

## INSTALLATION INSTRUCTIONS

**FIRESAFE GPG MARINE MORTAR****Fire stopping System:**

Fire resistant mortar for cables and pipes in penetrations in bulkheads and decks.

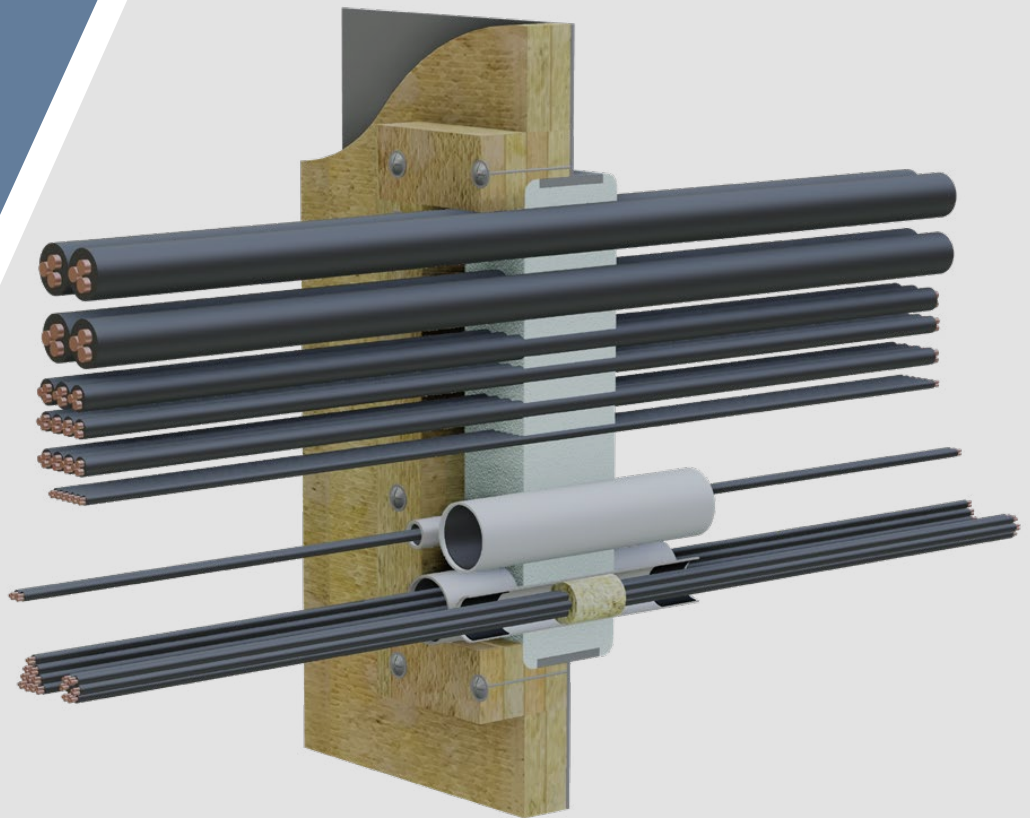
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# General description

## FIRESAFE GPG MARINE (GPGM) MORTAR

GPGM is a powder consisting of gypsum, perlite and fiberglass that when mixed with water forms a light green fire resistant mortar of a fluid or firm consistency. GPGM is a gypsum-based fast curing fire resistant mortar with high mechanical strength and good sound insulation properties. Even in small thicknesses, GPGM provides good thermal conductivity around all cables and pipes and insulates against heat. GPGM increases by approx. 1 % in volume as it cures and has excellent adhesion to most materials. GPGM is mainly used as a fire sealant for large or small penetrations around cables and pipes as well as open sleeves in bulkheads or decks.

## INSTALLATION

GPGM is added to a bucket filled with a little water in the bottom. The mortar is mixed with a trowel or mixed for about ½ minute with a drill to achieve a smooth mixture at the desired consistency. Initial curing time is 75 minutes, but may vary depending on the mixing ratio between water and GPGM. FS retarder may be added to delay the curing time. A firm mixture is made with 4 parts GPGM and 1 part water. A fluid mixture is made with 2 parts GPGM and 1 part water.

Sleeves must be cleaned of dust and dirt before applying the fire sealant. Carbon steel pipes must always be rust proofed before applying the fire sealant. Masking tape should be used around sleeves for a nice final result.

GPGM mortar is applied according to the tables for the

relevant fire resistance, construction and equipment listed in these installation instructions.

GPGM must be applied in one operation per sleeve.

## CORROSION PROTECTION

For all fire sealing around uninsulated metal pipes, it is important to ensure that the pipes have sufficient corrosion resistance for the particular environment in which they are installed. This is because moisture/condensation can easily occur at and around a fire seal. Steel pipes of the most commonly used types in offshore and marine environments are tested in a salt spray chamber (ASTM B117).

## SAFETY FACTORS

Firesafe GPGM complies with CLP 1272/2008.

## STORAGE

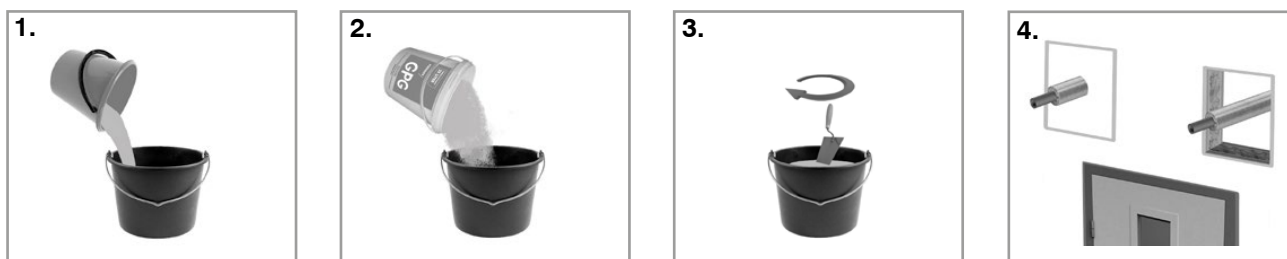
Store dry and frost-free. The shelf life of the product is virtually unlimited.

## FIRE TESTING

The heat exposure during the tests were according to IMO fire curve as described in IMO 2010 FTP Code Part 3 of Annex 1, Hydrocarbon fire curve as described in NS-EN 1363-2 and Jet Fire 350 kW/m<sup>2</sup> curve as described in ISO 22899-1 for cable transit systems.

## TECHNICAL INFORMATION

For other technical information, see the Product Data Sheet for FIRESAFE GPGM MORTAR.



## DELIVERY FORM

GPGM comes in a 20 litre plastic tub.



20 litre plastic tub with 4 off 5L plastic bags  
FS article No: 100 052

# General description of products and GPGM certificates

## FIRESAFE CIRCULAR CABLE CONDUITS

FIRESAFE circular cable conduits are tested for fire resistance class A0 and A60 in bulkhead in combination with FIRESAFE GPGM MORTAR in single or multiple cable penetrations.

FIRESAFE circular cable conduit is made of 1.5 mm thick powder-coated steel. The cable conduit is fitted internally with an intumescent laminate in each end of the conduit. The laminates expand at a temperature of approx. 180 °C, and expand approx. 20 times of the original thickness hence quickly closes the penetration of cables in case of a fire.

In addition, FS circular cable conduits contains a circular cold-smoke seal of 100 mm stone wool in the middle of the conduit. When used the whole bag, it can be reinstalled into the cable conduit, or the stone wool can be removed from the bag and placed back into the conduit around the cables if necessary. Make sure that the stone wool is compressed sufficiently for good cold-smoke seal.

FIRESAFE cable conduits are available in standard sizes (d) Ø32 - Ø52 and Ø76 mm. Length 330 mm.

FIRESAFE circular cable conduits have the function as reserve pipes for pulling new cables through a FIRESAFE GPGM sealed sleeve. FS cable conduits can be filled with multiple cables assuming there is room for the requisite smoke seal of stone wool inside of the conduits.

## FIRESAFE FT GRAPHITE

FIRESAFE FT Graphite is tested for fire resistance class A0 and A60 in bulkhead and deck in combination with FIRESAFE GPGM MORTAR.

FIRESAFE FT Graphite is a heat-expanding, one-component water-based graphite joint sealant.

FS FT Graphite expands at a temperature of approx. 180 °C, and expands approx. 20 times the original thickness of the seal at a high pressure.

Flexibility: 12%

Storage and application temperature: +5 °C – +30 °C

Colour: Dark grey

Application temperature: +5 °C – +30 °C

Drying (looks): 15 min

Drying (toughened): 1-24 hours

## FIRESAFE PIPE WRAP MARINE 25

FIRESAFE Pipe Wrap Marine 25 (PWM25) is developed to be used in combination with GPGM MORTAR in pipe penetrations through bulkhead and deck.

PWM25 is wrapped around the pipe by using stainless steel strips or bands. The wrap enables small movements/ vibrations of the pipe due to e.g. hull pump vibrations, pressure pulses. The thickness of the wrap is approx. 4 mm.

The core of PWM25 consists of a special staple fibre yarns with SiO<sub>2</sub> content above 95%. The core is covered on both sides with a special fire-resistant silicon rubber.

Density: 50 kg/m<sup>3</sup> (fibre yarn core)

Density: 1350 kg/m<sup>3</sup> (silicon rubber)

Colour: Brick red

Width: 250 mm

Thickness: 4 mm

Length: 10 m (or other on request)

## FIRESAFE GPG MARINE DNV-GL TYPE APPROVAL CERTIFICATE :

Certificate No:	TAF000014A
Certificate No:	TAF000014B
Certificate No:	TAF000014C
Certificate No:	TAF000014D
Certificate No:	TAF000014E
Certificate No:	TAF000014F
Certificate No:	TAF000014G

## FIRESAFE GPG MARINE DNV-GL MED-B AND U.S. COAST GUARD CERTIFICATE:

Certificate No:	MEDB00004MV
Certificate No:	MEDB00004T0
Certificate No:	MEDB00004W6
Certificate No:	MEDB00004W7
Certificate No:	MEDB00004W8
Certificate No:	MEDB00004W9
Certificate No:	MEDB00004WA

## FIRESAFE GPG MARINE HYDRO CARBON (HC) FIRE CERTIFICATE:

Certificate No:	TAF00000SK
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# Cable penetrations

## FIRE CLASSIFICATION AND CABLE TYPES

Fire classification for cables applies to the following types of cables in offshore and marine environments, BFOU, RFOU and XTREM with maximum diameter specified in the tables. There will at some configurations be a requirement for spacing between cables or the distance from cables to the edge of the sleeve, cables can (where applicable) lie right next to each other.

FIRESAFE circular cable conduits are made of powder-coated steel, coated internally with an intumescent laminate that quickly closes the penetration in the event of a fire. Firesafe cable conduits is used as a reserve pipe for pulling cable in combination with FIRESAFE GPGM MORTAR.

The FIRESAFE circular cable conduit can be used with all types of approved electric cables with a diameter of  $\leq 21$  mm

or it can remain empty for later use. The cable conduit must not be left open without a smoke seal, as this can result in smoke during a fire. The conduits are delivered with stone wool pads to be stuffed around the cables or to fill the open hole after installation.

Multiple penetrations shall not exceed more than 35% of the area of sleeve. (Multiple means more than one installation in the same sleeve.) Single cables or cable bundles should have a minimum of 10-30 mm (as specified) of clearance between the cable(s) and the inside of the sleeve. The fire sealant can be applied with and without stone wool insulation assuming compliance with described fire resistance class.

Tested for A0, A60, H0, H60, H120 and Jet Fire 350 kW/m<sup>2</sup>.

/ For fire resistance class and installation details, see tables:

Table	Type of penetration	Figure	Fire resistance class	Page
1	A0 Bulkhead, cable-single (d) 10-20 mm in 60 mm sleeve	1-2	A0	6
2	Bulkhead, single cable (d) 52 mm in 60-90 mm sleeve	3	A0	7
3	Bulkhead, cable bundles (d) 90 mm, cable (d) 10 mm in 60 mm sleeve. FS FT Graphite	4	A0	8
4	Bulkhead, multi / single cables (d) $\leq 52$ mm w/ and w/o FS cable conduit in 60-90 mm sleeves	5	A0	9
5	Deck, single cable (d) 52 mm in 60-90 mm sleeve	6	A0	10
6	Deck, multi / single cables (d) $\leq 52$ mm in 60 mm sleeve	7	A0	11
7	Bulkhead, single cable (d) 52 mm in 60-90 mm sleeves	8	A60	12
8	Bulkhead, cable bundles (d) 120 mm, cable (d) 10 mm in 60 mm sleeve. FS FT Graphite	9	A60	13
9	Bulkhead, multi / single cables (d) $\leq 52$ mm w/ and w/o FS cable conduit in 60-90 mm sleeves	10	A60	14
10	Deck, single cable (d) 52 mm in 60-120 mm sleeves	11	A60	15
11	Deck, multi / single cables $\leq 52$ mm in 60 mm sleeve	12	A60	16
12	Deck, cable bundles (d) 120 mm, cable (d) 10 mm in 60 mm sleeve. FS FT Graphite	13	A60	17
13	Bulkhead, single cable (d) $\leq 52$ mm in $\geq 300$ mm sleeve	14	H0	18
14	Bulkhead, multi / single cables (d) $\leq 52$ mm in $\geq 250$ mm sleeve	15	H0	19
15	Deck, single cable (d) $\leq 52$ mm in $\geq 250$ mm sleeve	16	H0	20
16	Deck, multi / single cables (d) $\leq 52$ mm in $\geq 250$ mm sleeve	17	H0	21
17	Bulkhead, single cable (d) $\leq 52$ mm in $\geq 200$ mm sleeve	18	H60	22
18	Bulkhead, multi / single cables (d) $\leq 52$ mm in $\geq 200$ mm sleeve	19	H60	23
19	Deck, single cable (d) $\leq 52$ mm in 200 mm sleeve	20	H60	24
20	Deck, multi / single cables (d) $\leq 52$ mm in 200 mm sleeve	21	H60	25
21	Deck, single cable (d) $\leq 52$ mm in $\geq 250$ mm sleeve	22	H120	26
22	Deck, multi / single cables (d) $\leq 52$ mm in $\geq 250$ mm sleeve	23	H120	27
23	Bulkhead, multi / single cables (d) 9.7-55.9 mm mm in $\geq 250$ mm sleeve	24	Jet Fire (350kW/m <sup>2</sup> )	28

# A0 Bulkhead

Table: 1

Fire resistance class A0				
Steel plate (t) ≥ 4.5 mm Small single cable penetration. Thickness 100 mm GPGM in 60 mm sleeve				
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Figure
Single cable	10 mm ≤ d ≤ 20 mm	Ø 56 mm	GPGM 20+60+20 mm	1-2

Installation

Single cable shall be mounted in the center of the sleeve.

GPGM sealant must have a thickness of 100 mm: apply 20 mm extra on each side of sleeve as shown on drawing below. GPGM compound is mixed to a firm consistency with 4 parts GPGM and 1 part water. To be applied in one operation per sleeve.

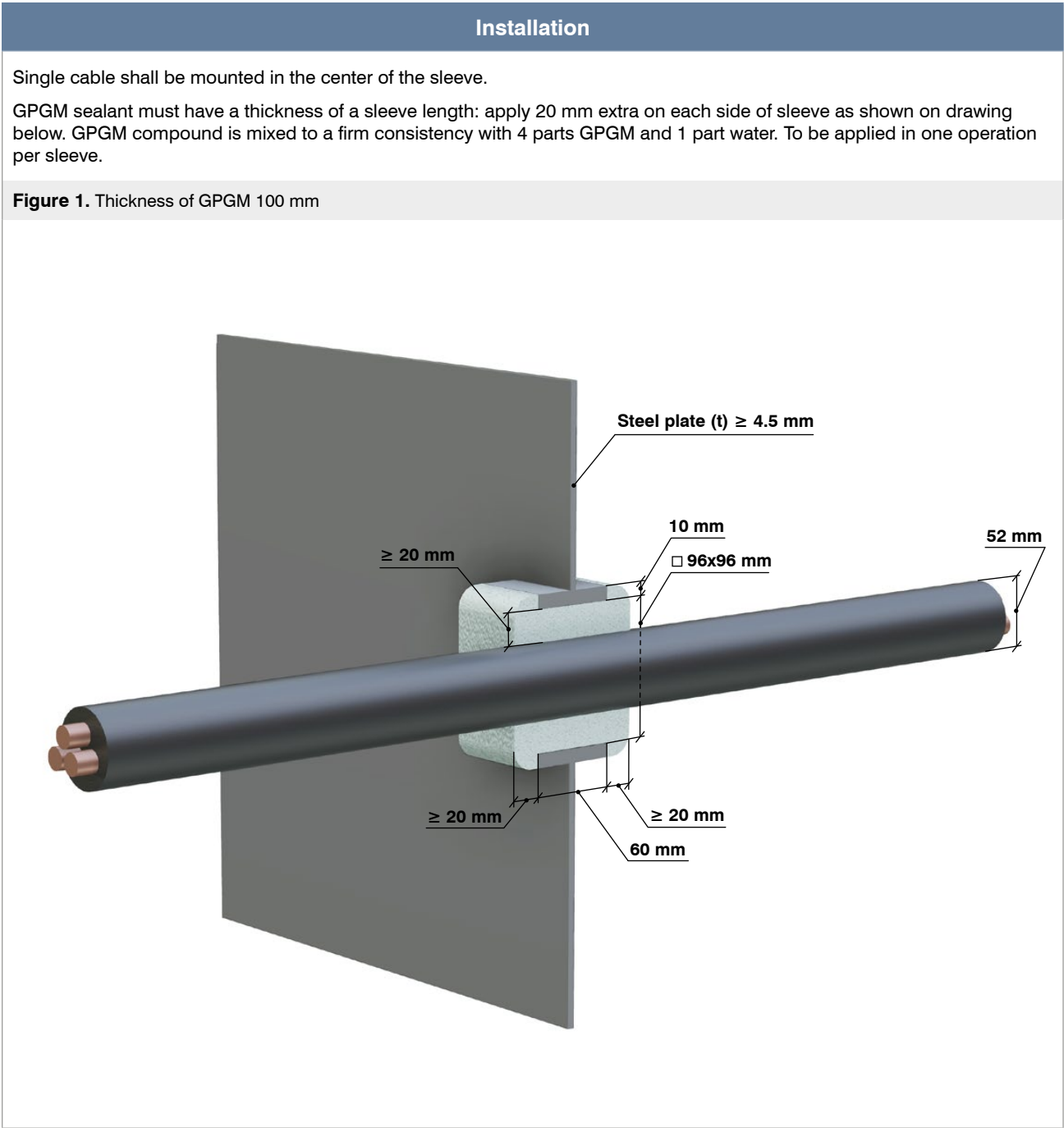
Figure 1. Thickness of GPGM 100 mm

Figure 2. Thickness of GPGM 100 mm

# A0 Bulkhead

Table: 2

Fire resistance class A0					
Steel plate (t) ≥ 4.5 mm Small single cable penetration.					
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Sleeve length	Figure
Single cable	52 mm	116 x 116 mm	GPGM 20+60+20 mm	60 mm	3
Single cable	52 mm	116 x 116 mm	GPGM 20+90+20 mm	90 mm	





# A0 Bulkhead

Table: 3

Fire resistance class A0					
Steel plate (t) ≥ 4.5 mm Large cable-bundles penetration. Thickness 100 mm GPGM in 60 mm sleeve					
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Additional product	Figure
Cable bundle, cable (d)10 mm	90 mm	532 x 240 mm	GPGM 20+60+20 mm	FS FT Graphite	4

## Installation

Cable bundles shall be mounted in the center of the sleeve.

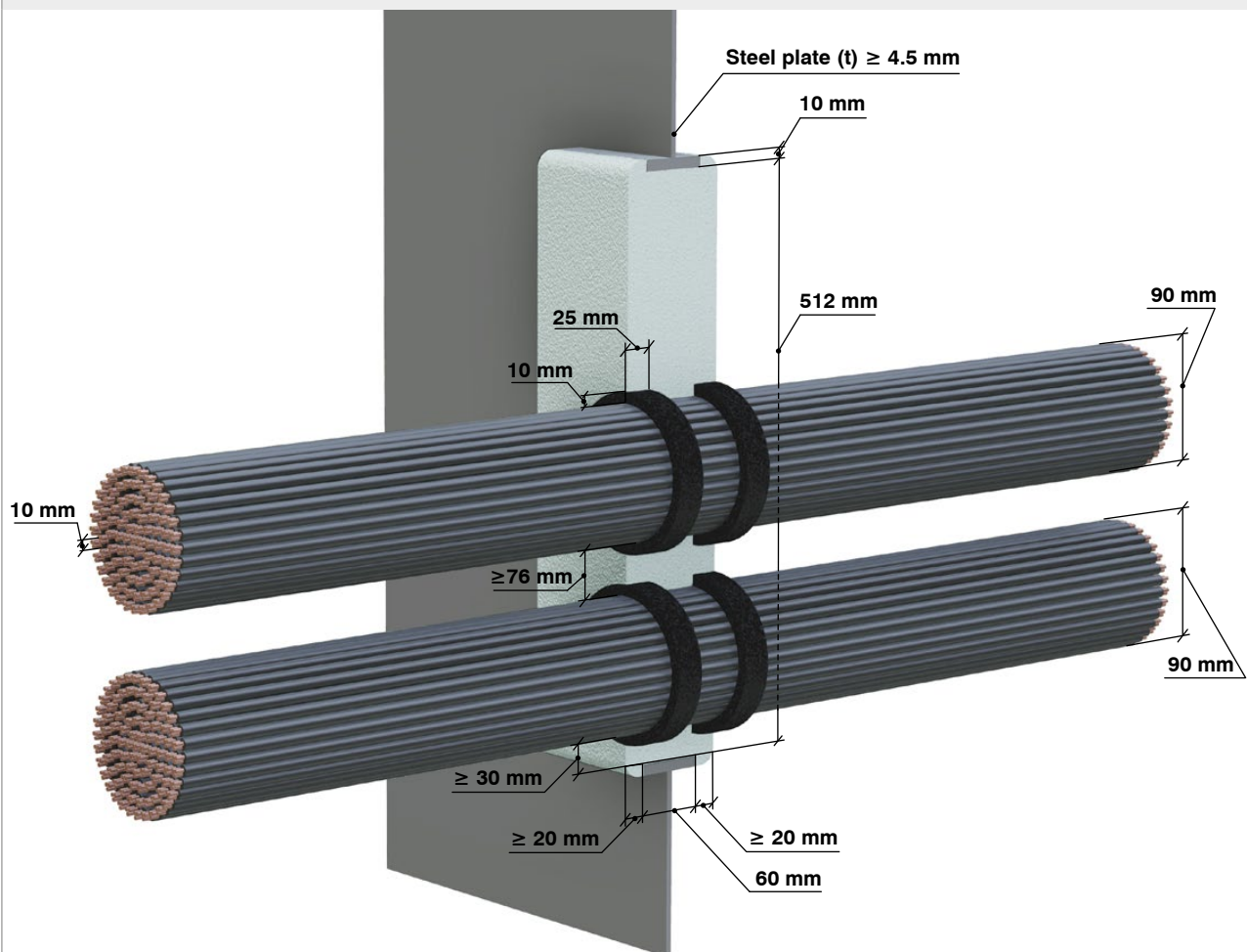
GPGM sealant must have a thickness of 100 mm: apply 20 mm extra on each side of sleeve as shown on drawing below. GPGM compound is mixed to a firm consistency with 4 parts GPGM and 1 part water. To be applied in one operation per sleeve.

Min. distance between cable bundles ≥ 76 mm.

Min. distance between cable bundle and inside edge of the sleeve ≥ 30 mm.

FIRESAFE FT Graphite must be applied around cable bundles in the GPG sealant on both sides of the sleeve. Width 10 mm and depth 25 mm.

Figure 4. Thickness of GPGM 100 mm





# A0 Bulkhead

Table: 4

Fire resistance class A0						
Steel plate (t) ≥ 4.5 mm Large multi cable penetration.						
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Sleeve length	Additional product	Figure
Multi / single cables	≤ 52 mm	532 x 240 mm	GPGM 20+60+20 mm	60 mm		5
Multi / single cables	10 mm				FS circular cable conduit	
Multi / single cables	≤ 52 mm	532 x 240 mm	GPGM 20+90+20 mm	90 mm		
Multi / single cables	10 mm				FS circular cable conduit	

## Installation

Multi / single cables and Firesafe circular cable conduits shall be mounted in the center of the sleeve.

GPGM sealant must have a thickness of a sleeve length: apply 20 mm extra on each side of sleeve as shown on drawing below. GPGM compound is mixed to a firm consistency with 4 parts GPGM and 1 part water. To be applied in one operation per sleeve.

Min. distance between cables and inside edge of the sleeve ≥ 20 mm. Cables can lie right next to each other in a bundle, as shown below with a minimum distance between horizontal cable layers of ≥ 16 mm.

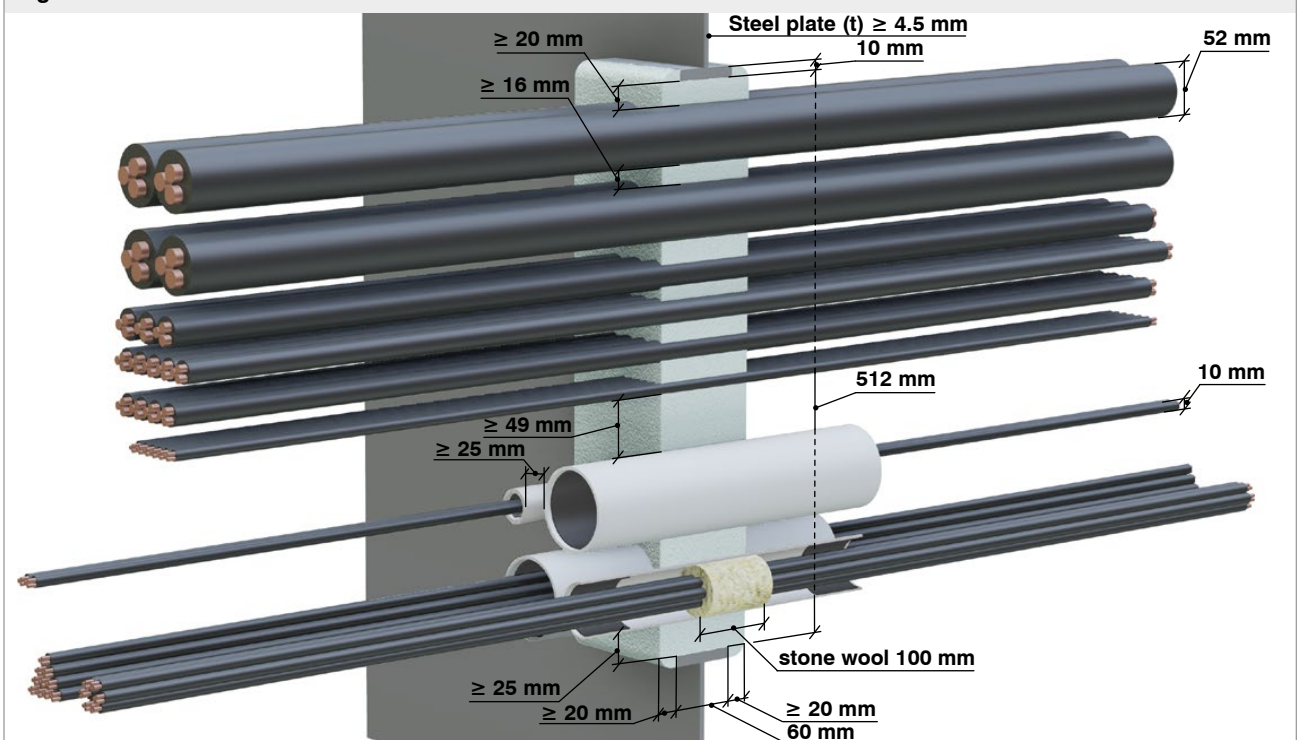
Min. distance between cables and cable conduits ≥ 49 mm.

Min. distance between cable conduits and inside edge of the sleeve and distance between multiple cable conduits ≥ 25 mm.

100 mm stone wool to be fitted around cables inside Firesafe circular cable conduit (to stop cold smoke).

The conduit can be filled with multiple cables assuming there is room for the requisite smoke seal inside the conduit.

Figure 5. Thickness of GPGM 100 mm



# A0 Deck

Table: 5

Fire resistance class A0					
Steel plate (t) ≥ 4.5 mm Small single cable penetration.					
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Sleeve length	Figure
Single cable	52 mm	116 x 116 mm	GPGM 20+60 mm	60 mm	6
Single cable	52 mm	116 x 116 mm	GPGM 20+90 mm	90 mm	

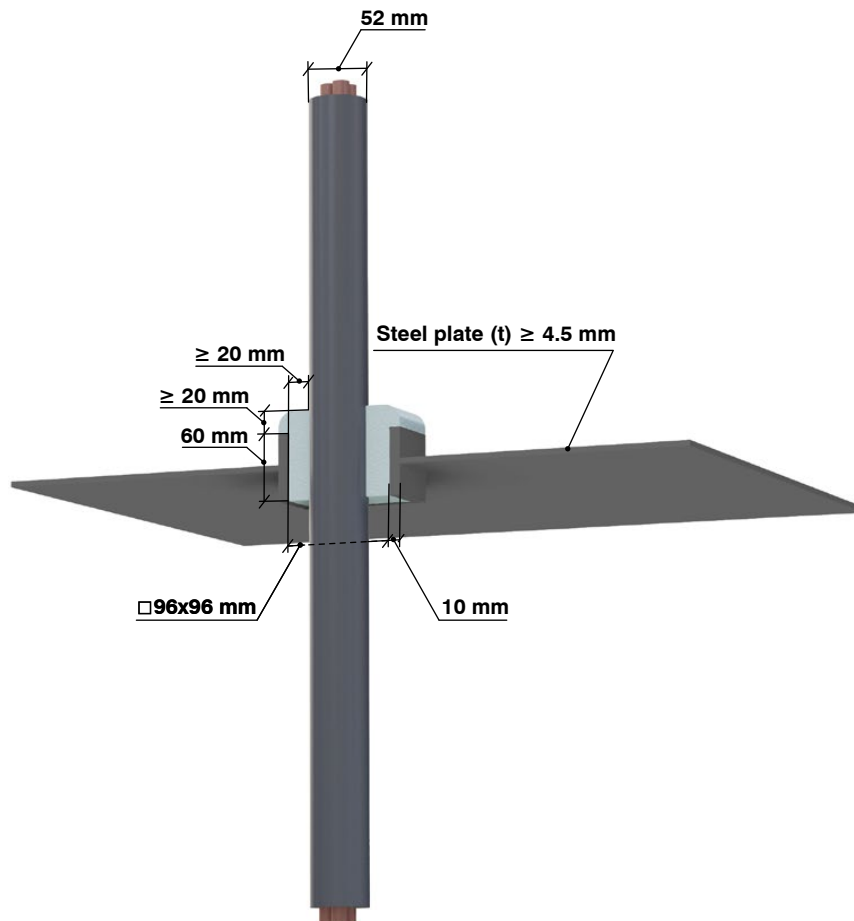
## Installation

Single cable shall be mounted in the center of the sleeve.

GPGM sealant must have a thickness of a sleeve length: apply 20 mm extra on upper side of sleeve as shown on drawings below. GPGM compound is mixed to a fluid consistency with 2 parts GPGM and 1 part water. To be applied in one operation per sleeve. Use a firm formwork to keep mortar in sleeve before drying phase starts. If a stone wool plate is used, it does not need to be removed after installation.

Min. distance between cable and inside edge of the sleeve ≥ 20 mm.

Figure 6. Thickness of GPGM 80 mm



# A0 Deck

Table: 6

Fire resistance class A0					
Steel plate (t) $\geq$ 4.5 mm Large multi cable penetration.					
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Sleeve length	Figure
Multi / single cables	$\leq$ 52 mm	532 x 240 mm	GPGM 20+60 mm	60 mm	7
Multi / single cables	$\leq$ 52 mm	532 x 240 mm	GPGM 20+90 mm	90 mm	

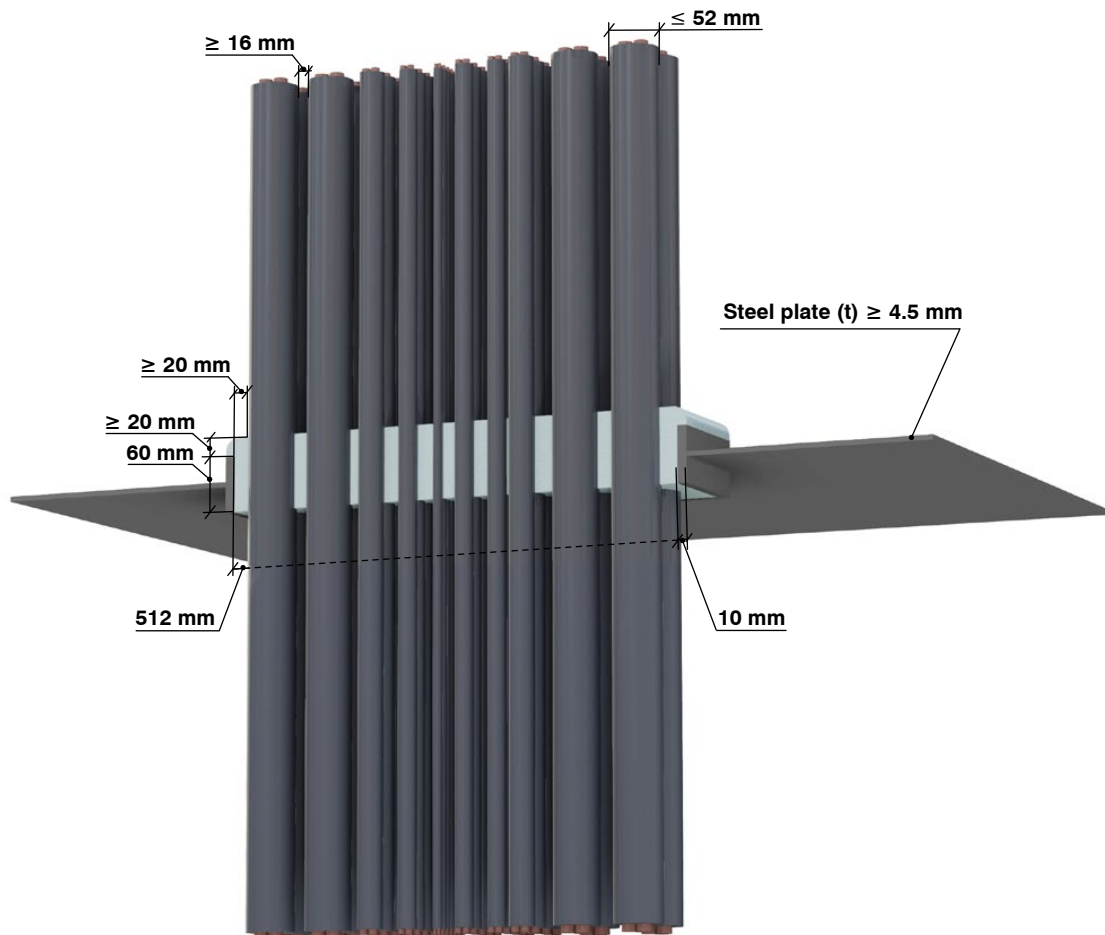
## Installation

Multi / single cables shall be mounted in the center of the sleeve.

GPGM sealant must have a thickness of a sleeve length: apply 20 mm extra on upper side of sleeve as shown on drawings below. GPGM compound is mixed to a fluid consistency with 2 parts GPGM and 1 part water. To be applied in one operation per sleeve. Use a firm formwork to keep mortar in sleeve before drying phase starts. If a stone wool plate is used, it does not need to be removed after installation.

Cables can lie right next to each other with a minimum distance between vertical cable layers of  $\leq$  16 mm.  
Min. distance between cables and inside edge of the sleeve  $\geq$  20 mm.

Figure 7. Thickness of GPGM 80 mm



# A60 Bulkhead

Table: 7

Fire resistance class A60						
Steel plate (t) $\geq$ 4.5 mm Small single cable penetration.						
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Sleeve length	Insulation type	Figure
Single cable	52 mm	116 x 116 mm	GPGM 20+60+20 mm	60 mm	Rockwool SeaRox SL 620	8
Single cable	52 mm	116 x 116 mm	GPGM 20+90+20 mm	90 mm	Rockwool SeaRox SL 620	

## Installation

Single cable shall be mounted in the center of the sleeve.

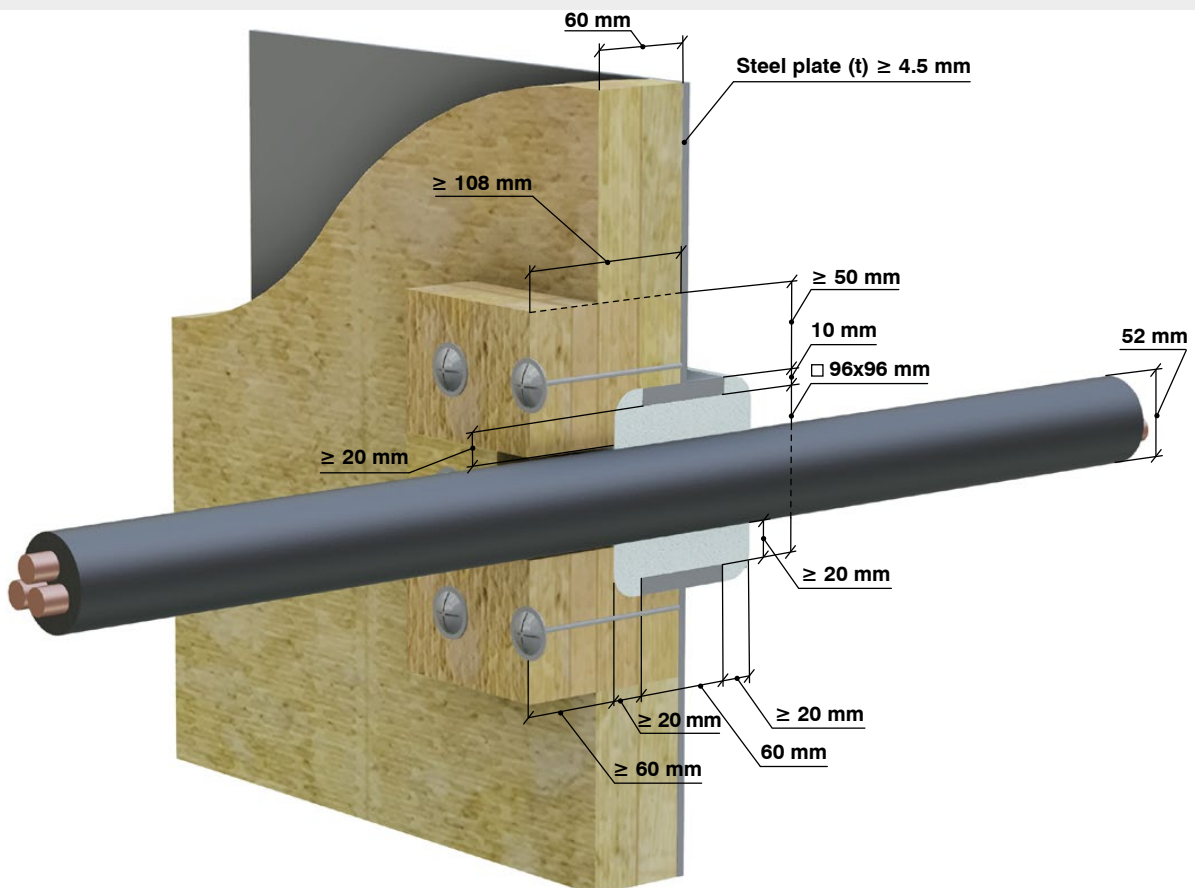
GPGM sealant must have a thickness of a sleeve length: apply 20 mm extra on each side of sleeve as shown on drawing below. GPGM compound is mixed to a firm consistency with 4 parts GPGM and 1 part water. To be applied in one operation per sleeve.

Min. distance between cable and inside edge of the sleeve  $\geq$  20 mm.

The bulkhead only needs insulation on one side when 60 mm Searox SL 620 (density 100kg/m<sup>3</sup>) is used.

Sleeve insulated with Searox SL 620 (density 100kg/m<sup>3</sup>), covering min. 20 mm of GPGM from inside the sleeve, min. 50 mm outside the sleeve and at least 60 mm from GPGM along the cable.

Figure 8. Thickness of GPGM 100 mm



# A60 Bulkhead

Table: 8

Fire resistance class A60						
Steel plate (t) $\geq 4.5$ mm Large cable-bundles penetration. Thickness 100 mm GPGM in 60 mm sleeve						
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Insulation type	Additional product	Figure
Cable bundle, cable (d) 10 mm	120 mm	532 x 240 mm	GPGM 20+60+20 mm	Rockwool SeaRox SL 620	FS FT Graphite	9

## Installation

Cable bundles shall be mounted in the center of the sleeve.

GPGM sealant must have a thickness of 100 mm: apply 20 mm extra on each side of sleeve as shown on drawing below. GPGM compound is mixed to a firm consistency with 4 parts GPGM and 1 part water. To be applied in one operation per sleeve.

Min. distance between cable bundles  $\geq 130$  mm.

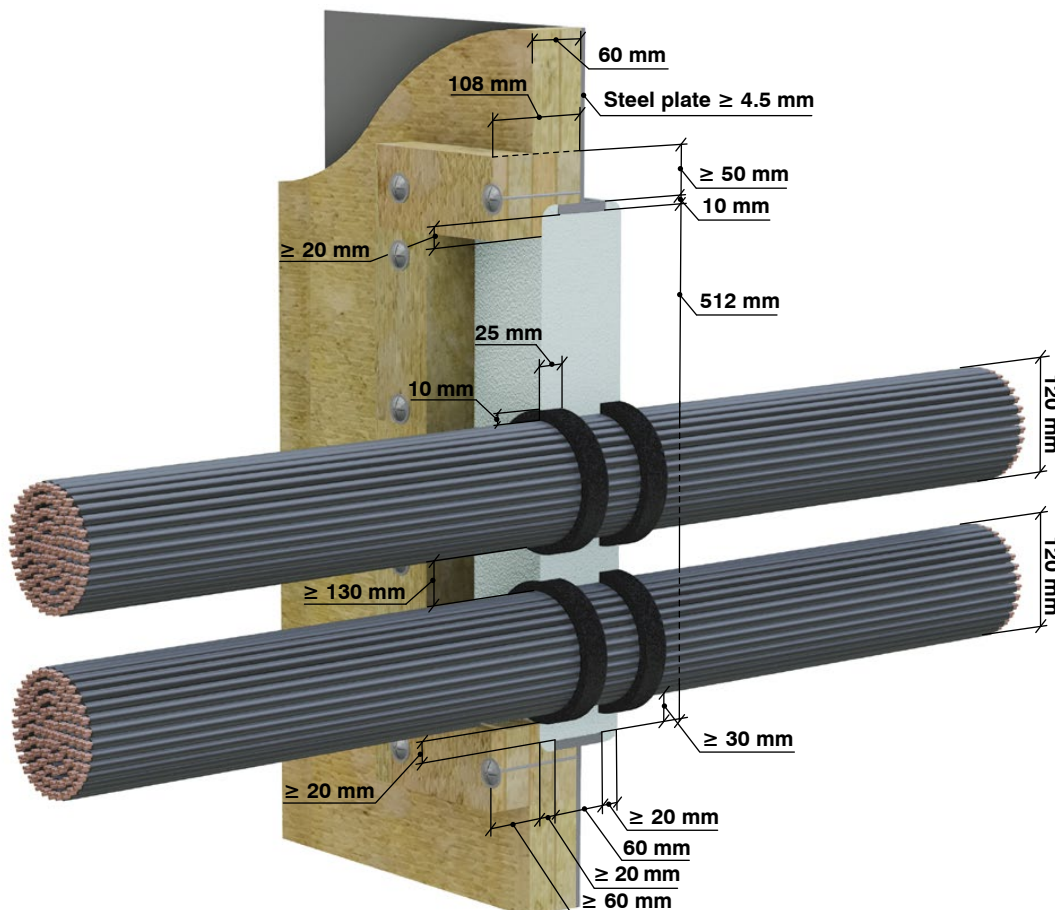
Min. distance between cable bundle and inside edge of the sleeve  $\geq 30$  mm.

FIRESAFE FT Graphite must be applied around cable bundles in the GPG sealant on both sides of the sleeve. Width 10 mm and depth 25 mm.

The bulkhead only needs insulation on one side when 60 mm Searox SL 620 (density 100kg/m<sup>3</sup>) is used.

Sleeve insulated with Searox SL 620 (density 100kg/m<sup>3</sup>), covering min. 20 mm of GPGM from inside the sleeve, min. 50 mm outside the sleeve and at least 60 mm from GPGM along the cable.

Figure 9. Thickness of GPGM 100 mm





# A60 Bulkhead

Table: 9

Fire resistance class A60							
Steel plate (t) ≥ 4.5 mm Large multi cable penetration.							
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Sleeve length	Insulation type	Additional product	Figure
Multi /single cables	≤ 52 mm	532 x 240 mm	GPGM 20+60+20 mm	60 mm	Rockwool SeaRox SL 620	FS circular cable conduit	
Multi /single cables	10 mm						
Multi /single cables	≤ 52 mm	532 x 240 mm	GPGM 20+90+20 mm	90 mm	Rockwool SeaRox SL 620	FS circular cable conduit	10
Multi /single cables	10 mm						

## Installation

Cables and Firesafe circular cable conduits shall be mounted in the center of the sleeve.

GPGM sealant must have a thickness of a sleeve length: apply 20 mm extra on each side of sleeve as shown on drawing below. GPGM compound is mixed to a firm consistency with 4 parts GPGM and 1 part water. To be applied in one operation per sleeve.

Min. distance between cables and inside edge of the sleeve ≥ 20 mm. Cables can lie right next to each other in a bundle, as shown below with a minimum distance between horizontal cable layers of ≥ 16 mm.

Min. distance between cables and cable conduits ≥ 49 mm. Cables in conduit ≤ 10mm.

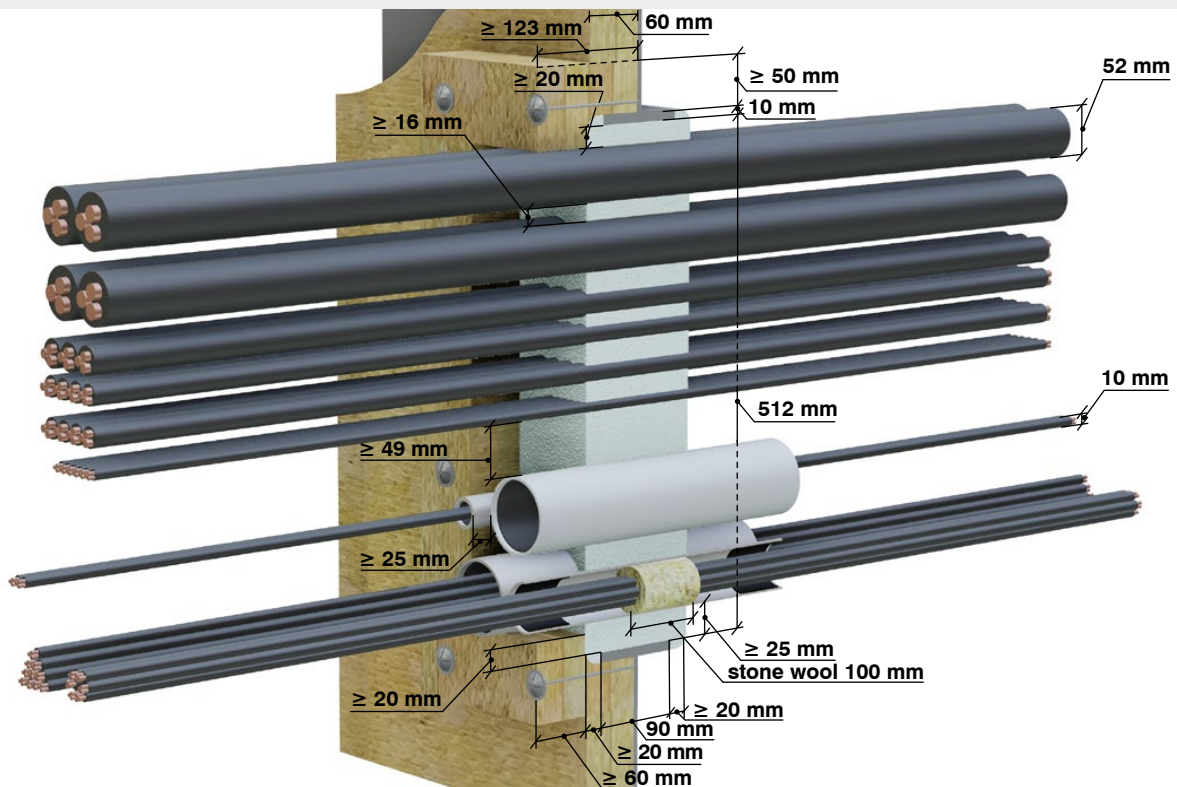
Min. distance between cable conduits and inside edge of the sleeve and distance between multiple cable conduits: ≥ 25 mm.

100 mm stone wool to be fitted around cables inside FS circular cable conduit (to stop cold smoke). The conduit can be filled with multiple cables assuming there is room for the requisite smoke seal inside the conduit.

The bulkhead only needs insulation on one side when 60 mm Searox SL 620 (density 100kg/m³) is used.

Sleeve insulated with Searox SL 620 (density 100kg/m³), covering min. 20 mm of GPGM from inside the sleeve, min. 50 mm outside the sleeve and at least 60 mm from GPGM along the cable.

Figure 10. Thickness of GPGM 130 mm





# A60 Deck

Table: 10

Fire resistance class A60						
Steel plate (t) $\geq$ 4.5 mm Small single cable penetration.						
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Sleeve length	Insulation type	Figure
Single cable	52 mm	116 x 116 mm	GPGM 20+60 mm	60 mm	Rockwool SeaRox SL 620	11
Single cable	52 mm	116 x 116 mm	GPGM 20+90 mm	90 mm	Rockwool SeaRox SL 620	
Single cable	52 mm	116 x 116 mm	GPGM 20+120 mm	120 mm	Rockwool SeaRox SL 620	

## Installation

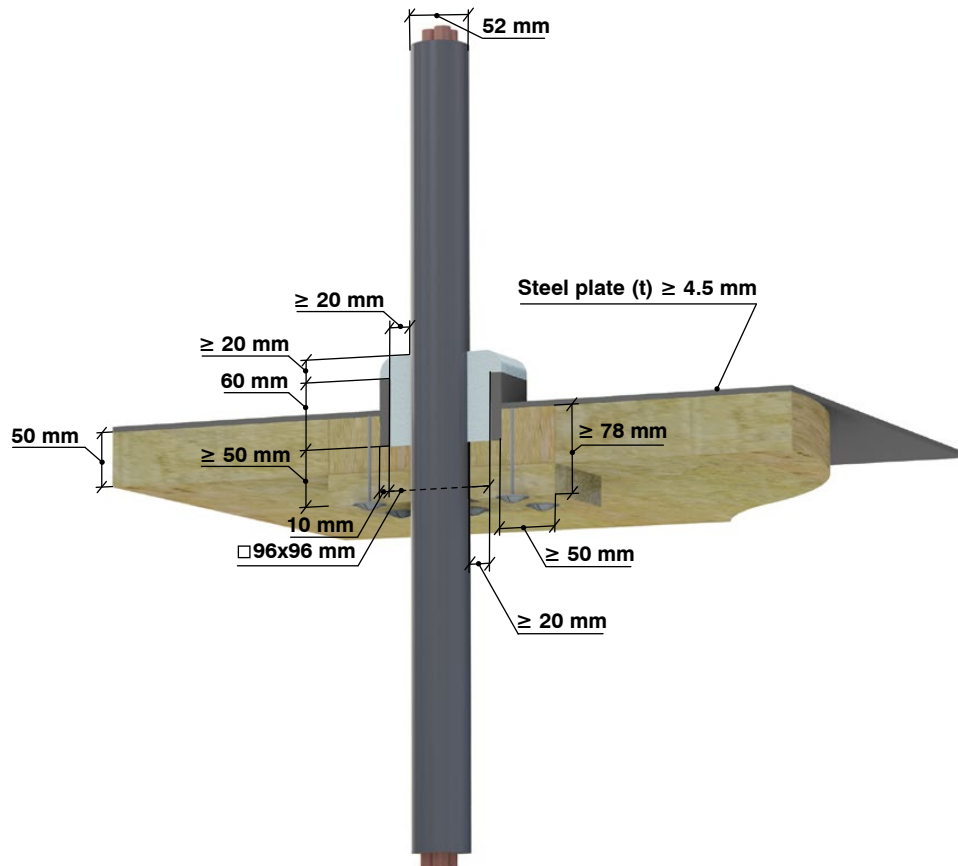
Single cable shall be mounted in the center of the sleeve.

GPGM sealant must have a thickness of a sleeve length: apply 20 mm extra on upper side of sleeve as shown on drawing below. GPGM compound is mixed to a fluid consistency with 2 parts GPGM and 1 part water. To be applied in one operation per sleeve. Use a firm formwork to keep mortar in sleeve before drying phase starts. If a stone wool plate is used, it does not need to be removed after installation.

Min. distance between cable and inside edge of the sleeve  $\geq$  20 mm.

The deck only needs insulation on the underside of the deck when 50 mm Searox SL 620 (density 100kg/m<sup>3</sup>) is used. Sleeve insulated with Searox SL 620 (density 100kg/m<sup>3</sup>), covering min. 20 mm of GPGM from inside the sleeve, min. 50 mm outside the sleeve and at least 50 mm from GPGM along the cable.

Figure 11. Thickness of GPGM 80 mm



# A60 Deck

Table: 11

Fire resistance class A60						
Steel plate (t) ≥ 4.5 mm Small single cable penetration.						
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Sleeve length	Insulation type	Figure
Multi / single cables	$10 \leq d \leq 52 \text{ mm}$	532 x 240 mm	GPGM 20+60 mm	60 mm	Rockwool SeaRox SL 620	12
Multi / single cables	$10 \leq d \leq 52 \text{ mm}$	532 x 240 mm	GPGM 20+90 mm	90 mm	Rockwool SeaRox SL 620	
Multi / single cables	$10 \leq d \leq 52 \text{ mm}$	532 x 240 mm	GPGM 20+120 mm	120 mm	Rockwool SeaRox SL 620	

## Installation

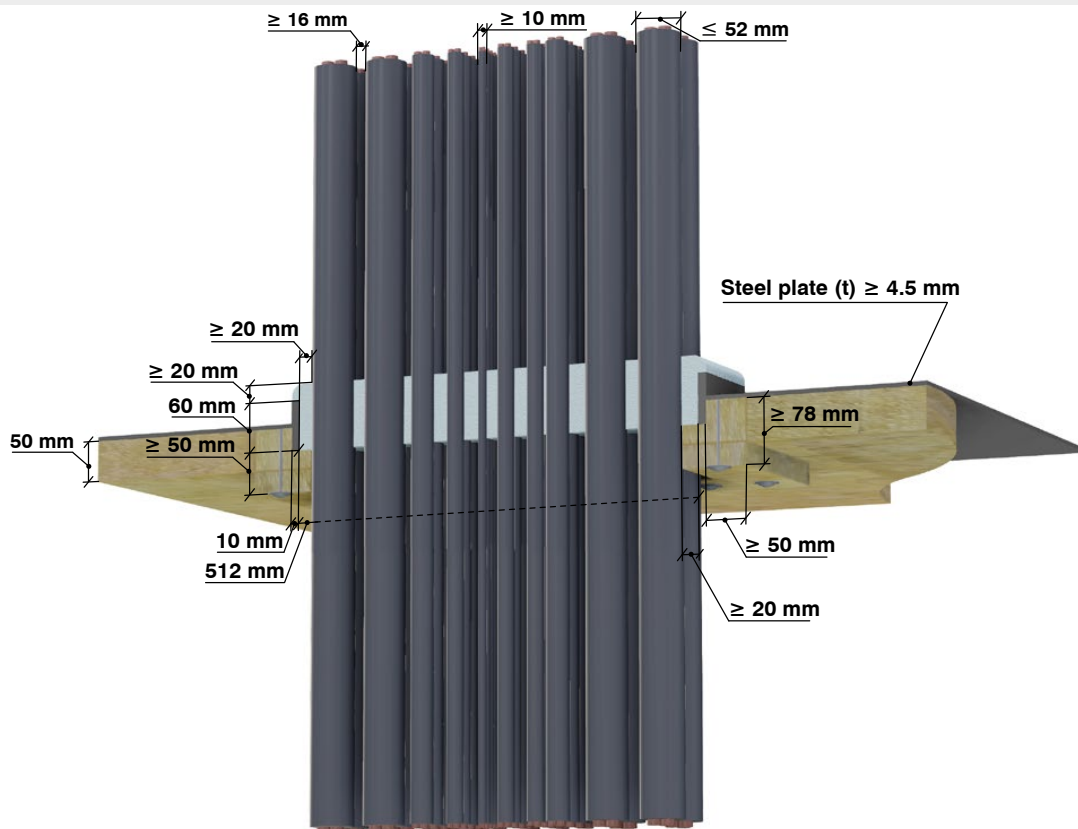
Multi / single cables shall be mounted in the center of the sleeve.

GPGM sealant must have a thickness of a sleeve length: apply 20 mm extra on upper side of sleeve as shown on drawings below. GPGM compound is mixed to a fluid consistency with 2 parts GPGM and 1 part water. To be applied in one operation per sleeve. Use a firm formwork to keep mortar in sleeve before drying phase starts. If a stone wool plate is used, it does not need to be removed after installation.

Cables can lie right next to each other with a minimum distance between vertical cable layers of  $\leq 16 \text{ mm}$ .  
Min. distance between cables and inside edge of the sleeve  $\geq 20 \text{ mm}$ .

The deck only needs insulation on the underside of the deck when 50 mm Searox SL 620 (density  $100\text{kg/m}^3$ ) is used.  
Sleeve insulated with Searox SL 620 (density  $100\text{kg/m}^3$ ), covering min. 20 mm of GPGM from inside the sleeve, min. 50 mm outside the sleeve and at least 50 mm from GPGM along the cable.

Figure 12. Thickness of GPGM 80 mm



# A60 Deck

Table: 12

Fire resistance class A30						
Steel plate (t) $\geq 4.5$ mm						
Large cable-bundles penetration. Thickness 80 mm GPGM in 60 mm sleeve						
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Insulation type	Additional product	Figure
Cable bundle, cable (d) 10 mm	120 mm	532 x 240 mm	GPGM 20+60 mm	Rockwool SeaRox SL 620	FS FT Graphite	13

## Installation

Cable bundles shall be mounted in the center of the sleeve.

GPGM sealant must have a thickness of 80 mm: apply 20 mm extra on upper side of sleeve as shown on drawings below. GPGM compound is mixed to a fluid consistency with 2 parts GPGM and 1 part water. To be applied in one operation per sleeve.

Use a firm formwork to keep mortar in sleeve before drying phase starts. If a stone wool plate is used, it does not need to be removed after installation.

Min. distance between cable bundles  $\geq 46$  mm.

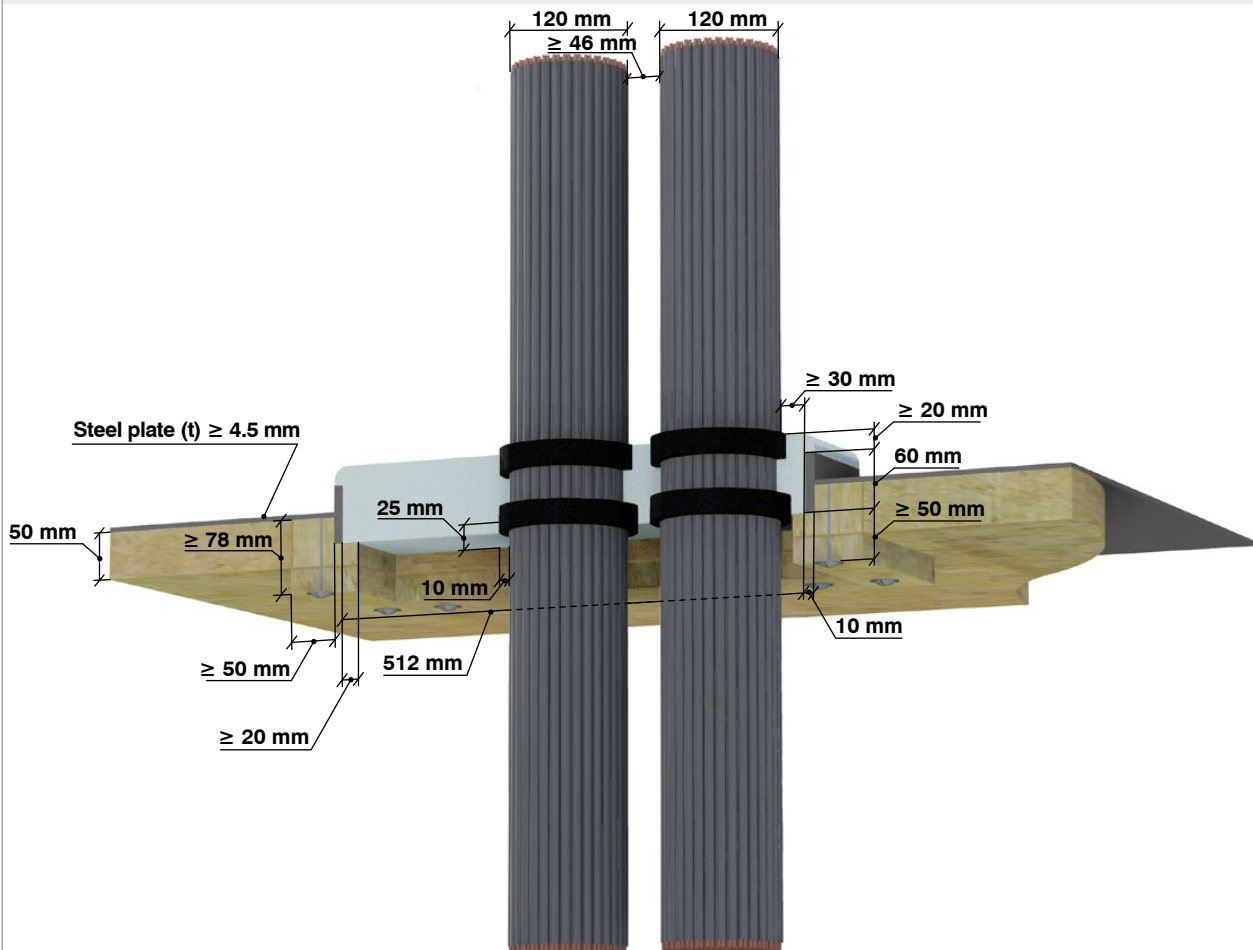
Min. distance between cable bundle and inside edge of the sleeve  $\geq 30$  mm.

FIRESAFE FT Graphite 10 mm width and 25 mm depth around cable bundle on both sides of the sleeve, inside the GPGM.

The deck only needs insulation on the underside of the deck when 50 mm Searox SL 620 (density 100kg/m<sup>3</sup>) is used.

Sleeve insulated with Searox SL 620 (density 100kg/m<sup>3</sup>), covering min. 20 mm of GPGM from inside the sleeve, min. 50 mm outside the sleeve and at least 50 mm from GPGM along the cable.

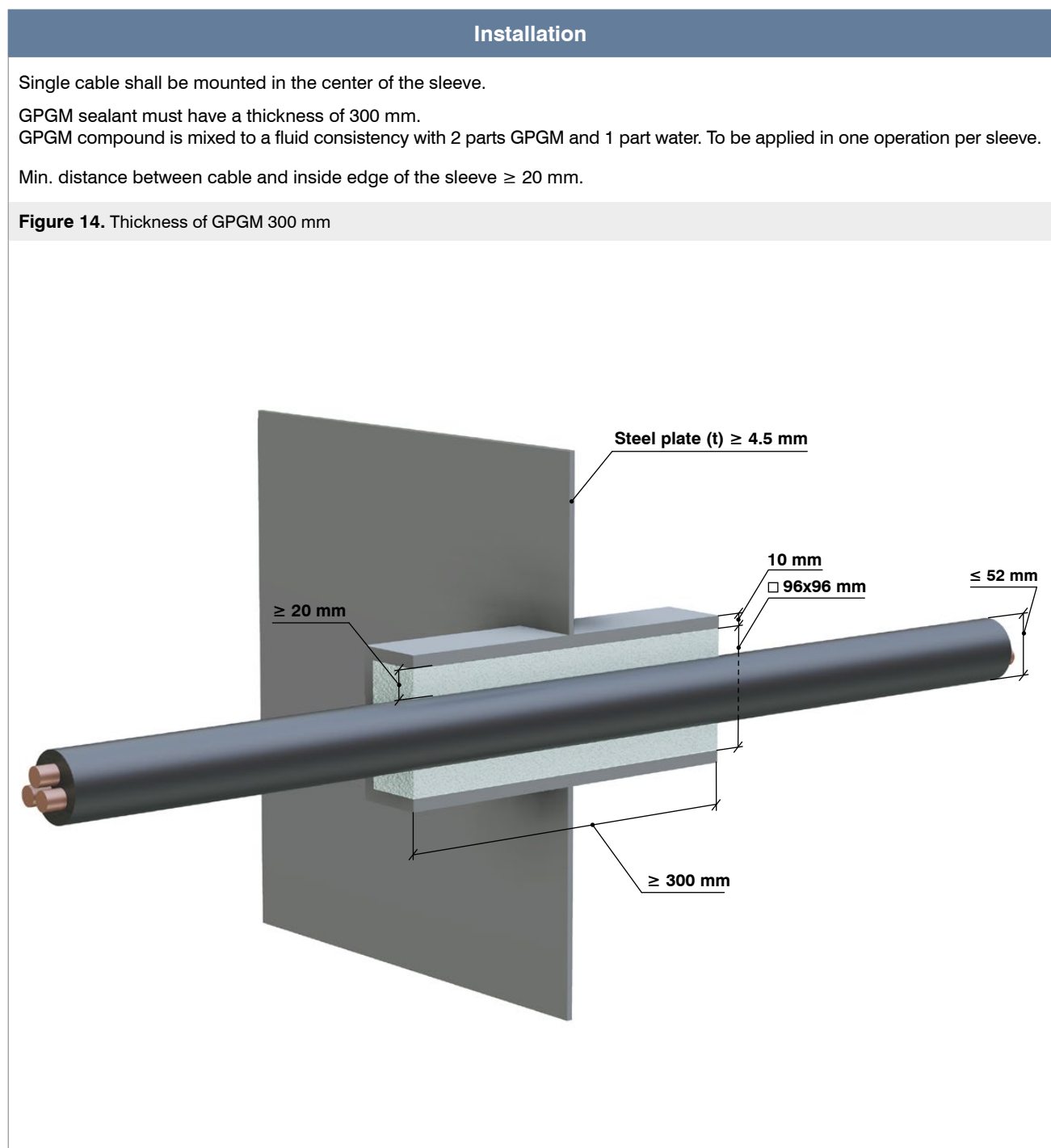
Figure 13. Thickness of GPGM 80 mm



# H0 Bulkhead

Table: 13

Fire resistance class H0				
Steel plate (t) ≥ 4.5 mm Small single cable penetration. Thickness 300 mm GPGM in 300 mm sleeve				
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Figure
Single cable	≤ 52 mm	≥ 116 x 116 mm	GPGM 300 mm	14



# H0 Bulkhead

Table: 14

Fire resistance class H0				
Steel plate (t) $\geq 4.5$ mm Large multi cable penetration. Thickness 250 mm GPGM in 250 mm sleeve				
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Figure
Multi / single cables	$\leq 52$ mm	$\leq 532 \times 240$ mm	GPGM 250 mm	15

## Installation

Multi / single cables shall be mounted in the center of the sleeve.

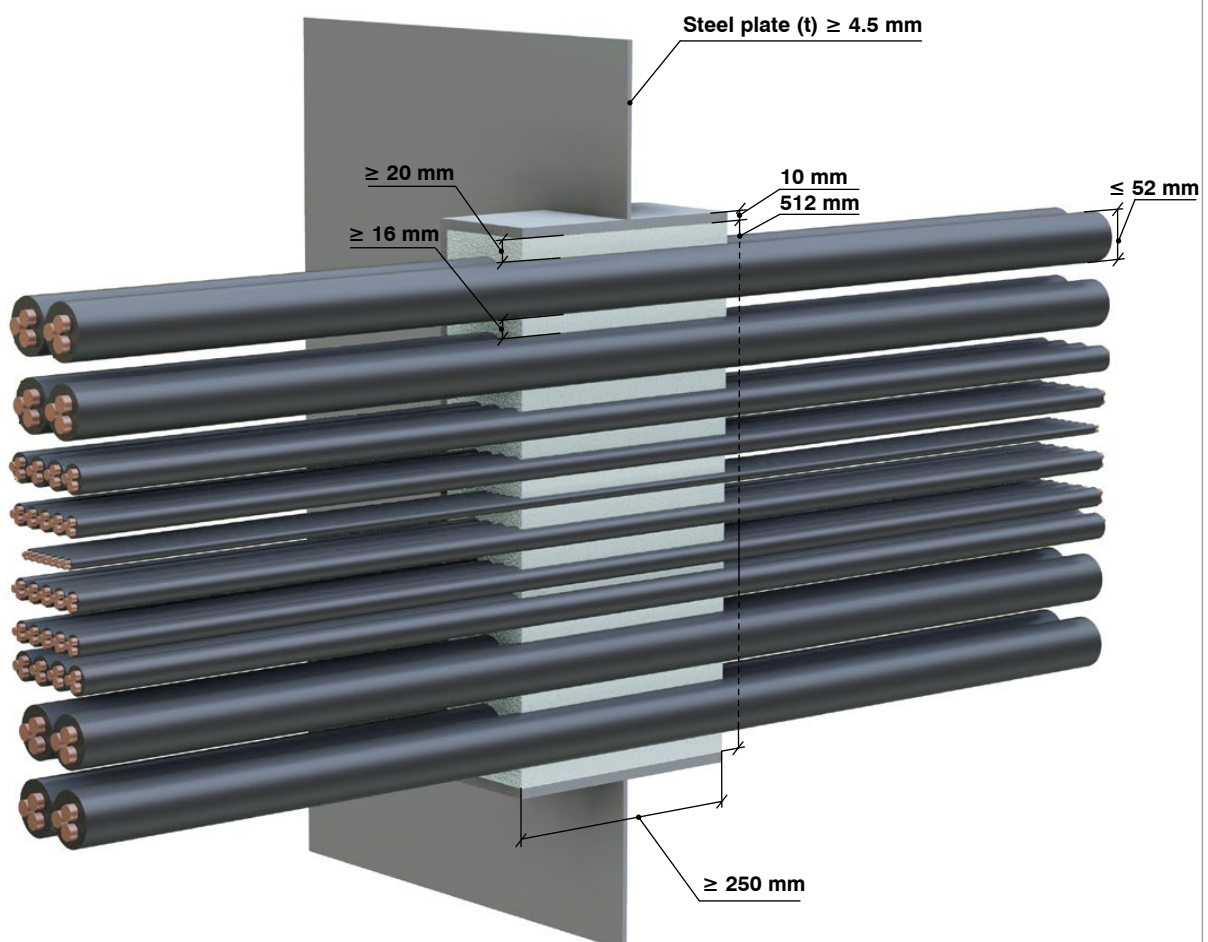
GPGM sealant must have a thickness of 250 mm.

GPGM compound is mixed to a fluid consistency with 2 parts GPGM and 1 part water. To be applied in one operation per sleeve.

Min. distance between cables and the inside edge of the sleeve  $\geq 20$  mm.

Cables can lie right next to each other as shown below with a minimum distance between horizontal cable layers of  $\leq 16$  mm.

Figure 15. Thickness of GPGM 250 mm



# H0 Deck

Table: 15

Fire resistance class H0				
Steel plate (t) ≥ 4.5 mm Small single cable penetration. Thickness 250 mm GPGM in 250 mm sleeve				
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Figure
Single cable	≤ 52 mm	≥ 116 x 116 mm	GPGM 250 mm	16

## Installation

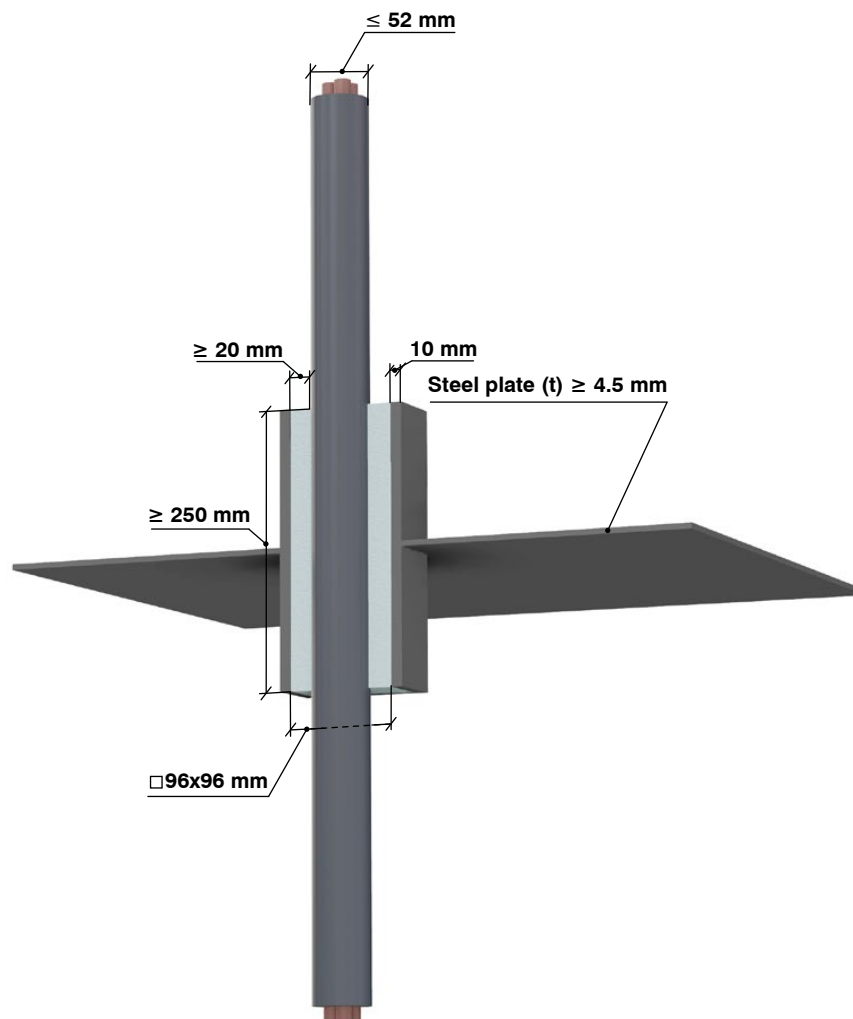
Single cable shall be mounted in the center of the sleeve.

GPGM sealant must have a thickness of 250 mm.

GPGM compound is mixed to a fluid consistency with 2 parts GPGM and 1 part water. To be applied in one operation per sleeve. Use a firm formwork to keep mortar in sleeve before drying phase starts. If a stone wool plate is used, it does not need to be removed after installation.

Min. distance between cable and inside edge of the sleeve ≥ 20 mm.

**Figure 16.** Thickness of GPGM 250 mm

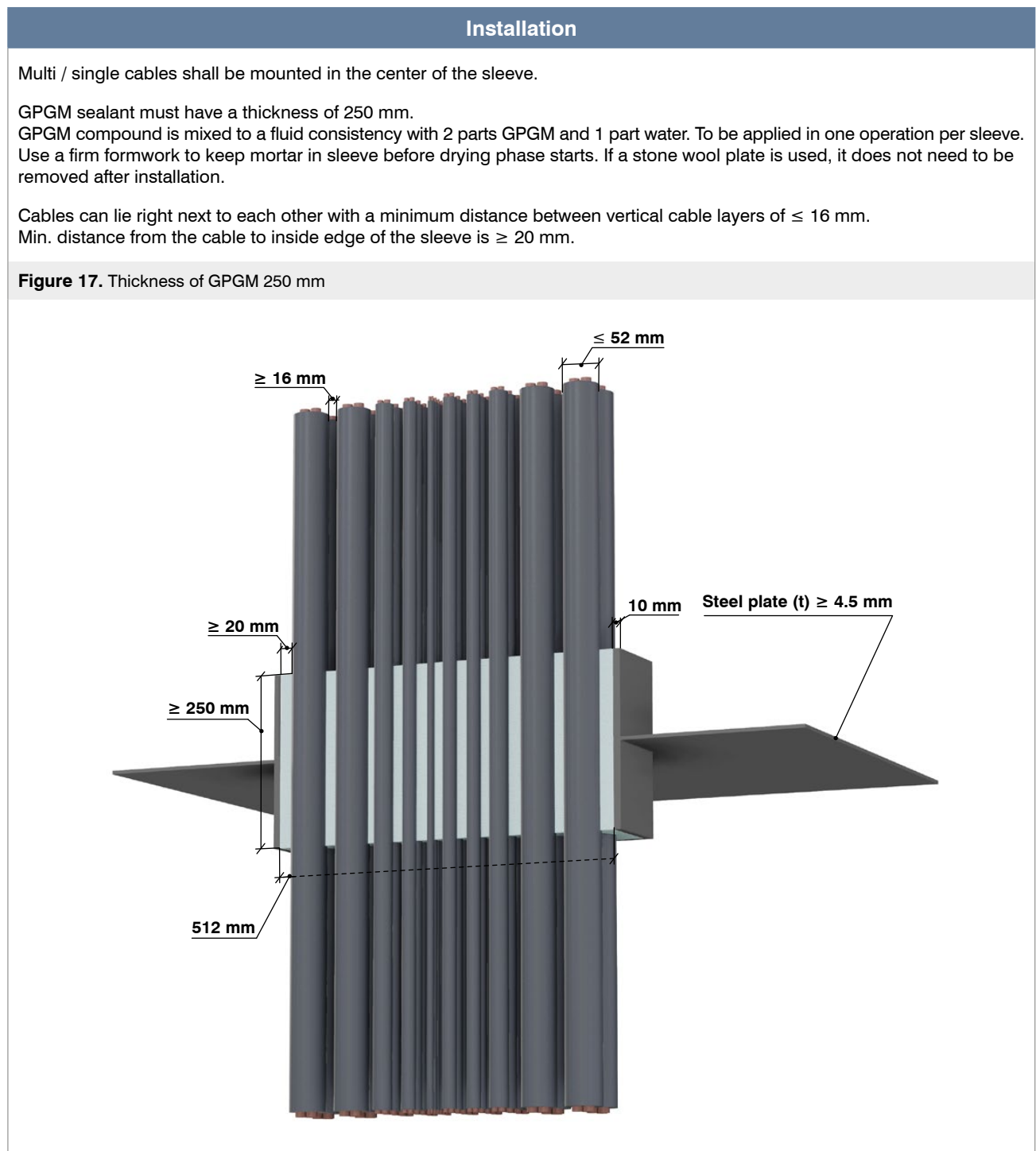




# H0 Deck

Table: 16

Fire resistance class H0				
Steel plate (t) $\geq 4.5$ mm Small single cable penetration. Thickness 250 mm GPGM in 250 mm sleeve				
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Figure
Multi /single cables	$\leq 52$ mm	$\leq 532 \times 240$ mm	GPGM 250 mm	17



# H60 Bulkhead

Table: 17

Fire resistance class H60					
Steel plate (t) ≥ 4.5 mm					
Small single cable penetration. Thickness 200 mm GPGM in 200 mm sleeve					
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Insulation type	Figure
Single cable	≤ 52 mm	≥ 116 x 116 mm	GPGM 200 mm	Firemaster® Marine Plus	18

## Installation

Single cable shall be mounted in the center of the sleeve.

GPGM sealant must have a thickness of 200 mm.

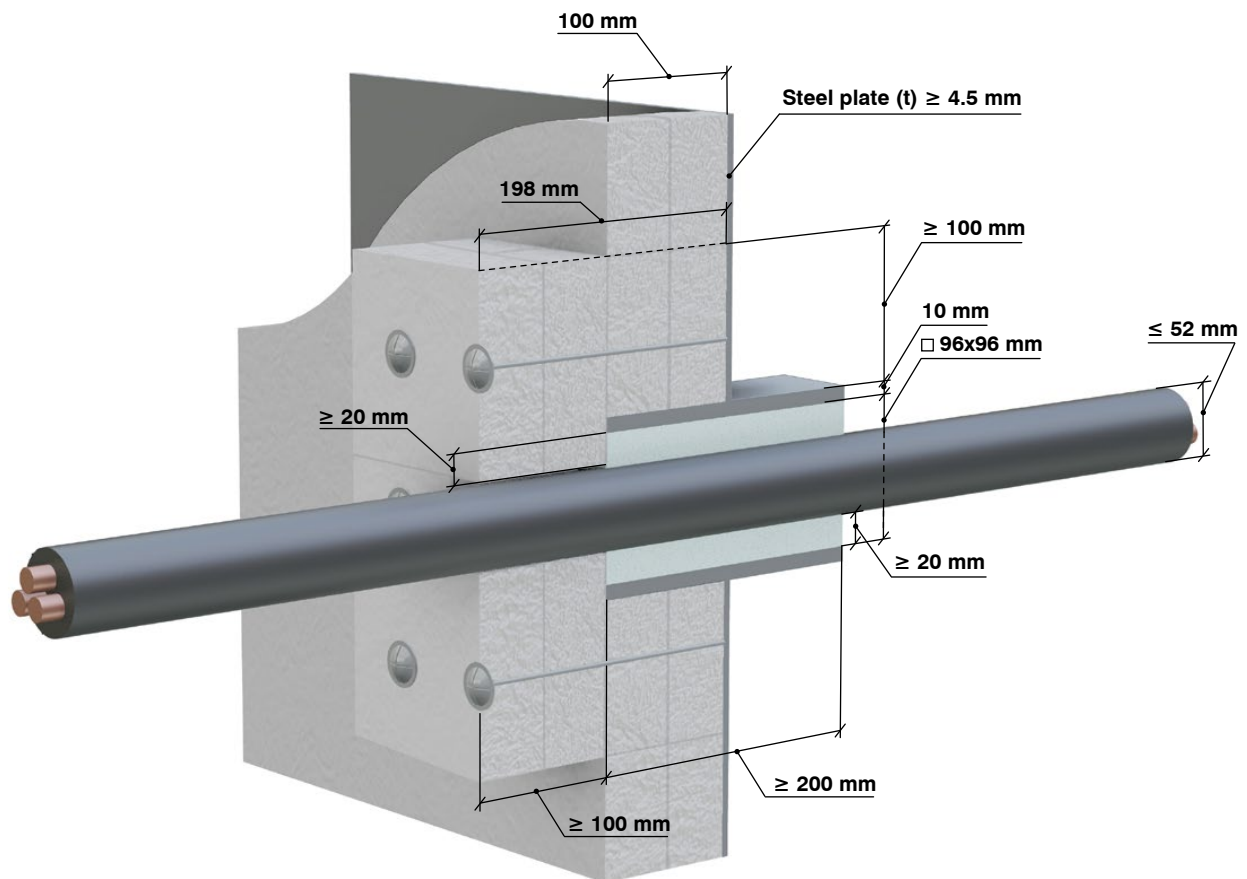
GPGM compound is mixed to a firm consistency with 4 parts GPGM and 1 part water. To be applied in one operation per sleeve.

Min. distance between cable and inside edge of the sleeve ≥ 20 mm.

The bulkhead only needs insulation on one side when 100 mm Firemaster® Marine Plus (density 96kg/m³) is used.

Sleeve insulated with Firemaster® Marine Plus (density 96kg/m³), covering min. 20 mm of GPGM from inside the sleeve, min. 100 mm outside the sleeve and at least 100 mm from GPGM along the cable.

**Figure 18.** Thickness of GPGM 200 mm



# H60 Bulkhead

Table: 18

Fire resistance class H60					
Steel plate (t) ≥ 4.5 mm Large multi cable penetration. Thickness 200 mm GPGM in 200 mm sleeve					
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Insulation type	Figure
Multi / single cables	≤ 52 mm	≤ 532 x 240 mm	GPGM 200 mm	Firemaster® Marine Plus	19

## Installation

Single cables shall be mounted in the center of the sleeve.

GPGM sealant must have a thickness of 200 mm.

GPGM compound is mixed to a firm consistency with 4 parts GPGM and 1 part water. To be applied in one operation per sleeve.

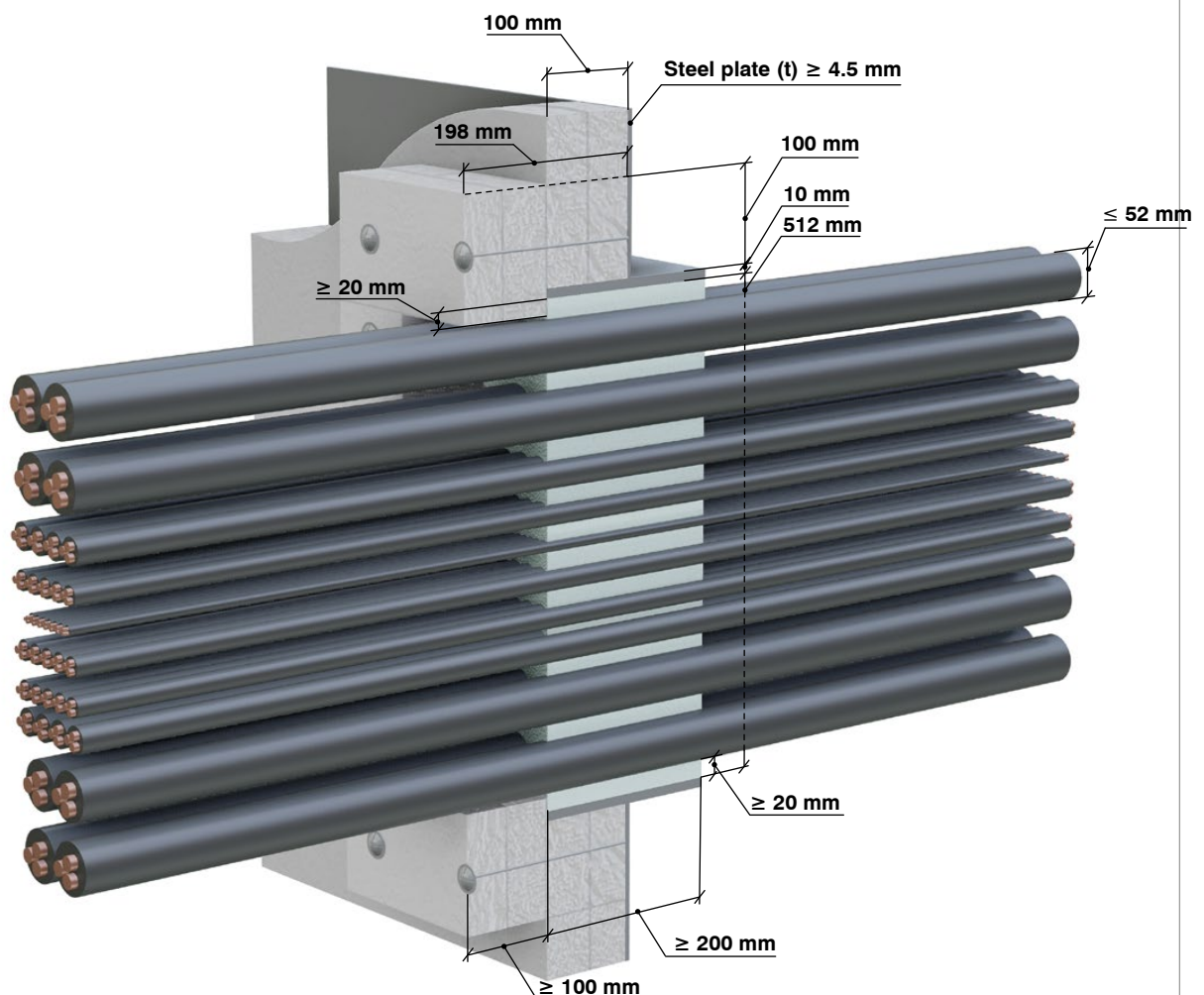
Min. distance between cables and inside edge of the sleeve ≥ 20 mm.

Cables can lie right next to each other with a minimum distance between horizontal cable layers of ≤ 16 mm.

The bulkhead only needs insulation on one side when 100 mm Firemaster® Marine Plus (density 96kg/m³) is used.

Sleeve insulated with Firemaster® Marine Plus (density 96kg/m³), covering min. 20 mm of GPGM from inside the sleeve, min. 100 mm outside the sleeve and at least 100 mm from GPGM along the cable.

Figure 19. Thickness of GPGM 200 mm



# H60 Deck

Table: 19

Fire resistance class H60					
Steel plate (t) $\geq 4.5$ mm					
Small single cable penetration. Thickness 200 mm GPGM in 200 mm sleeve					
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Insulation type	Figure
Single cable	$\leq 52$ mm	$\geq 116 \times 116$ mm	GPGM 200 mm	Firemaster® Marine Plus	20

## Installation

Single cable shall be mounted in the center of the sleeve.

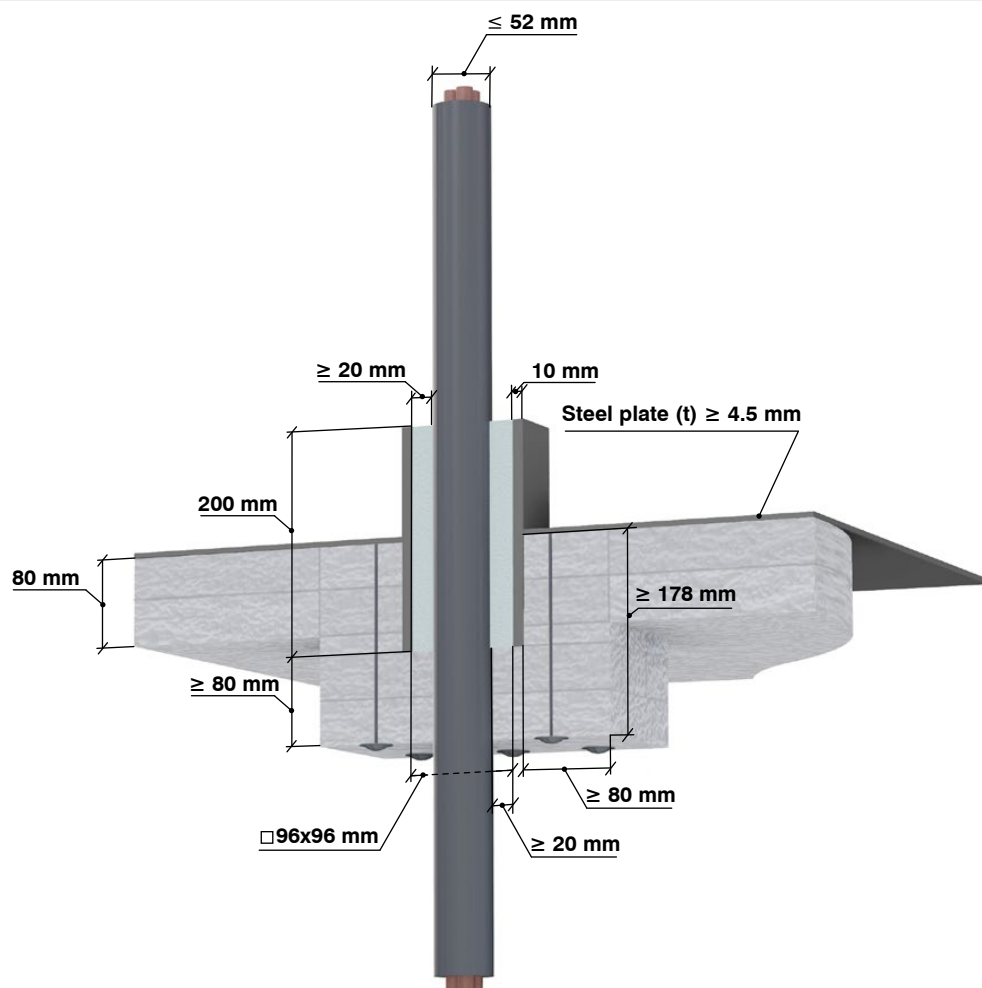
GPGM sealant must have a thickness of 200 mm.

GPGM compound is mixed to a fluid consistency with 2 parts GPGM and 1 part water. To be applied in one operation per sleeve. Use a firm formwork to keep mortar in sleeve before drying phase starts. If a stone wool plate is used, it does not need to be removed after installation.

Min. distance between cable and inside edge of the sleeve  $\geq 20$  mm.

The deck only needs insulation on the underside of the deck when 100 mm Firemaster® Marine Plus (density 70kg/m<sup>3</sup>) is used. Sleeve insulated with Firemaster® Marine Plus (density 70kg/m<sup>3</sup>), covering min. 20 mm of GPGM from inside the sleeve, min. 80 mm outside the sleeve and at least 80 mm from GPGM along the cable.

Figure 20. Thickness of GPGM 200 mm



# H60 Deck

Table: 20

Fire resistance class H60					
Steel plate (t) $\geq 4.5$ mm Large multi cable penetration. Thickness 200 mm GPGM in 200 mm sleeve					
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Insulation type	Figure
Multi /single cables	$\leq 52$ mm	$\leq 532 \times 240$ mm	GPGM 200 mm	Firemaster® Marine Plus	21

## Installation

Multi / single cables shall be mounted in the center of the sleeve.

GPGM sealant must have a thickness of 200 mm.

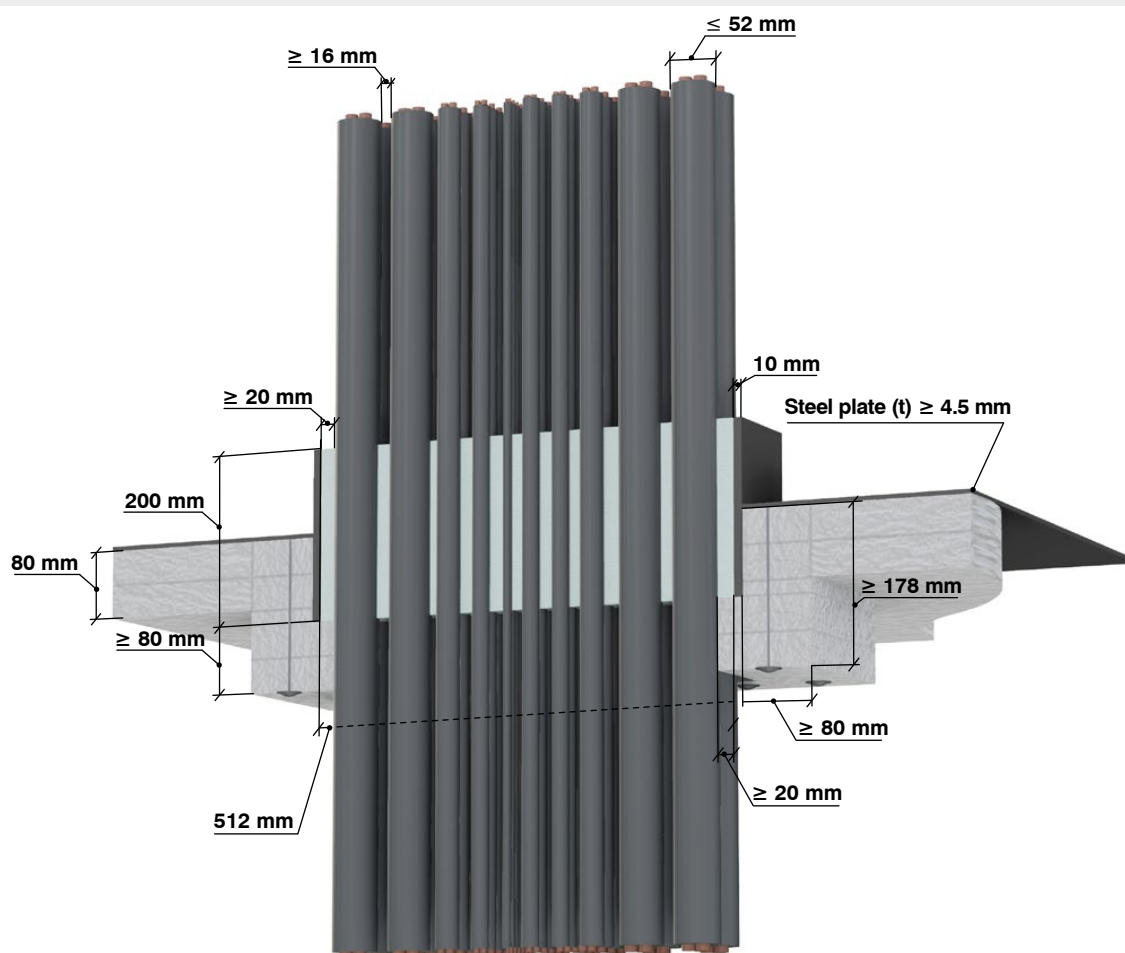
GPGM compound is mixed to a fluid consistency with 2 parts GPGM and 1 part water. To be applied in one operation per sleeve. Use a firm formwork to keep mortar in sleeve before drying phase starts. If a stone wool plate is used, it does not need to be removed after installation.

Cables can lie right next to each other with a minimum distance between vertical cable layers of  $\leq 16$  mm.

Min. distance between cables and inside edge of the sleeve  $\geq 20$  mm.

The deck only needs insulation on the underside of the deck when 100 mm Firemaster® Marine Plus (density 70kg/m<sup>3</sup>) is used. Sleeve insulated with Firemaster® Marine Plus (density 70kg/m<sup>3</sup>), covering min. 20 mm of GPGM from inside the sleeve, min. 80 mm outside the sleeve and at least 80 mm from GPGM along the cable.

Figure 21. Thickness of GPGM 250 mm



# H120 Deck

Table: 21

Fire resistance class H120					
Steel plate (t) ≥ 4.5 mm					
Small single cable penetration. Thickness 250 mm GPGM in 250 mm sleeve					
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Insulation type	Figure
Single cable	≤ 52 mm	≥ 116 x 116 mm	GPGM 250 mm	Firemaster® Marine Plus	22

## Installation

Single cable shall be mounted in the center of the sleeve.

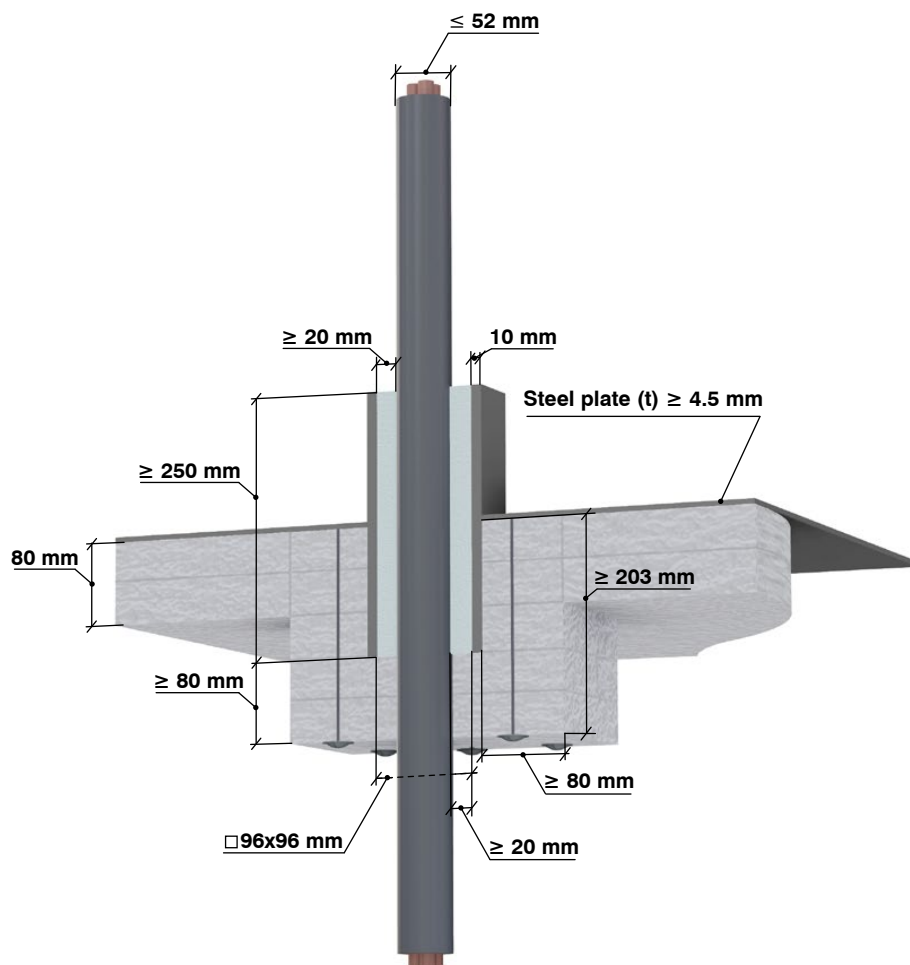
GPGM sealant must have a thickness of 250 mm.

GPGM compound is mixed to a fluid consistency with 2 parts GPGM and 1 part water. To be applied in one operation per sleeve. Use a firm formwork to keep mortar in sleeve before drying phase starts. If a stone wool plate is used, it does not need to be removed after installation.

Min. distance between cable and inside edge of the sleeve  $\geq 20$  mm.

The deck only needs insulation on the underside of the deck when 100 mm Firemaster® Marine Plus (density 70kg/m³) is used. Sleeve insulated with Firemaster® Marine Plus (density 70kg/m³), covering min. 20 mm of GPGM from inside the sleeve, min. 80 mm outside the sleeve and at least 80 mm from GPGM along the cable.

**Figure 22. Thickness of GPGM 250 mm**





# H120 Deck

Table: 22

Fire resistance class H120					
Steel plate (t) $\geq 4.5$ mm Large multi cable penetration. Thickness 250 mm GPGM in 250 mm sleeve					
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Insulation type	Figure
Multi /single cables	$\leq 52$ mm	$\leq 532 \times 240$ mm	GPGM 250 mm	Firemaster® Marine Plus	23

## Installation

Multi / single cables shall be mounted in the center of the sleeve.

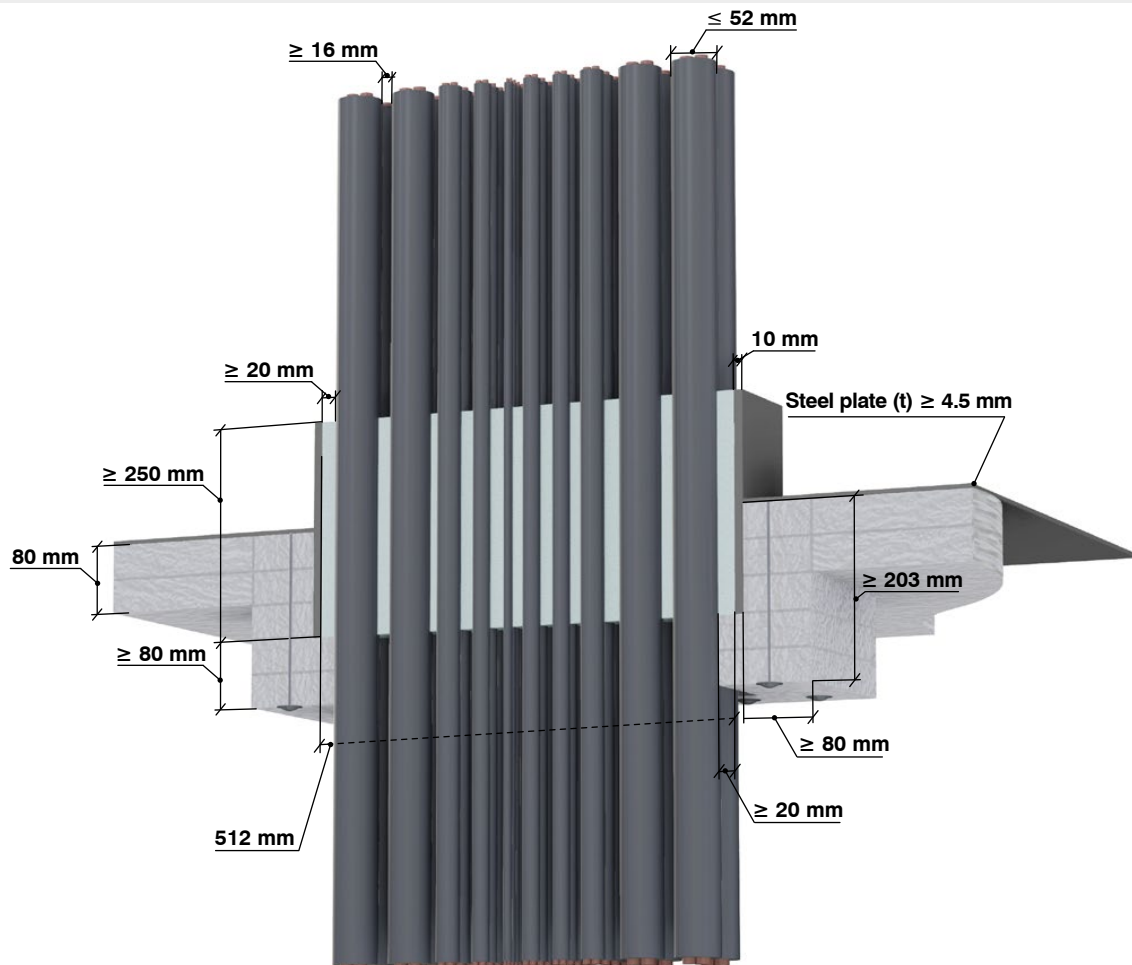
GPGM sealant must have a thickness of 250 mm.

GPGM compound is mixed to a fluid consistency with 2 parts GPGM and 1 part water. To be applied in one operation per sleeve. Use a firm formwork to keep mortar in sleeve before drying phase starts. If a stone wool plate is used, it does not need to be removed after installation.

Cables can lie right next to each other with a minimum distance between vertical cable layers of  $\leq 16$  mm.  
Min. distance between cables and inside edge of the sleeve  $\geq 20$  mm.

The deck only needs insulation on the underside of the deck when 100 mm Firemaster® Marine Plus (density 70kg/m<sup>3</sup>) is used. Sleeve insulated with Firemaster® Marine Plus (density 70kg/m<sup>3</sup>), covering min. 20 mm of GPGM from inside the sleeve, min. 80 mm outside the sleeve and at least 80 mm from GPGM along the cable.

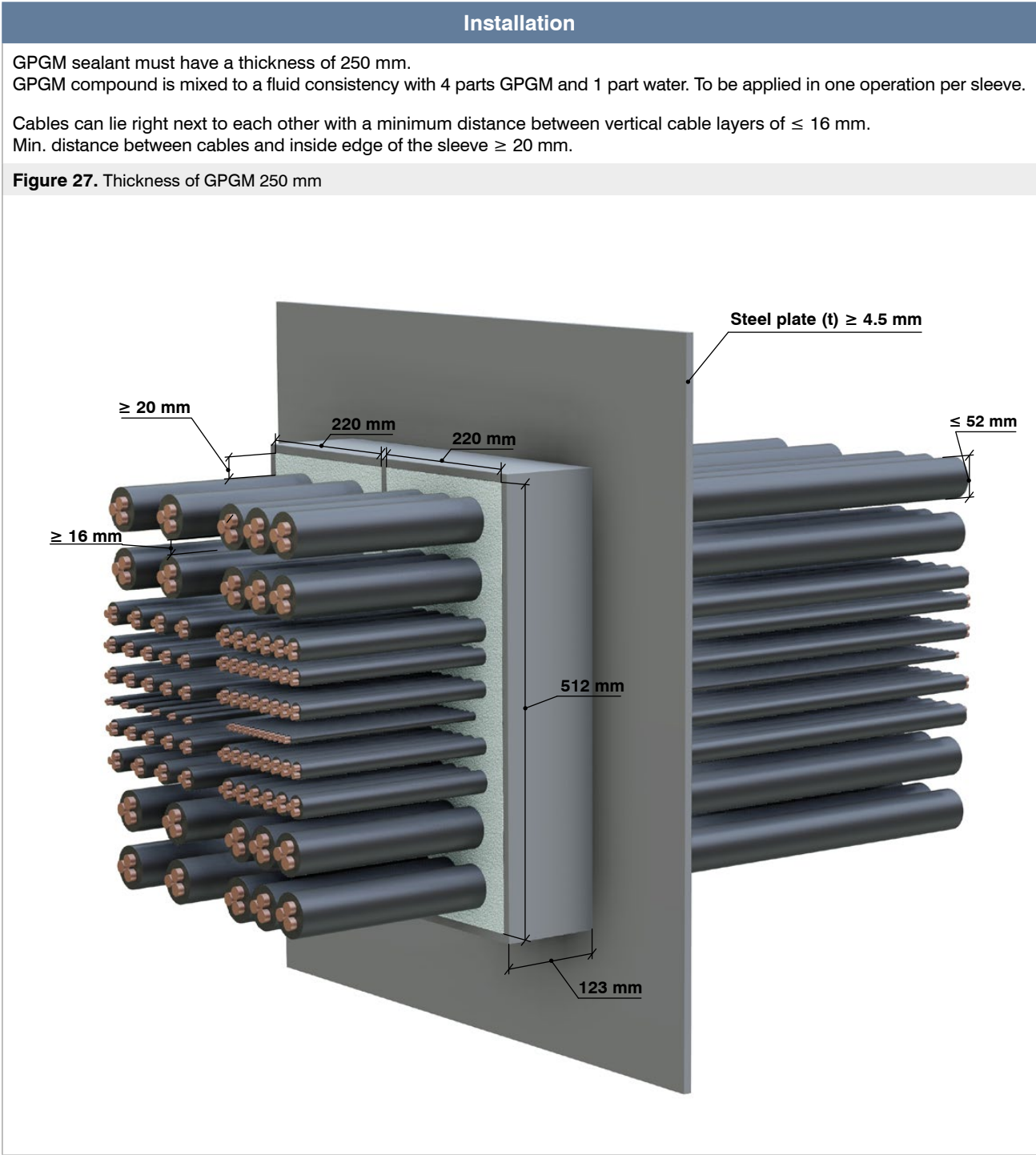
Figure 26. Thickness of GPGM 250 mm



# JET FIRE (350 kW/m²) Bulkhead

Table: 23

Fire resistance class JET FIRE (350 kW/m²)				
Steel plate (t) ≥ 4.5 mm				
Large multi cable penetration. Thickness 250 mm GPGM in 250 mm sleeve				
Cable type	Diameter (d)	Outer sleeve dimensions	Thickness of GPGM	Figure
Multi / single cables	10 ≤ d ≤ 52 mm	≤ 532 x 240 mm	GPGM 250 mm	24



# Pipe penetrations

## FIRE CLASSIFICATION AND PIPE TYPES

Fire classification for steel pipes applies to all types of steel pipes in offshore and marine environments with maximum diameter specified in the tables. The distance between pipes should be as described to ensure compliance with requirements for sealant thickness between the pipes.

The fire sealant can be applied with and without insulation (type specified where applicable) assuming compliance with described fire resistance class.

FIRESAFE Pipe Wrap Marine 25 (PWM25) is developed to be used together with GPG Marine in pipe penetrations through fire decks/bulkheads. PWM25 is wrapped around the pipe by using stainless steel strips or bands. A minimum of 20 mm PWM25 overlap is recommended in the connection. The wrap enables small movements/vibration of pipe in a pipe-penetration due to e.g. hull/pump vibrations, pressure pulses etc. The thickness of the wrap is approximately 4 mm.

Tested for A0, A60, H0 and H60.

/ For fire resistance class and installation details, see tables:

Table	Type of penetration	Figure	Fire resistance class	Page
1	Bulkhead, single pipe (d) 6 mm in 125 mm sleeve	1	A0	30
2	Bulkhead, single pipe (d) 406.4 mm in 125 mm sleeve	2	A0	31
3	Bulkhead, single pipe (d) 6 mm in 125 mm sleeve	3	A60	32
4	Bulkhead, single pipe (d) 406.4 mm in 125 mm sleeve	4	A60	33
5	Deck, single pipe (d) 6 mm in 125 mm sleeve	5	A60	34
6	Deck, single pipe (d) 406.4 mm in 125 mm sleeve	6	A60	35
7	Bulkhead, single pipe (d) $\geq 48.3$ mm with PWM25 in $\geq 250$ mm sleeve.	7	H0	36
8	Bulkhead, single pipe (d) $\leq 406.4$ mm with PWM25 in $\geq 250$ mm sleeve.	8	H0	37
9	Bulkhead, single pipe (d) 219.1 mm in $\geq 250$ mm sleeve	9	H0	38
10	Bulkhead, single pipe (d) 48.3 mm with PWM25 in $\geq 250$ mm sleeve.	10	H60	39

# A0 Bulkhead

Table: 1

Fire resistance class A0				
Steel plate (t) ≥ 4.5 mm Single pipe penetration. Thickness 125 mm GPGM in 125 mm sleeve				
Pipe type	Diameter (d) / wall thickness (t)	Outer sleeve dimensions	Thickness of GPGM	Figure
Single pipe	6 mm / 1mm	Ø 56 mm	GPGM 125 mm	1

## Installation

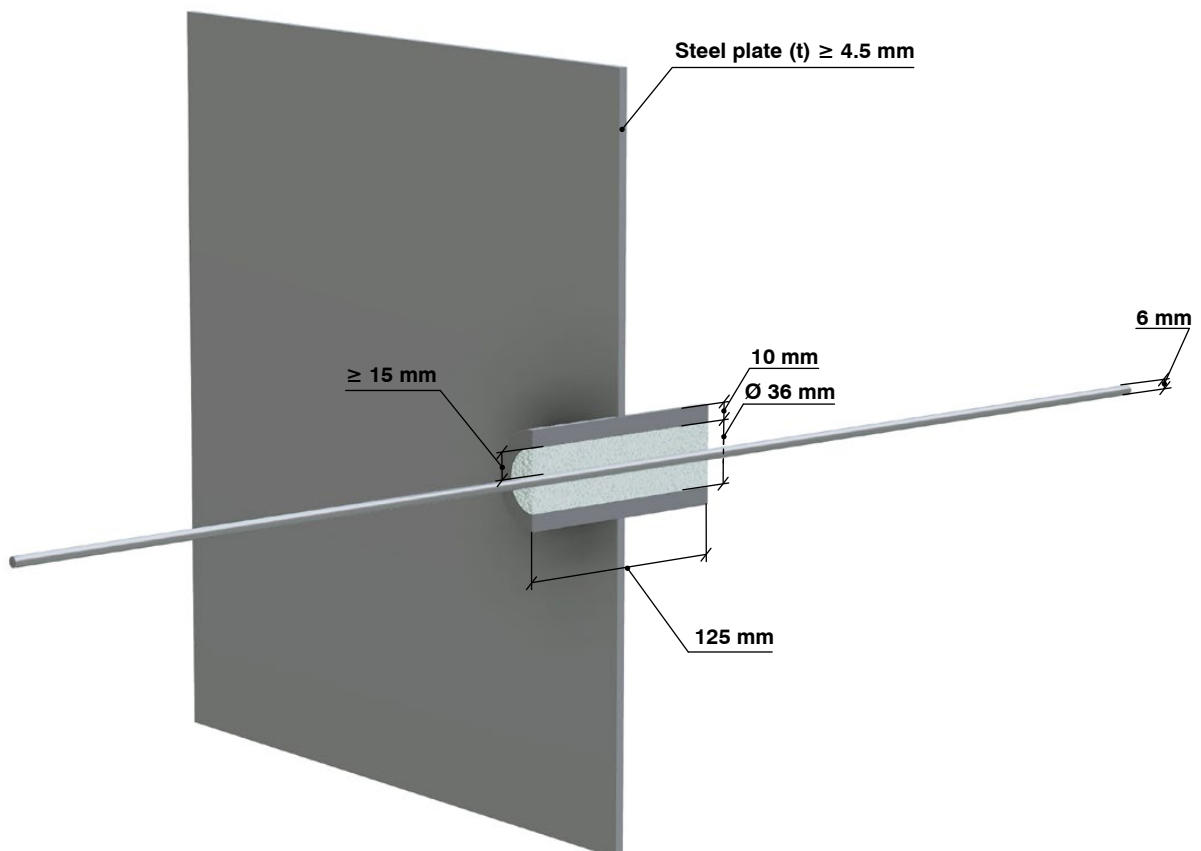
Single pipe shall be mounted in the center of the sleeve.

GPGM sealant must have a thickness of 125 mm.

GPGM compound is mixed to a firm consistency with 4 parts GPGM and 1 part water. To be applied in one operation per sleeve.

Min. distance between pipe and inside edge of the sleeve ≥ 15 mm.

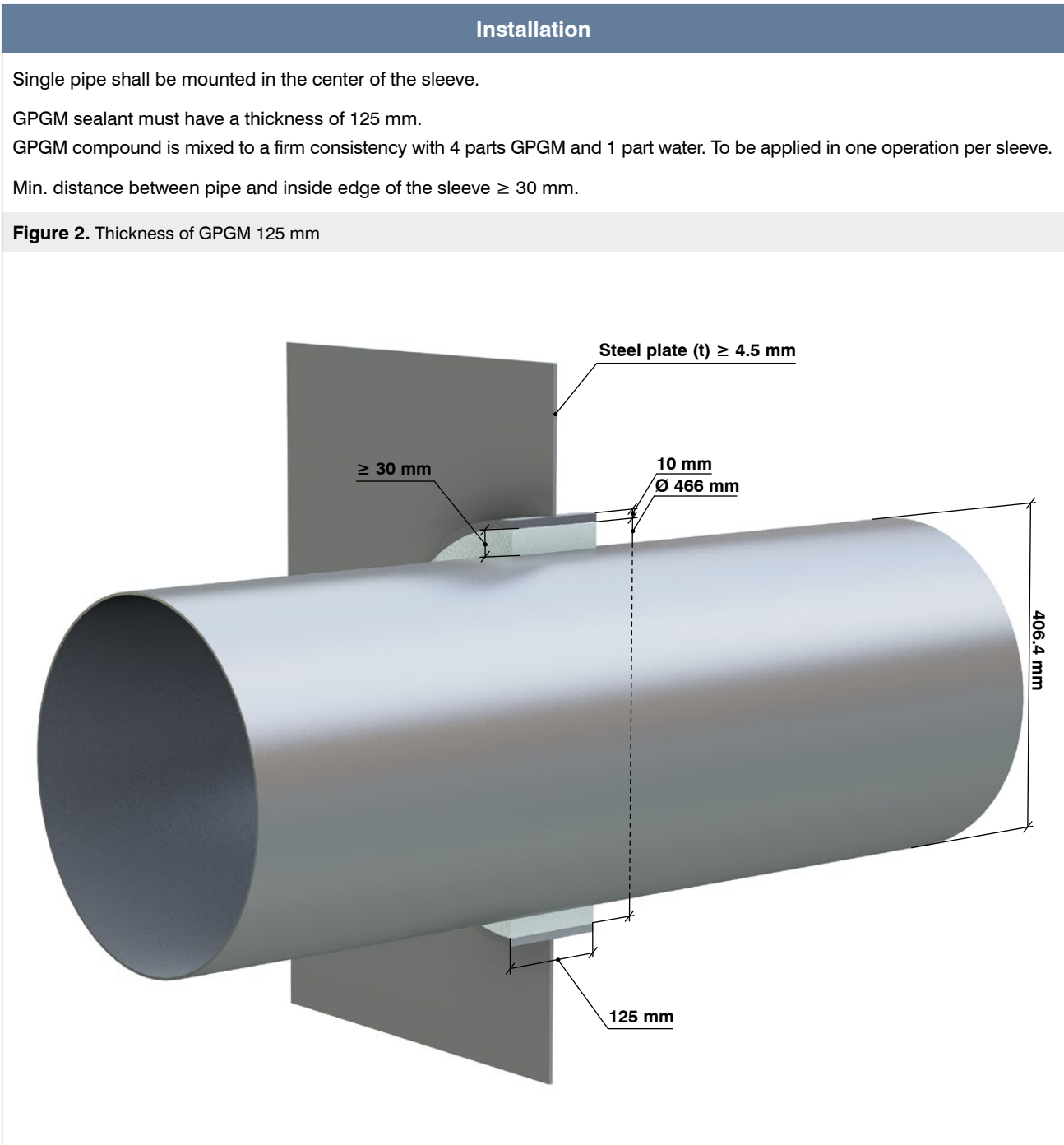
Figure 1. Thickness of GPGM 125 mm



# A0 Bulkhead

Table: 2

Fire resistance class A0				
Steel plate (t) ≥ 4.5 mm Single pipe penetration. Thickness 125 mm GPGM in 125 mm sleeve				
Pipe type	Diameter (d) / wall thickness (t)	Outer sleeve dimensions	Thickness of GPGM	Figure
Single pipe	406.4 mm	Ø 486 mm	GPGM 125 mm	2



# A60 Bulkhead

Table: 3

Fire resistance class A60						
Steel plate (t) ≥ 4.5 mm Single pipe penetration. Thickness 125 mm GPGM in 125 mm sleeve						
Pipe type	Diameter (d) / wall thickness (t)	Outer sleeve dimensions	Thickness of GPGM	Bulkhead insulation type	Sleeve, pipe insulation type	Figure
Single pipe	6 mm / 1 mm	Ø 56 mm	GPGM 125 mm	Rockwool SeaRox SL 620	Rockwool SeaRox WM 620	3

## Installation

Single pipe shall be mounted in the center of the sleeve.

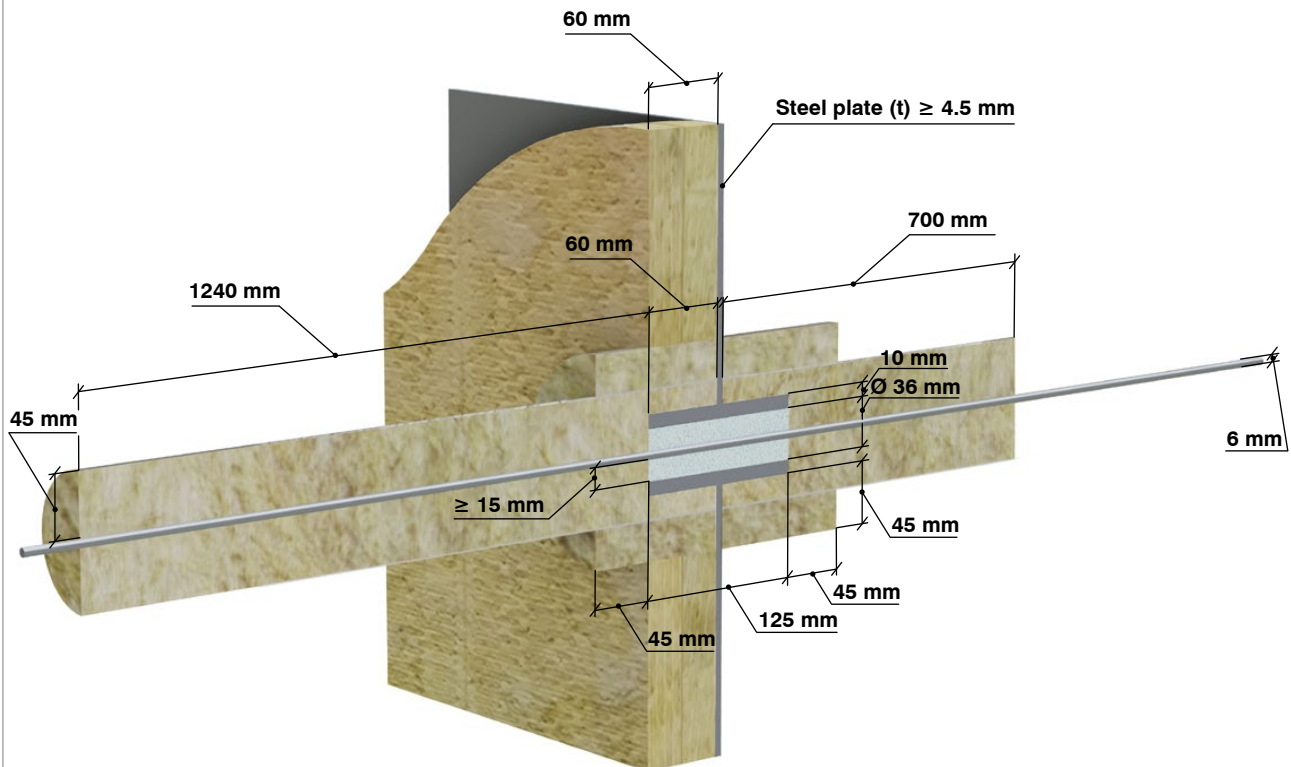
GPGM compound is mixed to a firm consistency with 4 parts GPGM and 1 part water. To be applied in one operation per sleeve. GPGM sealant must have a thickness of 125 mm.

Min. distance between pipe and inside edge of the sleeve ≥ 15 mm.

The bulkhead only needs insulation on one side when 60 mm Searox SL 620 (density 100kg/m³) is used.

Sleeve fully insulated on each side with SeaRox WM 620 (density 90kg/m³), covering GPGM from inside the sleeve, min. 45 mm outside the sleeve and at least 45 mm from GPGM along the pipe. The pipe insulation length shall totally be min. 2000 mm.

Figure 3. Thickness of GPGM 125 mm





# A60 Bulkhead

Table: 4

Fire resistance class A60						
Steel plate (t) ≥ 4.5 mm Single pipe penetration. Thickness 125 mm GPGM in 125 mm sleeve						
Pipe type	Diameter (d) / wall thickness (t)	Outer sleeve dimensions	Thickness of GPGM	Bulkhead insulation type	Sleeve, pipe insulation type	Figure
Single pipe	406.4 mm / 5 mm	Ø 486 mm	GPGM 125 mm	Rockwool SeaRox SL 620	Rockwool SeaRox WM 620	4

## Installation

Single pipe shall be mounted in the center of the sleeve.

GPGM sealant must have a thickness of 125 mm.

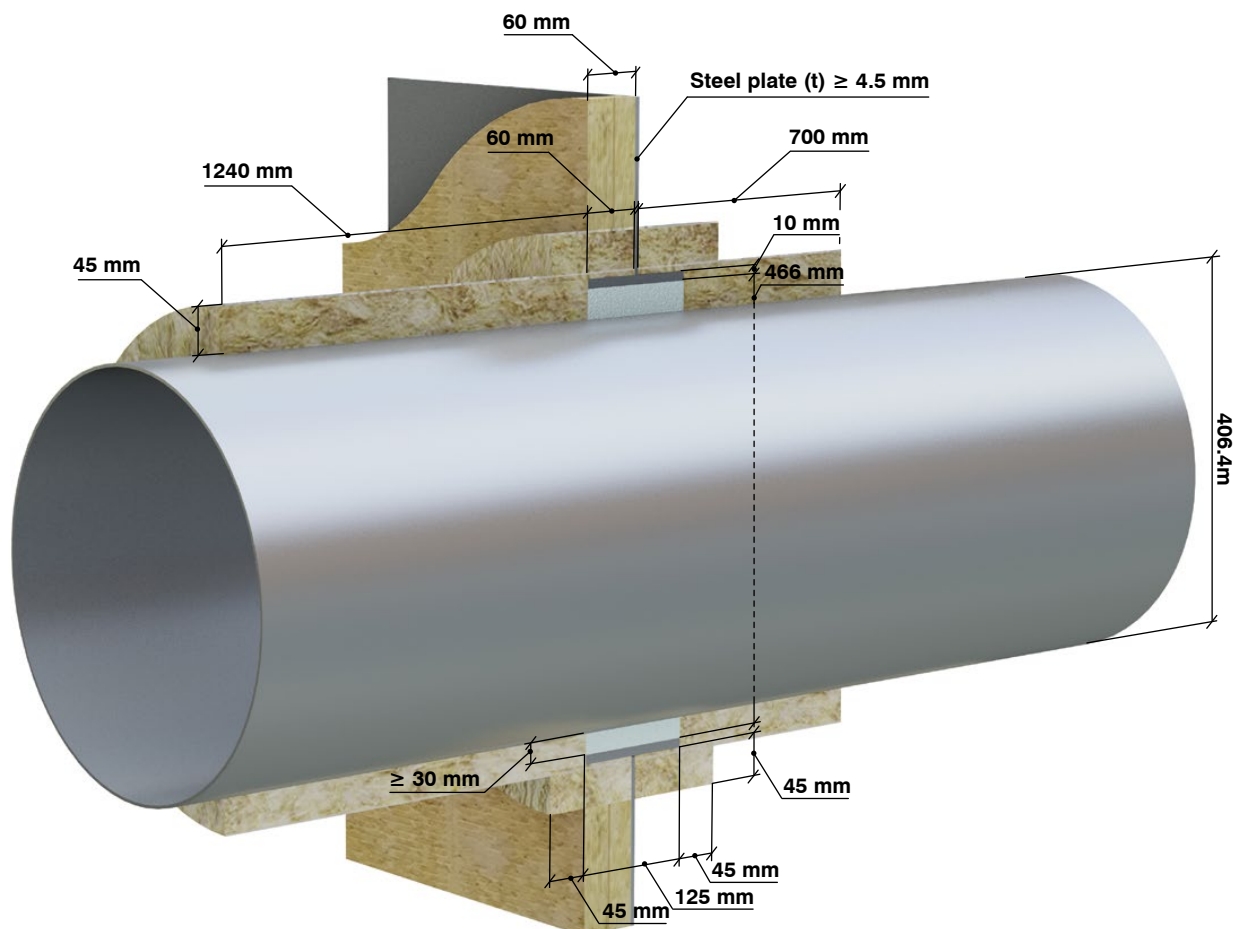
GPGM compound is mixed to a firm consistency with 4 parts GPGM and 1 part water. To be applied in one operation per sleeve.

Min. distance between pipe and inside edge of the sleeve ≥ 30 mm.

The bulkhead only needs insulation on one side when 60 mm Searox SL 620 (density 100kg/m³) is used.

Sleeve fully insulated on each side with SeaRox WM 620 (density 90kg/m³), covering GPGM from inside the sleeve, min. 45 mm outside the sleeve and at least 45 mm from GPGM along the pipe. The pipe insulation length shall totally be min. 2000 mm.

Figure 4. Thickness of GPGM 125 mm



# A60 Deck

Table: 5

Fire resistance class A60						
Steel plate (t) ≥ 4.5 mm Single pipe penetration. Thickness 125 mm GPGM in 125 mm sleeve						
Pipe type	Diameter (d) / wall thickness (t)	Outer sleeve dimensions	Thickness of GPGM	Deck insulation type	Sleeve, pipe insulation type	Figure
Single pipe	6 mm / 1 mm	Ø 56 mm	GPGM 125 mm	Rockwool SeaRox SL 620	Rockwool SeaRox WM 620	5

## Installation

Single pipe shall be mounted in the center of the sleeve.

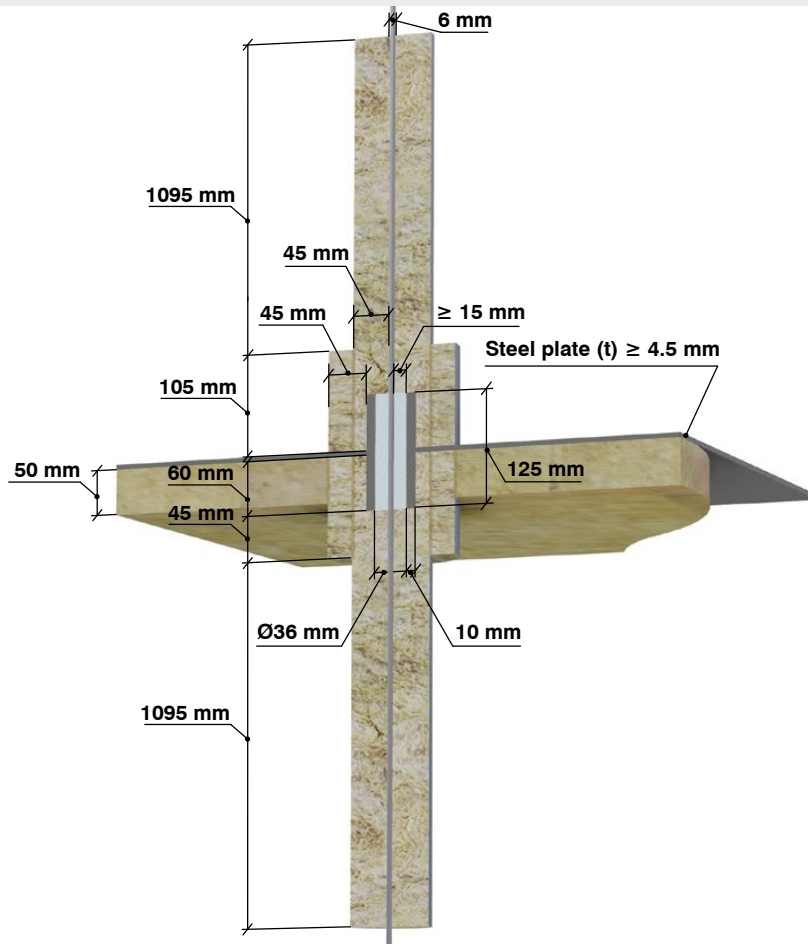
GPGM sealant must have a thickness of 125 mm.

GPGM compound is mixed to a fluid consistency with 2 parts GPGM and 1 part water. To be applied in one operation per sleeve. Use a firm formwork to keep mortar in sleeve before drying phase starts. If a stone wool plate is used, it does not need to be removed after installation.

Min. distance between pipe and inside edge of the sleeve ≥ 15 mm.

The deck only needs insulation on the underside of the deck when 50 mm Searox SL 620 (density 100kg/m³) is used. Sleeve fully insulated on each side with SeaRox WM 620 (density 90kg/m³), covering GPGM from inside the sleeve, min. 45 mm outside the sleeve and at least 45 mm from GPGM along the pipe. The pipe insulation shall be min. 1.200 mm on both sides of the deck.

Figure 5. Thickness of GPGM 125 mm



# A60 Deck

Table: 6

Fire resistance class A60						
Steel plate (t) $\geq$ 4.5 mm Single pipe penetration. Thickness 125 mm GPGM in 125 mm sleeve						
Pipe type	Diameter (d) / wall thickness (t)	Outer sleeve dimensions	Thickness of GPGM	Deck insulation type	Sleeve, pipe insulation type	Figure
Single pipe	406.4 mm / 5 mm	$\varnothing$ 486 mm	GPGM 125 mm	Rockwool SeaRox SL 620	Rockwool SeaRox WM 620	6

## Installation

Single pipes shall be mounted in the center of the sleeve.

GPGM sealant must have a thickness of 125 mm.

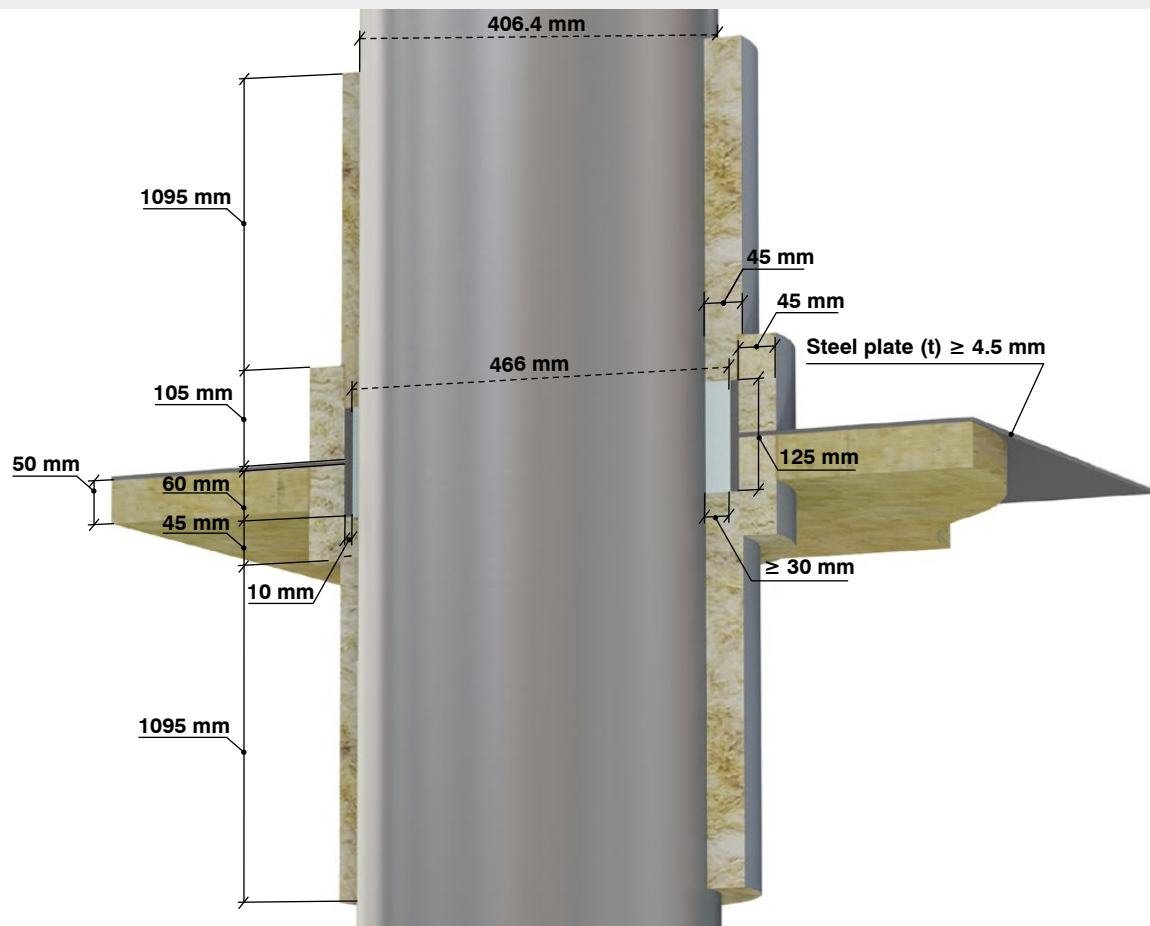
GPGM compound is mixed to a fluid consistency with 2 parts GPGM and 1 part water. To be applied in one operation per sleeve. Use a firm formwork to keep mortar in sleeve before drying phase starts. If a stone wool plate is used, it does not need to be removed after installation.

Min. distance between pipe and inside edge of the sleeve  $\geq$  30 mm.

The deck only needs insulation on the underside of the deck when 50 mm Searox SL 620 (density 100kg/m<sup>3</sup>) is used.

Sleeve fully insulated on each side with SeaRox WM 620 (density 90kg/m<sup>3</sup>), covering GPGM from inside the sleeve, min. 45 mm outside the sleeve and at least 45 mm from GPGM along the pipe. The pipe insulation shall be min. 1.200 mm on both sides of the deck.

Figure 6. Thickness of GPGM 125 mm



# H0 Bulkhead

Table: 7

Fire resistance class H0					
Steel plate (t) $\geq$ 4.5 mm Single pipe penetration. Thickness 250 mm GPGM in 250 mm sleeve					
Pipe type	Diameter (d) / wall thickness (t)	Outer sleeve dimensions	Thickness of GPGM	Additional product	Figure
Single pipe	$\geq$ 48.3 mm / 2.6 mm	$\varnothing$ 98 mm	GPGM 250 mm	FS Pipe Wrap	7

## Installation

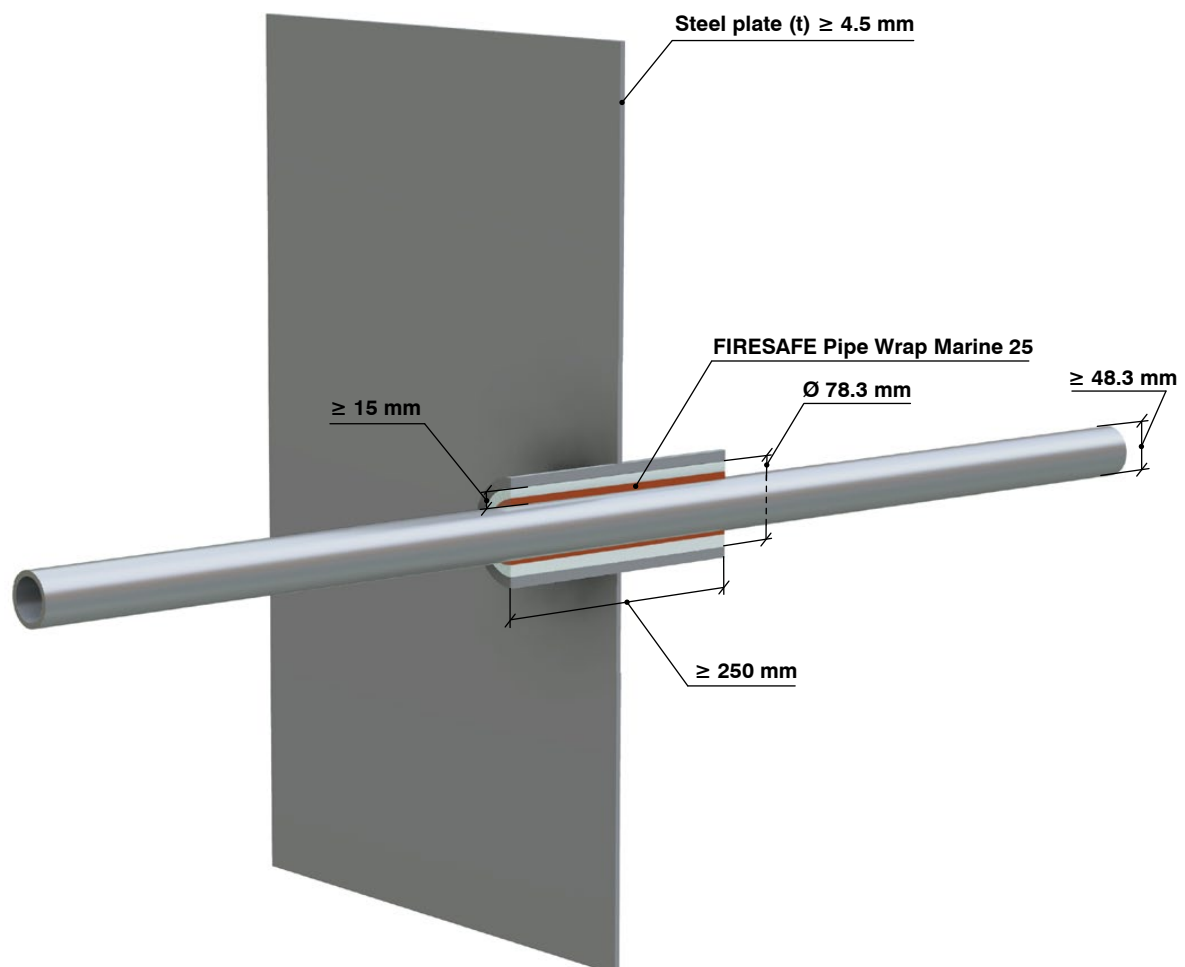
Single pipe shall be mounted in the center of the sleeve.

To be sealed with FIRESAFE Pipe Wrap Marine 25 (4 mm thick) between pipe and GPGM.

Min. distance between pipe and inside edge of the sleeve  $\geq$  15 mm.

GPGM sealant must have a thickness of 250 mm. GPGM compound is mixed to a firm consistency with 4 parts GPGM and 1 part water. To be applied in one operation per sleeve.

Figure 7. Thickness of GPGM 250 mm



# H0 Bulkhead

Table: 8

Fire resistance class H0					
Steel plate (t) $\geq$ 4.5 mm Single pipe penetration. Thickness 250 mm GPGM in 250 mm sleeve					
Pipe type	Diameter (d) / wall thickness (t)	Outer sleeve dimensions	Thickness of GPGM	Additional product	Figure
Single pipe	$\leq$ 406.4mm / 5 mm	$\varnothing$ 486.4 mm	GPGM 250 mm	FS Pipe Wrap	8

## Installation

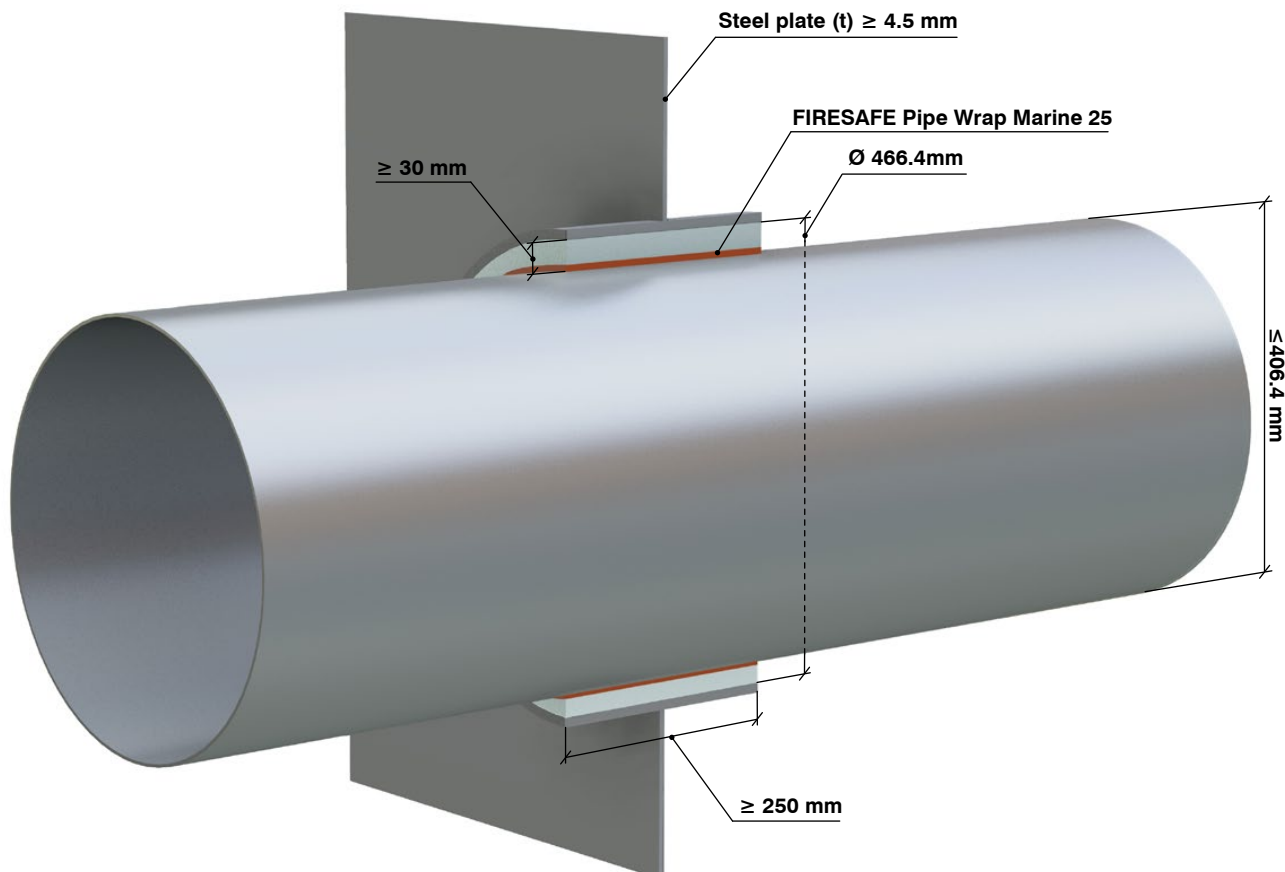
Single pipe shall be mounted in the center of the sleeve.

To be sealed with FIRESAFE Pipe Wrap Marine 25 (4 mm thick) between pipe and GPGM.

Min. distance between pipe and inside edge of the sleeve  $\geq$  30 mm.

GPGM sealant must have a thickness of 250 mm. GPGM compound is mixed to a firm consistency with 4 parts GPGM and 1 part water. To be applied in one operation per sleeve.

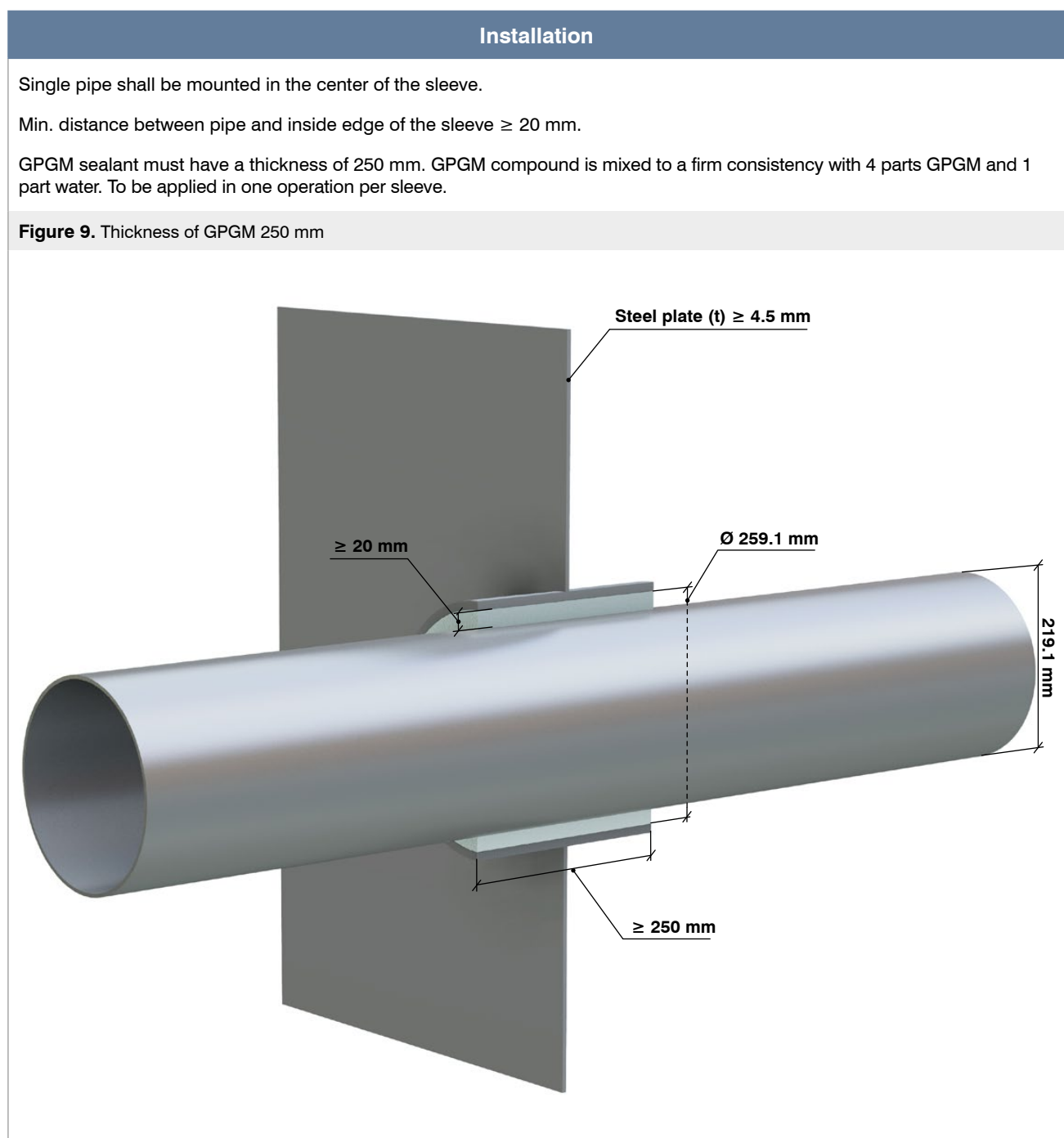
Figure 8. Thickness of GPGM 250 mm



# H0 Bulkhead

Table: 9

Fire resistance class H0				
Steel plate (t) ≥ 4.5 mm Single pipe penetration. Thickness 250 mm GPGM in 250 mm sleeve				
Pipe type	Diameter (d) / wall thickness (t)	Outer sleeve dimensions	Thickness of GPGM	Figure
Single pipe	219.1 mm / 4.5 mm	Ø 279 mm	GPGM 250 mm	9



# H60 Bulkhead

Table: 10

Fire resistance class A60						
Steel plate (t) $\geq$ 4.5 mm Single pipe penetration. Thickness 250 mm GPGM in 250 mm sleeve						
Pipe type	Diameter (d) / wall thickness (t)	Outer sleeve dimensions	Thickness of GPGM	Insulation type	Additional product	Figure
Single pipe	48.3 mm / 2.6 mm	Ø 98.3 mm	GPGM 250 mm	Firemaster® Marine Plus	FS Pipe Wrap	10

## Installation

Single pipe shall be mounted in the center of the sleeve.

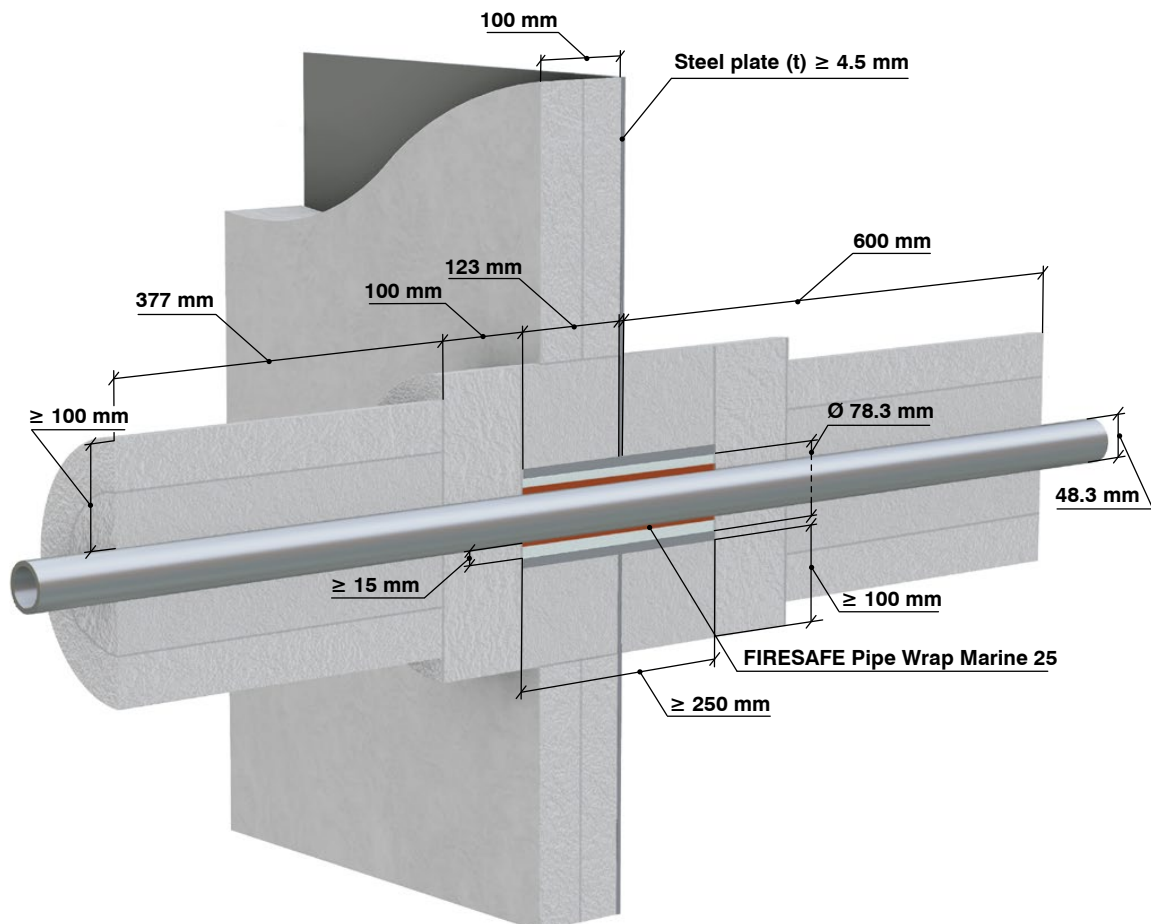
GPGM sealant must have a thickness of 250 mm. GPGM compound is mixed to a firm consistency with 4 parts GPGM and 1 part water. To be applied in one operation per sleeve.

To be sealed with FIRESAFE Pipe Wrap Marine 25 25 (4 mm thick) between pipe and GPGM.

Min. distance between pipe and inside edge of the sleeve  $\geq$  15 mm.

The bulkhead only needs insulation on one side when 100 mm Firemaster® Marine Plus (density 96 kg/m<sup>3</sup>) is used. Sleeve fully insulated on each side with 100 mm Firemaster® Marine Plus (density 96kg/m<sup>3</sup>), covering GPGM inside sleeve, min. 100 mm outside the sleeve and at least 100 mm from GPGM along the pipe. The pipe insulation length shall totally be min. 1200 mm.

Figure 10. Thickness of GPGM 250 mm





# Empty sleeves

## FIRE CLASSIFICATION

Fire classification for cables and pipes applies to all types of open sleeves in offshore and marine environments where IMO resolution MSC.307(88) (2010 FTP Code), Annex 1, Part 3 is applicable, with maximum diameter specified in the tables.

Large open sleeves: The maximum size sleeve tested in the test furnace with or without penetrations are 220 x 512 mm in bulkheads and 512 x 220 mm in decks.

The fire sealant can be applied with and without stone wool insulation assuming compliance with described fire resistance class.

Tested for A0, A60 and H0 but all tested sleeves with penetration can be used as empty sleeves. Sealant thickness of GPGM and specified insulation must be as in the tables for installations with penetrations.

/ For fire resistance class and installation details, see tables:

Table	Type of penetration	Figure	Fire resistance class	Page
1	Bulkhead, horizontal joint width $\leq$ 50 mm in 60 mm sleeve	1	A0	41
2	Bulkhead, vertical joint width $\leq$ 50 mm in 60 mm sleeve	2	A0	42
3	Bulkhead, vertical open sleeve in 60-90 mm sleeves	3	A0	43
4	Deck, horizontal open sleeve in 60 mm sleeve	4	A0	44
5	Bulkhead, vertical open sleeve in 60-90 mm sleeves	5	A60	45
6	Deck, horizontal open sleeve in 60 mm sleeve	6	A60	46
7	Bulkhead, horizontal open sleeve in $\geq$ 200 mm sleeve	7	H0	47
8	Deck, horizontal open sleeve in $\geq$ 200 mm sleeve	8	H0	48

# A0 Bulkhead

Table: 1

Fire resistance class A0			
Steel plate (t) ≥ 4.5 mm Empty sleeve. Thickness 100 mm GPGM in 60 mm sleeve			
Sleeve type	Opening / Joint width	Thickness of GPGM	Figure
Horizontal joint	≤ 50 mm	GPGM 20+60+20 mm	1

Installation

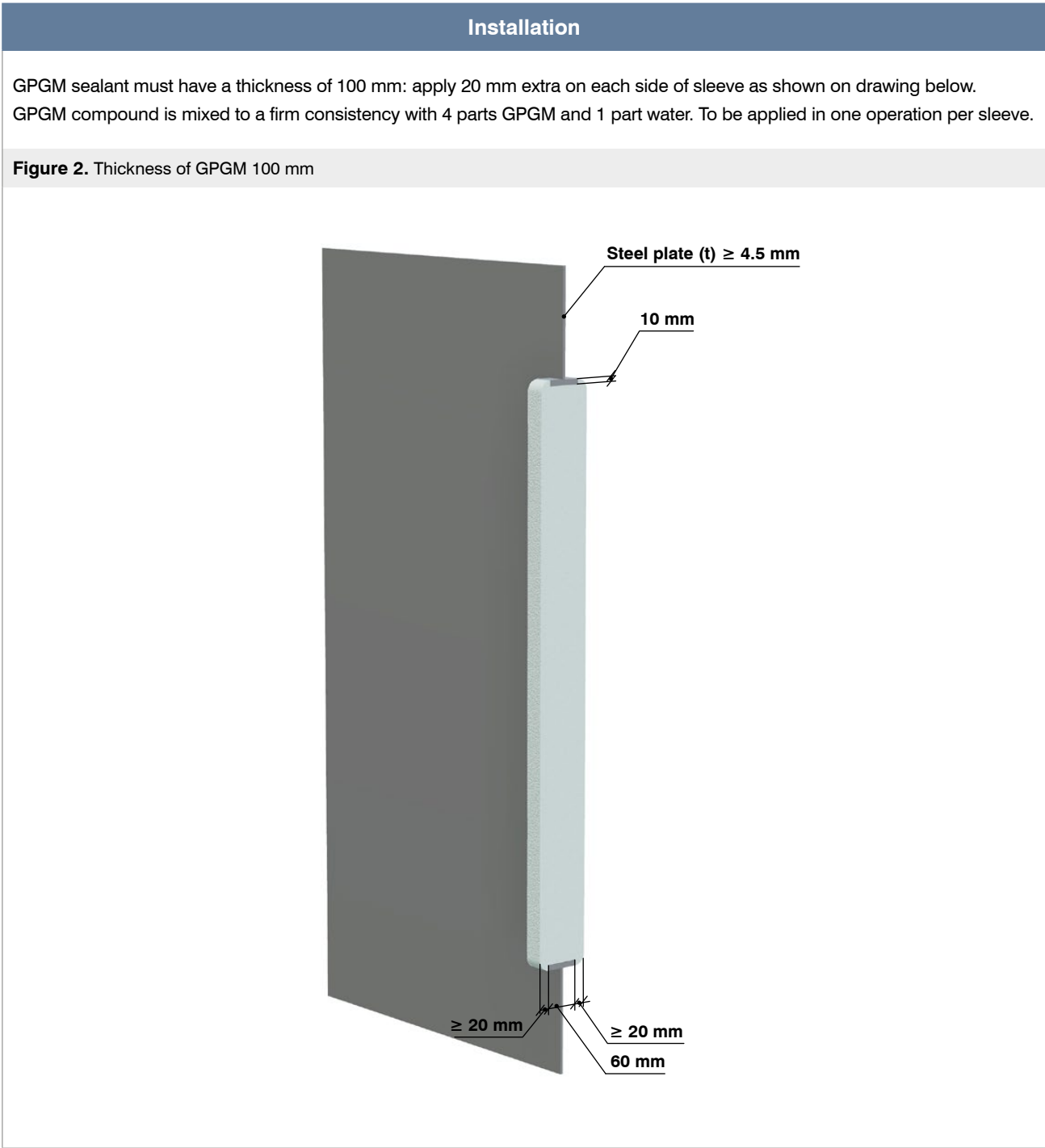
GPGM sealant must have a thickness of 100 mm: apply 20 mm extra on each side of sleeve as shown on drawing below. GPGM compound is mixed to a firm consistency with 4 parts GPGM and 1 part water. To be applied in one operation per sleeve.

**Figure 1.** Thickness of GPGM 100 mm

# A0 Bulkhead

Table: 2

Fire resistance class A0			
Steel plate (t) ≥ 4.5 mm Empty sleeve. Thickness 100 mm GPGM in 60 mm sleeve			
Sleeve type	Opening / Joint width	Thickness of GPGM	Figure
Vertical joint	≤ 50 mm	GPGM 20+60+20 mm	2



# A0 Bulkhead

Table: 3

Fire resistance class A0				
Steel plate (t) ≥ 4.5 mm Empty sleeve.				
Sleeve type	Outer sleeve dimensions	Thickness of GPGM	Sleeve length	Figure
Empty sleeve	532 x 240 mm	GPGM 20+60+20 mm	60 mm	3
Empty sleeve		GPGM 20+90+20 mm	90 mm	

Installation

GPGM sealant must have a thickness of a thickness of a sleeve length: apply 20 mm extra on each side of sleeve as shown on drawing below.

GPGM compound is mixed to a firm consistency with 4 parts GPGM and 1 part water. To be applied in one operation per sleeve.

**Figure 3.** Thickness of GPGM 100 mm

# A0 Deck

Table: 4

Fire resistance class A0			
Steel plate (t) ≥ 4.5 mm Empty sleeve. Thickness 80 mm GPGM in 60 mm sleeve			
Sleeve type	Outer sleeve dimensions	Thickness of GPGM	Figure
Empty sleeve	532 x 240 mm	GPGM 20+60 mm	4

Installation

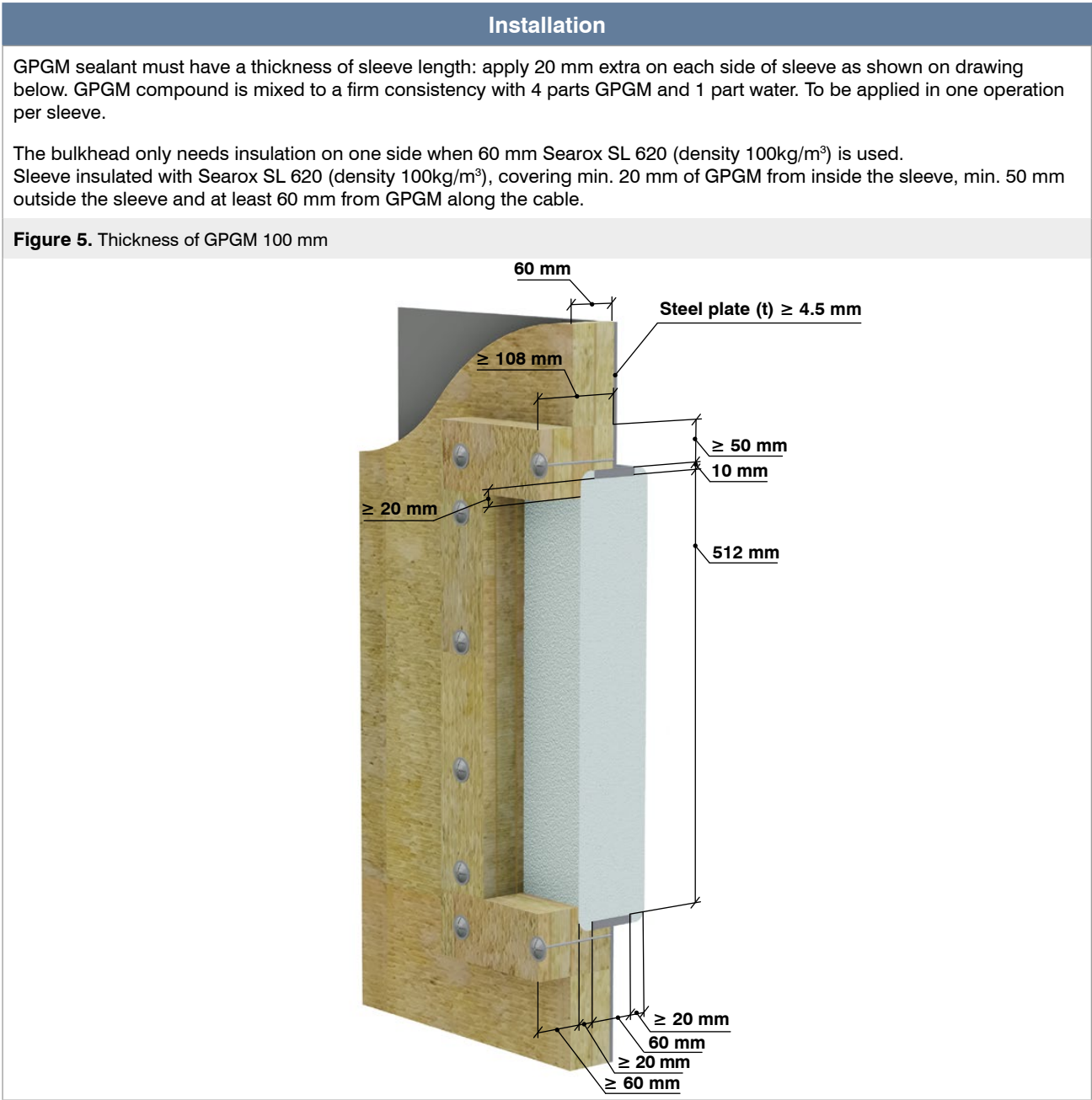
GPGM sealant must have a thickness of 80 mm: apply 20 mm extra on the top side of sleeve as shown on drawing below.  
Use a firm formwork to keep mortar in sleeve before drying phase starts. If a stone wool plate is used, it does not need to be removed after installation.  
GPGM compound is mixed to a firm consistency with 4 parts GPGM and 1 part water. To be applied in one operation per sleeve.

**Figure 4.** Thickness of GPGM 80 mm

# A60 Bulkhead

Table: 5

Fire resistance class A60					
Steel plate (t) ≥ 4.5 mm Empty sleeve.					
Sleeve type	Outer sleeve dimensions	Thickness of GPGM	Sleeve length	Insulation type	Figure
Empty sleeve	532 x 240 mm	GPGM 20+60+20 mm	60 mm	Rockwool SeaRox SL 620	5
Empty sleeve	532 x 240 mm	GPGM 20+90+20 mm	90 mm	Rockwool SeaRox SL 620	



# A60 Deck

Table: 6

Fire resistance class A60				
Steel plate (t) ≥ 4.5 mm Empty sleeve. Thickness 80 mm GPGM in 60 mm sleeve				
Sleeve type	Outer sleeve dimensions	Thickness of GPGM	Insulation type	Figure
Empty sleeve	532 x 240 mm	GPGM 20+60 mm	Rockwool SeaRox SL 620	6

Installation

GPGM sealant must have a thickness of 80 mm: apply 20 mm extra on the top side of sleeve as shown on drawing below. GPGM compound is mixed to a fluid consistency with 2 parts GPGM and 1 part water. To be applied in one operation per sleeve. Use a firm formwork to keep mortar in sleeve before drying phase starts. If a stone wool plate is used, it does not need to be removed after installation.

The deck only needs insulation on the underside of the deck when 50 mm Searox SL 620 (density 100kg/m³) is used. Sleeve insulated with Searox SL 620 (density 100kg/m³), covering min. 20 mm of GPGM from inside the sleeve, min. 50 mm outside the sleeve and at least 50 mm from GPGM along the sleeve.

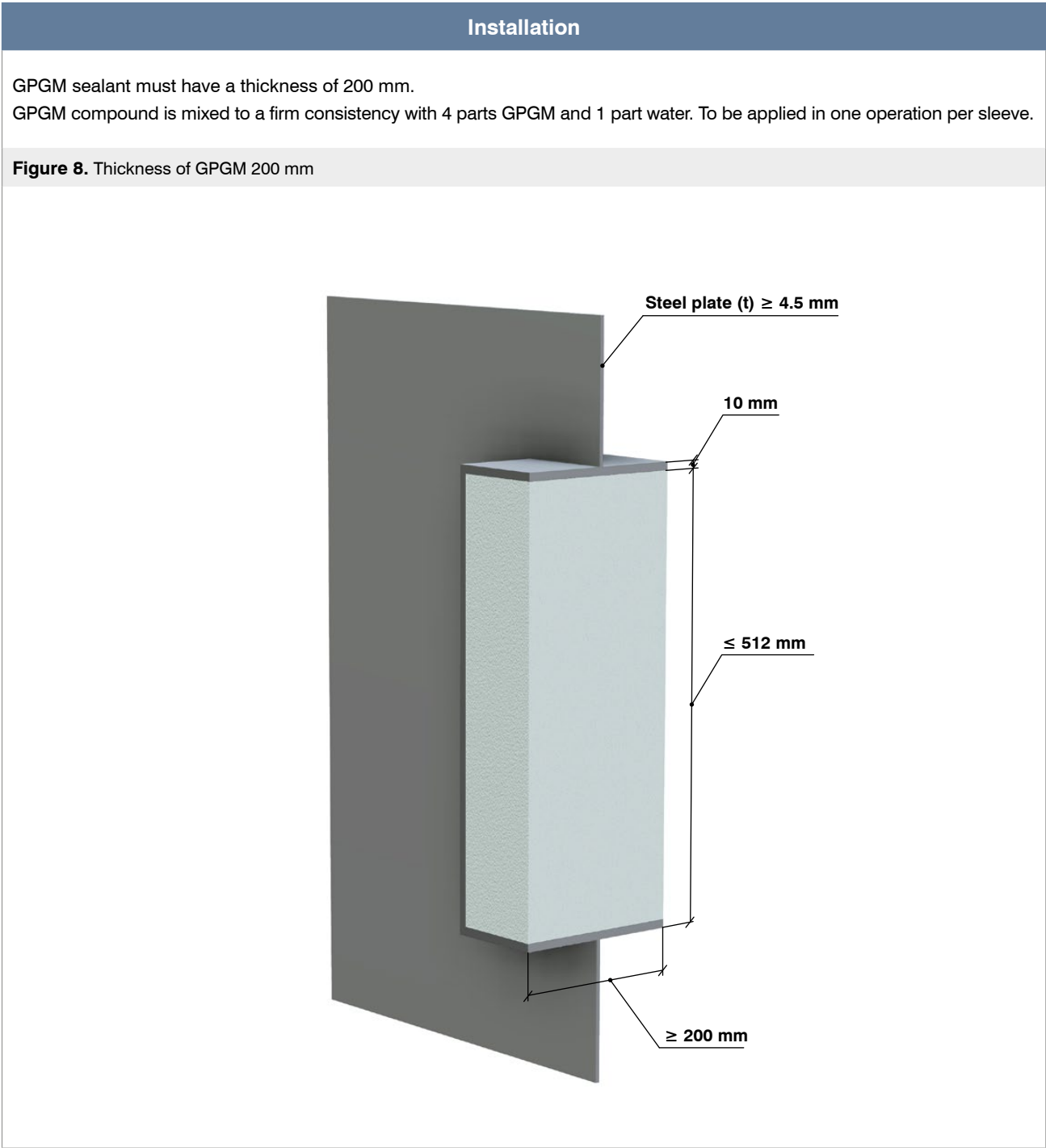
Figure 6. Thickness of GPGM 80 mm



# H0 Bulkhead

Table: 7

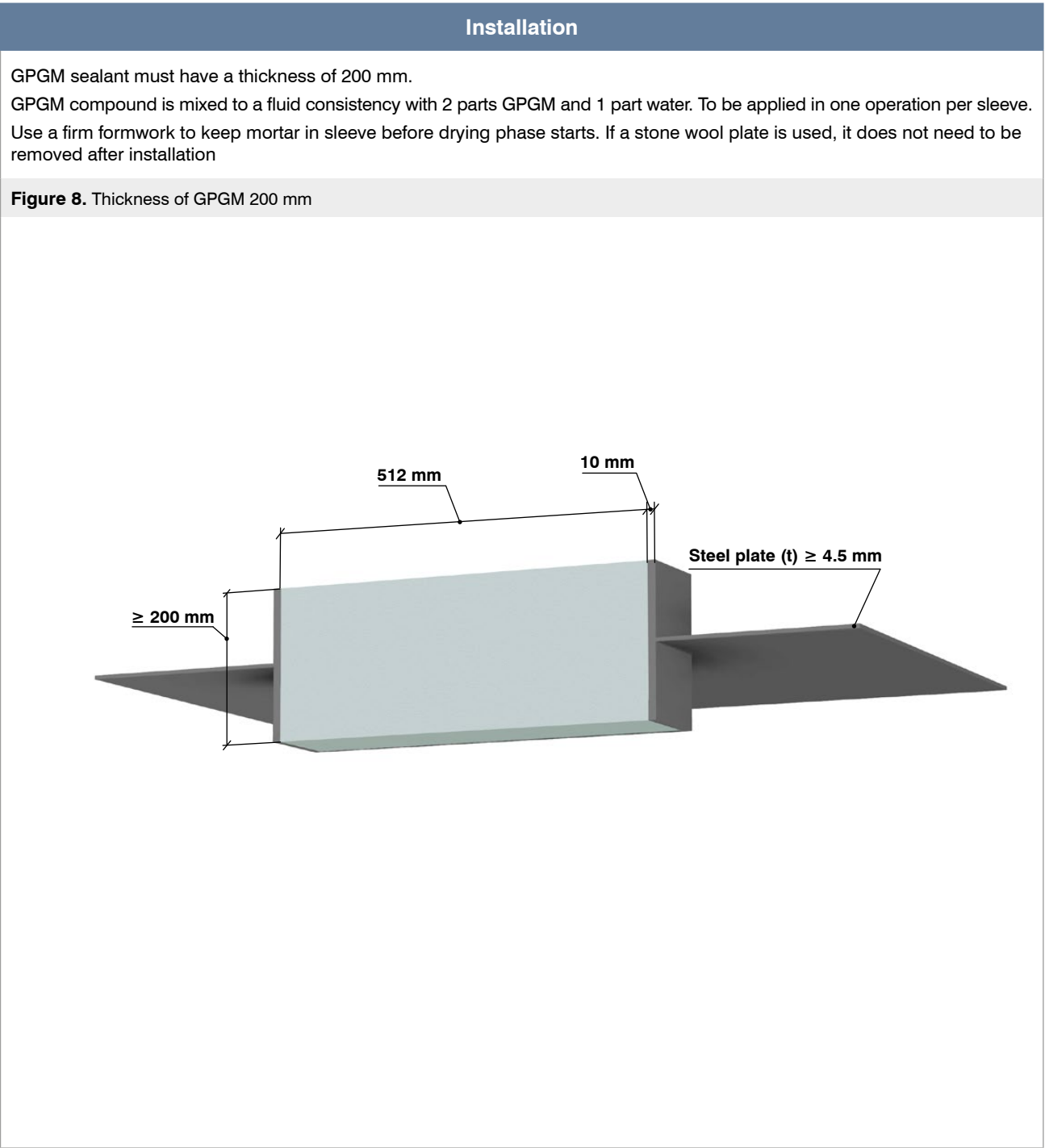
Fire resistance class H0			
Steel plate (t) ≥ 4.5 mm Empty sleeve. Thickness 200 mm GPGM in 200 mm sleeve			
Sleeve type	Outer sleeve dimensions	Thickness of GPGM	Figure
Empty sleeve	532 x 240 mm	GPGM 200 mm	8



# H0 Deck

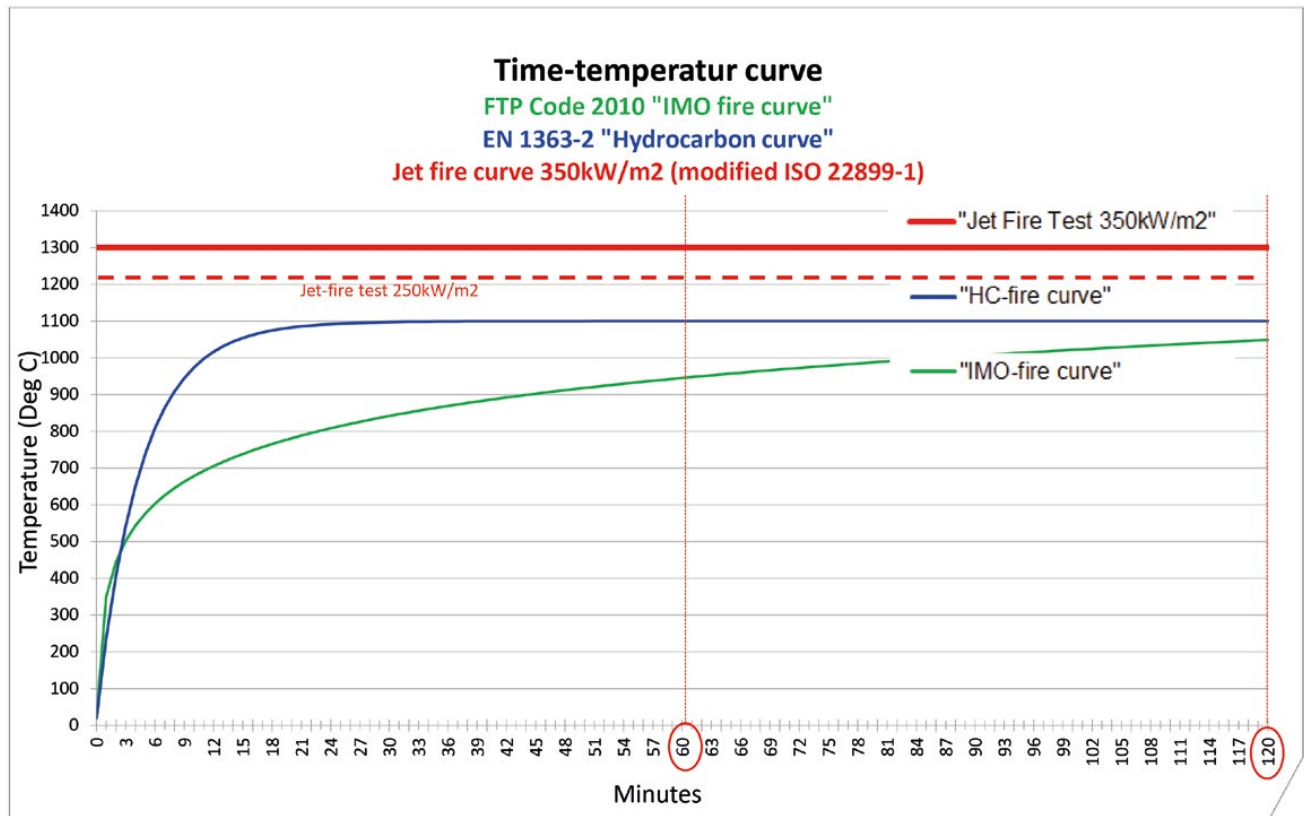
Table: 8

Fire resistance class H0			
Steel plate (t) ≥ 4.5 mm Empty sleeve. Thickness 200 mm GPGM in 200 mm sleeve			
Sleeve type	Outer sleeve dimensions	Thickness of GPGM	Figure
Empty sleeve	532 x 240 mm	GPGM 200 mm	8



# Fire tests

All fire tests are performed at RISE Fire Research outside Trondheim, Norway and according to the FTP Code.



Jet Fire 350 kw/m<sup>2</sup>



H-Class fire



A-Class fire

# Corrosion under Insulation (CUI)

GPG Marine has been tested for CUI by DNV-GL in Bergen, Norway.

Pipes in the following steel qualities were tested: E235, E355, galvanized carbon steel (Mannesman) AISI304, AISI316, 6MO, Duplex and Super Duplex. The carbon steel pipes were tested both unpainted and painted in acc. to NORSOK M501-Sys 1 (Topside).

The results were very positive, and a full report can be obtained by contacting Firesafe Energy AS.

DNV-GL

## CUI TEST

## Corrosion Under Insulation of GPG Marine

Firesafe Energy AS

Report No.: 2018-5314, Rev. 0  
Document No.: 228650  
Date: 2018-10-23

## 1 EXECUTIVE SUMMARY

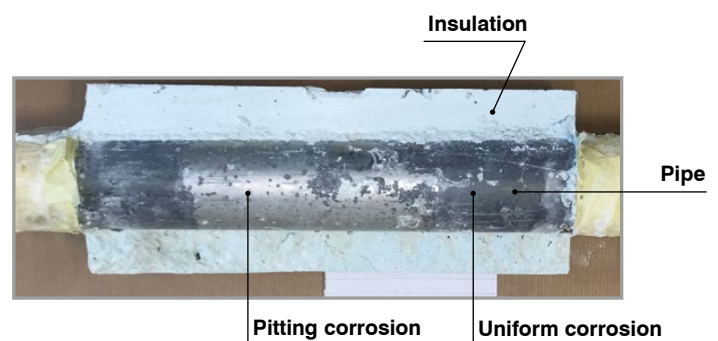
Firesafe Energy AS (in further text referred to as "the Client") has requested from DNV GL Bergen to expose 10 steel pipes insulated with insulation GPG Marine for 2 months to a salt spray, based on ASTM B117.

The main reason for conducting the test was to evaluate the extent of corrosion under insulation with GPG Marine at different steel pipe materials.

Based on the results, the following can be summarized:

- Unpainted carbon steel pipes experienced uniform and general corrosion at the areas covered by the insulation close to the pipes' edges.
- The middle section of the unpainted carbon steel pipes was locally corroded (shallow pitting), most likely due to the limited access of water to the pipe under the insulation.
- Pipe made of corrosion resistant alloys did not show any signs of corrosion attack.
- Painted carbon steel pipes did not show any visible signs of paint degradation. No corrosion was observed on the pipes' surface.

Sample 1



Sample 2



Sample 3





# Aging test

GPG Marine has been tested by DNV-GL in Bergen, Norway for lifetime expectancy. The test was done in acc. to ISO 20340.



AGEING OF GPG MARINE (GPGM), ISO 20340

## Technical Report

Firesafe Energy AS

Report No.: 2017-5364, Rev. 1

Document No.: 1151HEWM-1

Date: 2017-12-18

Before exposure



After exposure



Before exposure



After exposure



## 4 CONCLUSIONS

Based on the obtained results, the following can be concluded:

- During the ageing test, the tested specimens absorbed the water resulting in their weight increase of max 10 %. After a period of drying, the water level dropped.
- The surface of the specimens partly dissolved resulting in the weight loss of less than 5 %.
- If pores in the material are present, integrity of the system might be affected.

*Other documentation such as product data sheets, material safety data sheets (SDS) can be downloaded from **[www.firesafeenergy.no](http://www.firesafeenergy.no)***

*Always consult with [www.firesafeenergy.no](http://www.firesafeenergy.no) for the latest version of assembly instructions, product data sheet as product development and testing are ongoing processes in FIRESAFE ENERGY AS.*

*Contact FIRESAFE ENERGY AS for other non-standardized solutions or complex project-specific requirements;  
Email: **[support@firesafe.no](mailto:support@firesafe.no)***

*All information in these installation instructions are to be regarded as normative values obtained from tests and our collective knowledge and experience with the product. This data must not be used as a basis for or verification of other tests or systems. Firesafe AS accepts no liability for other use or misuse of the product. Users are responsible for ensuring they use the latest version of this document. Please check our website [www.firesafeenergy.no](http://www.firesafeenergy.no). Images and other information from this document may not be reproduced without the prior written consent of Firesafe Energy AS.*

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