermocouple which was placed inside the non-treated aluminum pipe hanging on top of the melted aluminum. The aluminum cooled down on the concrete due to the fact that the jet flame has a higher position.

The situation after 15 minutes testing. There is not much to see at the surface of the exposed FISSIC®, but the temperature measured inside the aluminum pipe is now close to 600 °C which is more or less the melting temperature of aluminum.

The temperature on the surface of the FISSIC® coating is >1000 °C. At 16 minutes testing the aluminum must have been melted. Obviously the thermocouple must have been covered by the melted aluminum since the temperature rise from 16 to 20 minutes is very limited.

No further changes visible during further testing.

The FISSIC® coating is still in place at the end of the jet test, the NOFIRNO® sealant has formed its protective char also. It looks at the outside of the coated aluminum pipe if nothing has happened.

After 30 minutes the jet fire is extinguished.

Close-up of the FISSIC® treated test specimen and the char of the NOFIRNO® sealant at the end of the jet test.

No after-flaming of the FISSIC® coating and NOFIRNO® sealant.

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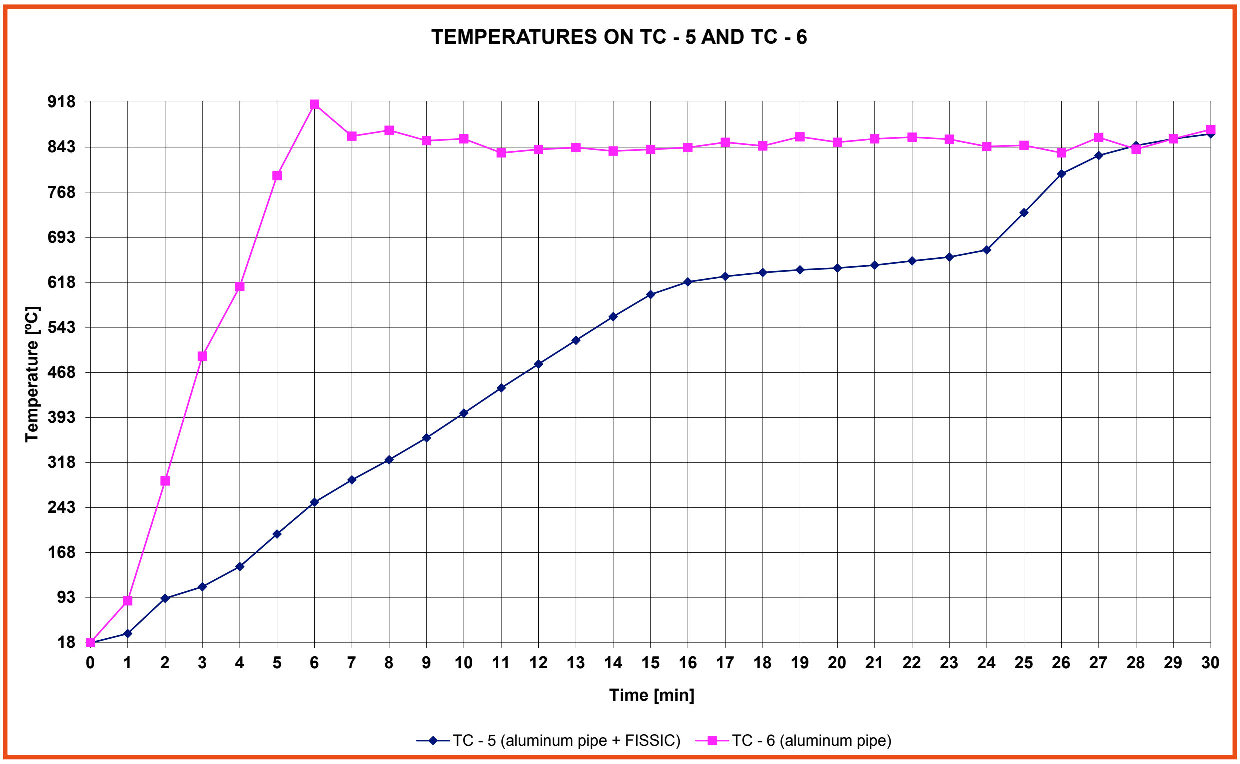
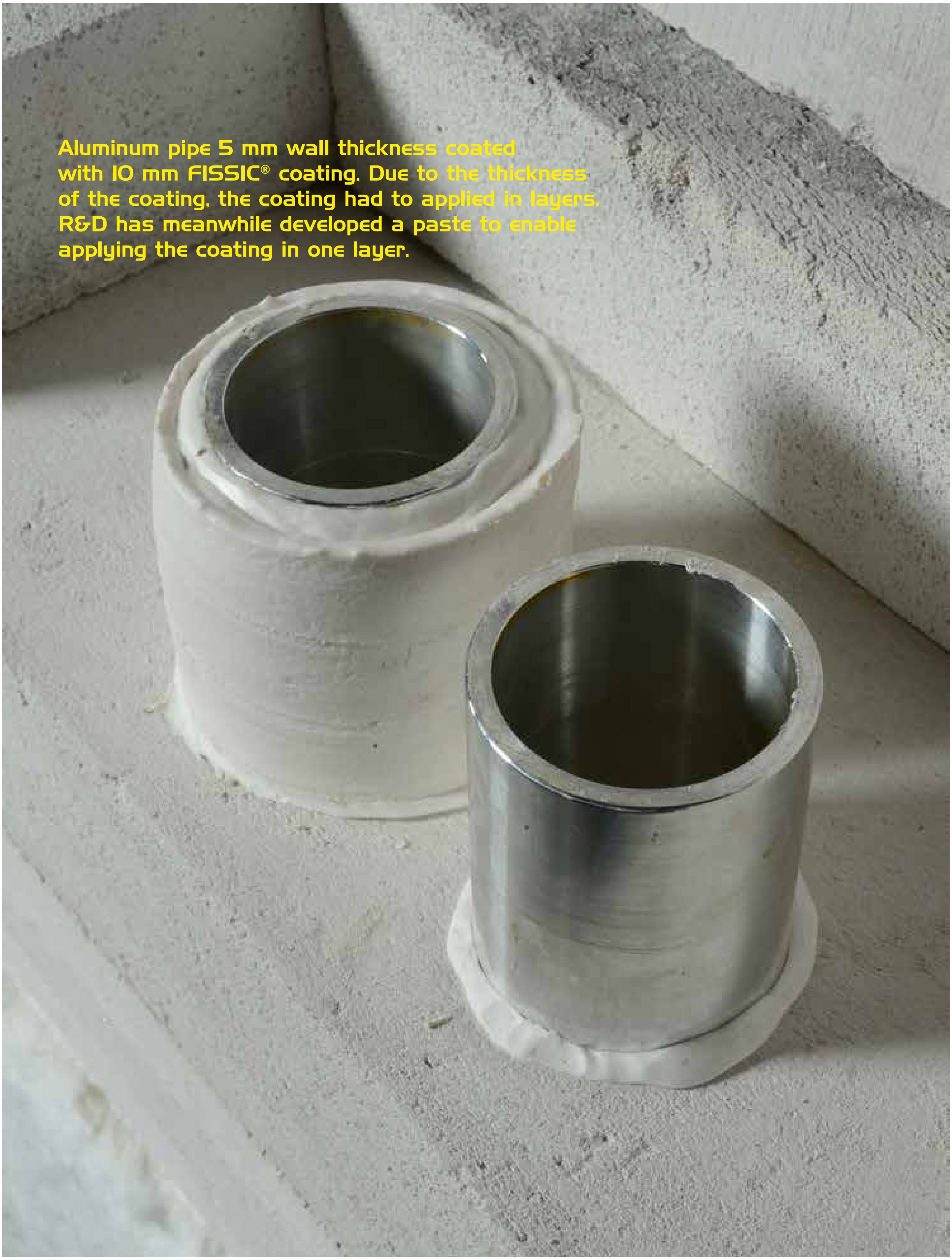
The performance of the FISSIC® coating is visible after removal of the concrete block at the top of the re-circulation chamber. The melted aluminum at the bottom inside the formed FISSIC® “pipe”. It is also visible that a part of the aluminum pipe is still intact. NOFIRNO has performed as usual under fire load - the terracotta colour still visible beyond the protective char.



Conclusion:
An only 4 mm thick layer of FISSIC® coating has protected an aluminum pipe for ca. 15 minutes from melting and collapsing. R&D is ongoing to obtain improved thermal insulation properties to determine the thickness required to protect the aluminum longer and at even higher temperatures as tested now.



Aluminum pipe 5 mm wall thickness coated with 10 mm FISSIC® coating. Due to the thickness of the coating, the coating had to applied in layers. R&D has meanwhile developed a paste to enable applying the coating in one layer.

JET TEST ON ALUMINUM PIPES

Second investigation of the feasibility to determine thermal insulation properties of the FISSIC® coating. Jet fire test carried out June 12, 2015 on two aluminum pipes 65x55 mm with a length of 80 mm. At the left side the aluminum pipe with a 10 mm thick FISSIC® coating and at the right side the non-treated aluminum pipe.

The pipe ends are sealed top/bottom with NOFIRNO® sealant to create tightness between the concrete blocks and the edges of the aluminum pipes. Inside the pipes a thermocouple is fixed against the wall at the spot of the flame exposure to measure temperature rise during fire exposure.

To maximize the heat flux and flame erosion the test was carried out in a small re-circulation chamber. The FISSIC® charred to form its protective layer. Shortly after 4 minutes the non-treated aluminum pipe started to deform and fluid aluminum dripped off.

After 5 minutes the non-treated aluminum pipe lost mechanical stability and started sagging. Flaming inside the re-circulation chamber intensified as can be seen on this picture. It looks that the melting/burning aluminum contributes substantially to the fire.

After the aluminum has burned away, leaving reminders on the floor, the intensified flaming disappeared.

Close-up of the FISSIC® coating after almost 10 minutes testing. The coating holds together and does not fall off.

The temperature on the surface of the FISSIC® coating is >1000 °C. Temperature on the aluminum inside the pipe at the position of the jet flame is only 102 °C.

The situation after 15 minutes testing. There is not much to see at the surface of the exposed FISSIC®, The temperature measured inside the aluminum pipe is now 173 °C against the temperature close to 600 °C measured after 15 minutes on the aluminum pipe coated with 4 mm FISSIC® in the previous jet test.

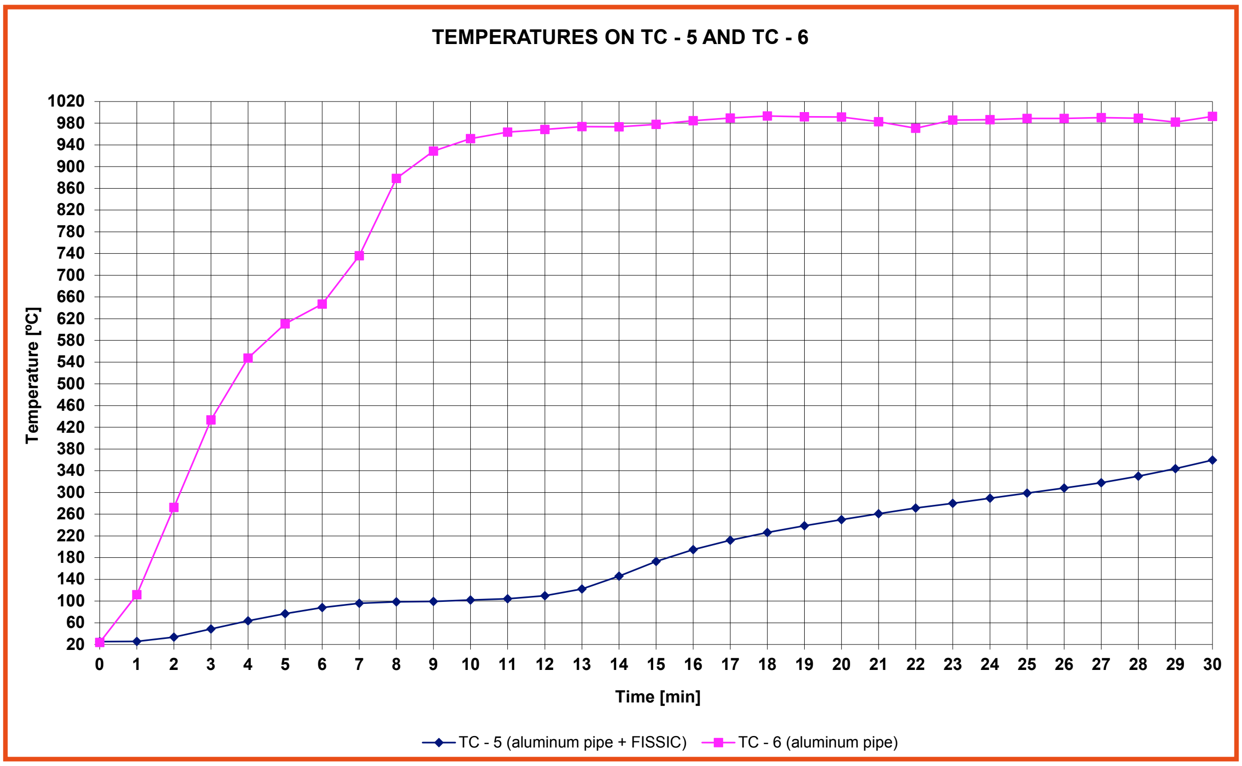
The heat inside the re-circulation chamber is increasing. The camera had to be protected with a mineral wool board. Temperature on the aluminum pipe now 260° C.

No further changes.

The situation at the end of the test. Temperature on the aluminum pipe 360 °C, far below the melting point of the aluminum.

Some after-flaming of the FISSIC® coating is visible after the jet flame has been extinguished. This might have been caused by the fact that the FISSIC® coating probably has not fully cured due to the thickness of the layer.

The performance of the FISSIC® coating is visible after removal of the concrete block at the top of the re-circulation chamber. The aluminum pipe is not affected by heat and flames. The FISSIC® layer is broken when the upper concrete block has been removed.



Conclusion:
An 10 mm thick layer of FISSIC® coating has protected an aluminum pipe during jet fire exposure of 30 minutes from melting and collapsing (max. temperature 360 °C). R&D is ongoing to improve the application methods and to improve time of hardening. Furthermore a higher filling of the compound will be investigated.

After removal of the charred FISSIC® layer it became obvious that the adhesion of the thicker FISSIC® has to be improved. This with a view of future shock testing.

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FISSIC®-TI coating has been formulated to a paste. The coating is light weight and flexible. The thermal insulating properties are higher than those of the standard FISSIC® coating.

Applying a FISSIC®-TI layer on a steel pipe for thermal protection with regard to the maximum allowable temperature rise of 180 °C according to the fire testing protocols.

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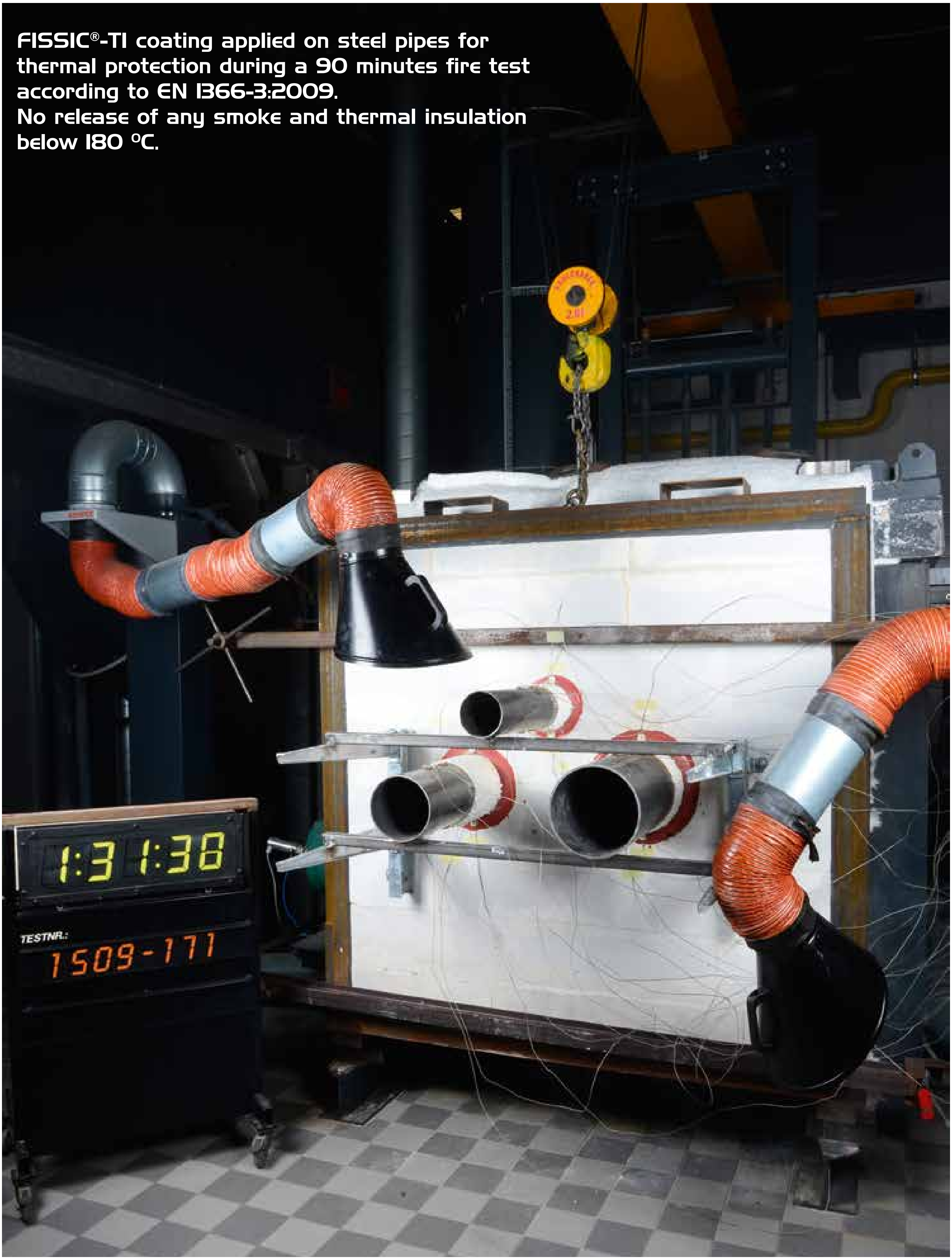
FISSIC®-TI coating applied on steel pipes for thermal protection during a 90 minutes fire test according to EN 1366-3:2009.
No release of any smoke and thermal insulation below 180 °C.




Applying a FISSIC®-TI layer on a steel partition to investigate thermal insulation properties when applied at the exposed side of the fire.

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FISSIC®-TI coating applied on a part of a steel partition. R&D is ongoing to develop spraying equipment for the paste.

The FISSIC® coating can be applied by airless spraying.
For spraying the FISSIC®-TI coating special equipment has to be developed.

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The FISSIC® coating can be applied by airless spraying. Or by brushing.
The next generations of the compound will be a paste to enable application of thicker layers of the FISSIC® coating and a casting version.

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BEELE ENGINEERING:
A COMPANY DEDICATED TO SAFETY
FOR OVER 40 YEARS

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