



# **Guidelines for Pipe Penetrations accepted for use on board DNV classed ships and MOU's**

## Introduction

In order to provide a practical guidance to pipe penetrations passing through fire rated decks and bulkheads, Det Norske Veritas' Section for Maritime Fire Safety has issued the below Guidelines that may be distributed to Clients upon request.

The Guidelines are in accordance with DNV's interpretations of SOLAS Am. 2000 Chapter II-2, Regulation 9.3 and the parts of MSC/Circ.1120 pertaining to the same regulation.

They describe acceptable minimum solutions to penetrations through divisions of different fire rating by pipes categorized by melting points corresponding to the fire ratings.

Other solutions of similar or better fire safety standard may also be accepted. Alternative penetrations that are tested in accordance with IMO Res. A.754(18) will be accepted subject to compliance with the test criteria.

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# 1 Pipe penetrations through class A divisions

## 1.1 Type approved pipe penetrations

Type approved pipe penetrations for use in class A rated fire divisions may be installed in compliance with manufacturers recommendations.

Pipes should pass through the division in the same direction/angle as tested.

Attention should be paid to possible limitations to the Type Approval.

## 1.2 Alternative acceptable pipe penetrations

### 1.2.1 Penetrations by pipes of material with melting point higher than 950°C.

- 1) The pipe should be welded to the division by continuous welds or joined to a penetration piece and double plate of the same material as the pipe, which should be welded or bolted to the division (*See fig. 1*).

Alternatively, the penetration piece could consist of two pieces joined together in a steel sleeve, which should be welded to the division (*See fig. 2*).

The penetration piece should have a wall thickness (t) and length (L) in accordance with *Table 1*, evenly distributed on both sides of the penetrated division.

Double plate and penetration sleeve dimensions should be such that the required division load bearing capacity is maintained and in no case less than the penetrated division thickness and the penetration piece wall thickness respectively.

For penetrations through insulated divisions, any threaded or flanged connection between penetration piece and piping (including possible access to bolts) shall be clear of the insulation material.

Details of the insulation in separate section below.

*Table 1 Dimensions of pipe penetration pieces*

External pipe diameter, D (mm)	Min. penetration piece wall thickness, t (mm)	Min. length of penetration piece, L (mm), *)
13,5 – 17,2	3	200
20	3,2	200
21,3 – 25	3,7	200
26,9 – 33,7	3,9	200
38 – 44,5	4,9	200
48,3	5,1	200
51 – 63,5	5,5	200
70	6,3	200
76,1 – 82,5	7,0	300
88,9 – 108	7,6	300
114,3 – 127	8,6	300
133 – 139,7	9,5	300
152,4 – 168,3	11	300

\*) In insulated divisions, the penetration piece shall extend beyond the required 450 mm insulation length and the penetration piece length has to be increased accordingly on the insulated side.

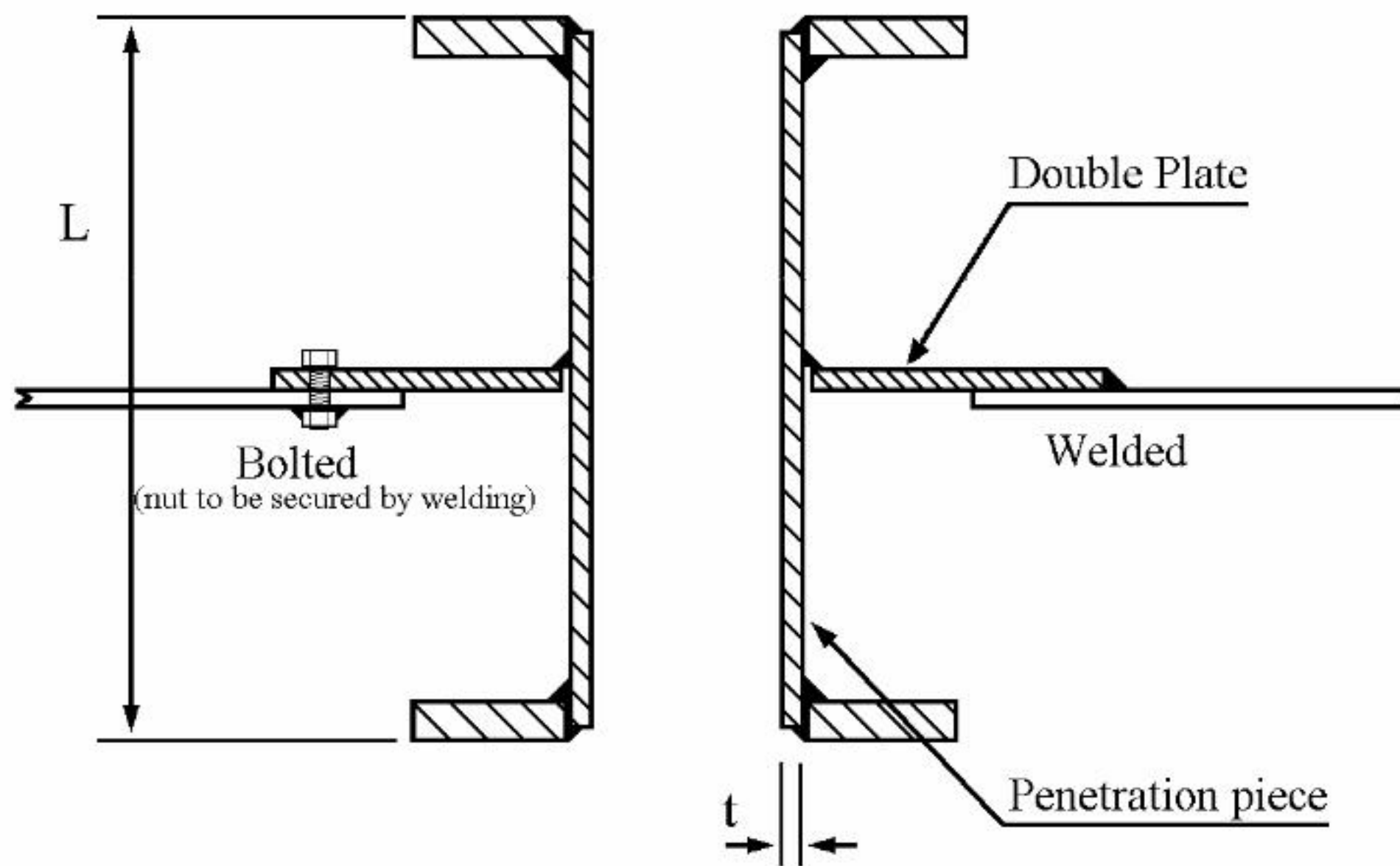


Fig. 1, Penetration through class A divisions with double plate and penetration piece with flange, bolted alternative indicated on the left side and welded alternative on the right side.

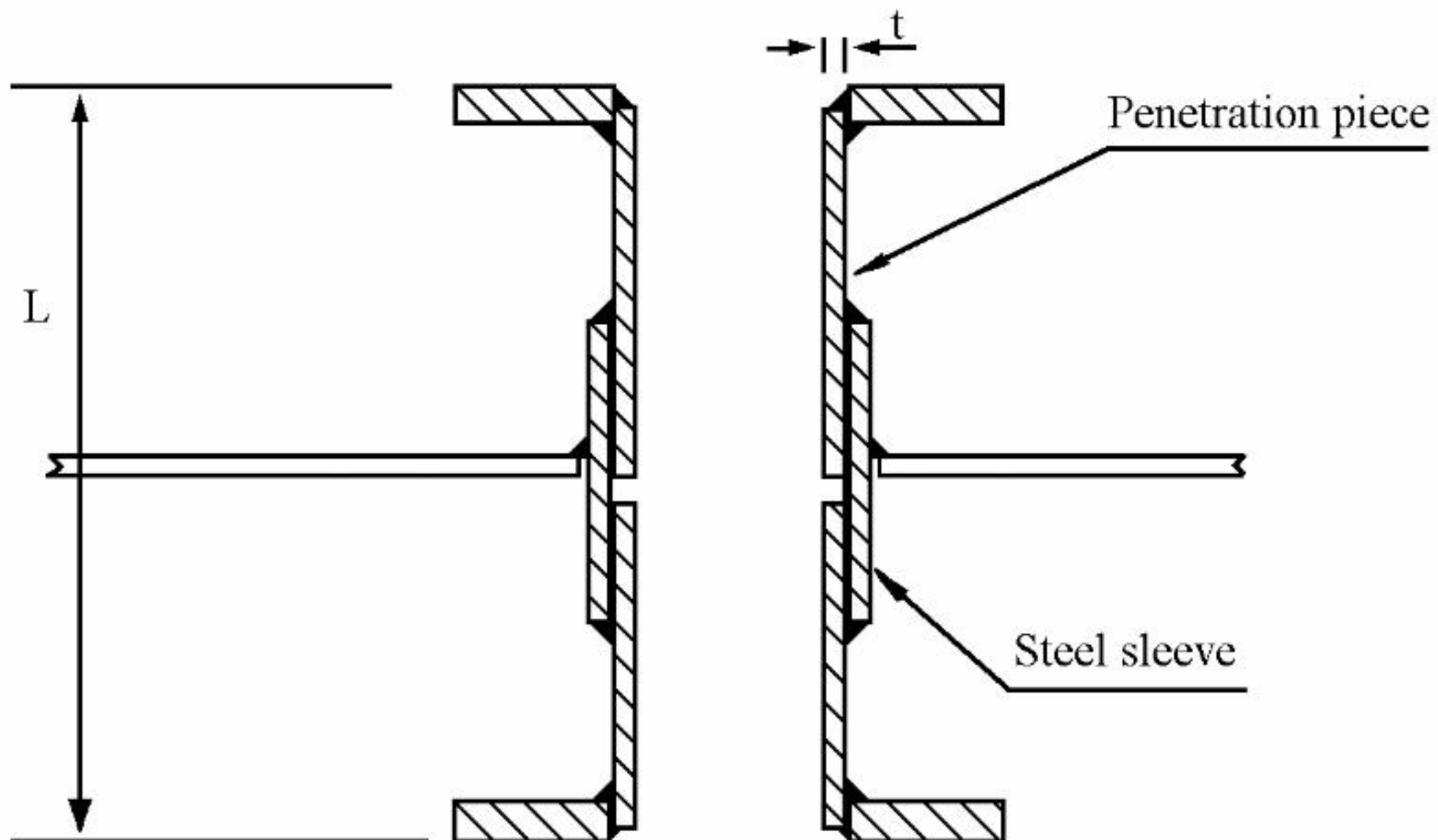


Fig. 2, Penetration through class A divisions with steel sleeve and penetration piece with flange



- 2) Pipes may also pass through a circular steel sleeve welded to the division (See figure 3).

The sleeve should be of at least 3 mm thickness ( $t$ ) and 200 mm length. Pipes with outside diameter larger than 70 mm should have a sleeve length of at least 300 mm and pipes with outside diameter larger than 150 mm should have a sleeve length of at least 900 mm. For fire insulated divisions, the sleeve should extend at least 450 mm on the insulated side for all pipe dimensions.

A nominal gap ( $d$ ) of 20 mm should be provided between the pipe and the sleeve. The gap should be packed tightly throughout the sleeve length with an approved insulation material and sealed at each end with a suitable flexible sealant for the purpose of avoiding moisture.

Pipe connections inside the penetration piece should be avoided.

Attention should be paid to possible galvanic corrosion for pipes of other metallic material than steel in moist environments, in which case the use of a non-conductive insulation material between the pipe and the sleeve may be recommended.

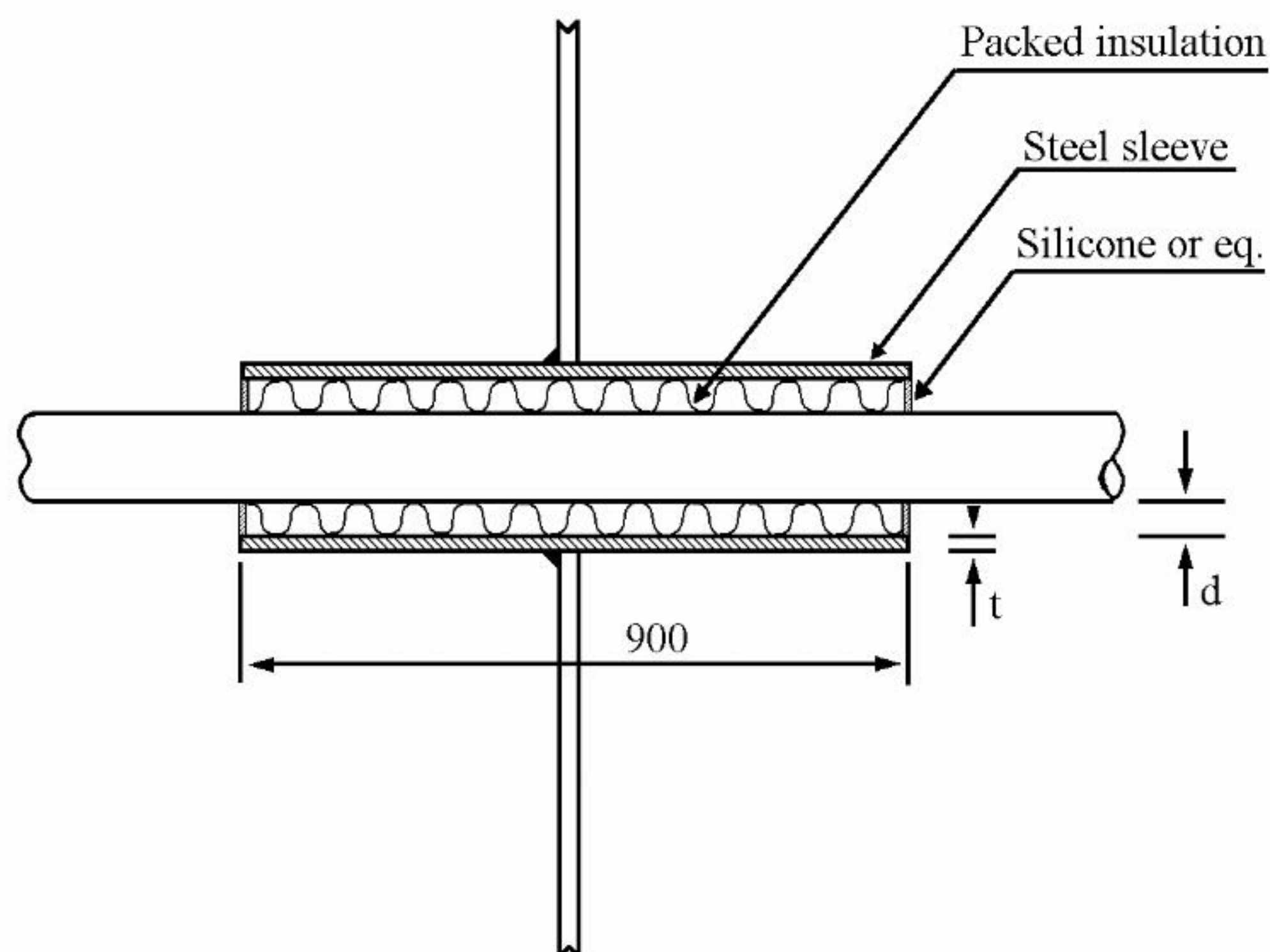


Fig. 3 Pipes led through sleeves welded to the class A division

### 1.2.2 Penetrations by pipes of material with melting point lower than 950°C.

These pipes should pass individually through a sleeve of at least 4.5 mm thickness and 900 mm length. The sleeve should be continuously welded to the penetrated division (See figure 4).

For penetrations through class A-15/30/60 divisions, the sleeve should extend at least 450 mm on the insulated side and be insulated with the same insulation as the division for 450 mm along the pipe (measured from the surface of the division insulation). Clearance between pipe and sleeve should not exceed 2.5 mm and should be sealed in both ends with a suitable flexible sealant.

Pipe connections inside the penetration piece should be avoided.

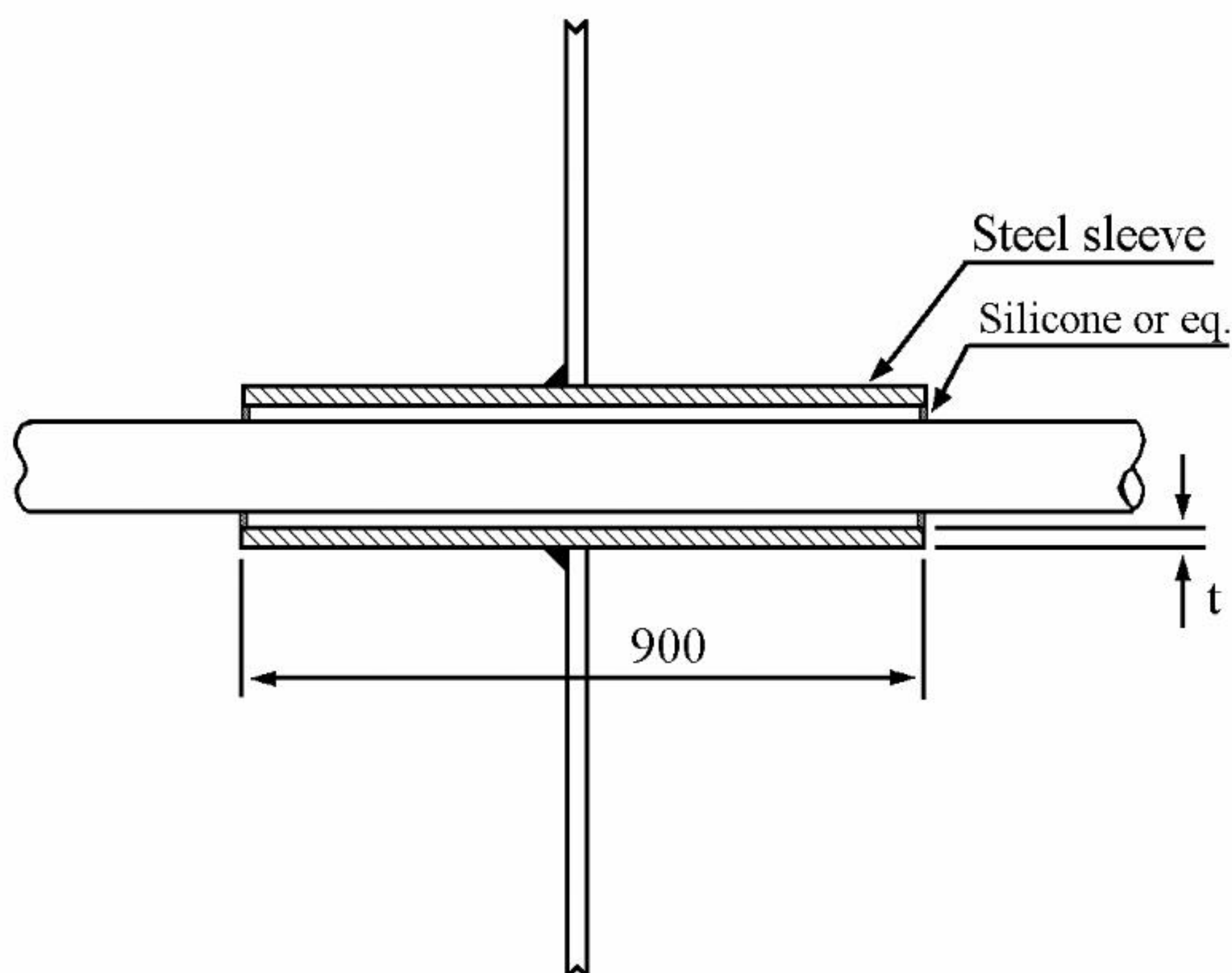


Fig. 4 Pipes with melting point lower than 950°C in class A divisions

### 1.2.3 Insulation of pipe penetrations.

For pipe penetrations through class A-15/30/60 divisions, the division insulation should be continued along the piping or penetration fitting for at least 450 mm on the fire exposed side (measured from the surface of the division insulation). The insulation material should be kept in place relative to the division insulation by a wire mesh or similar. Aluminum tape loses its integrity when subjected to excessive heat, and should be avoided as a means for fixing the pipe insulation to the division insulation.

### 1.3 Fire rated penetrations through combined watertight and fire rated divisions

#### 1.3.1 Limitations.

Fire rated pipe penetrations that are pressure tested are generally not to be used in the boundaries of tanks or in other locations with a permanent fluid pressure.

If used in the boundaries of tanks, the penetration should be:

- located at the top of the tank.
- compatible with the fluid contained in the tank.
- evaluated for the design temperature in the tank.
- subject to approval in each individual case.

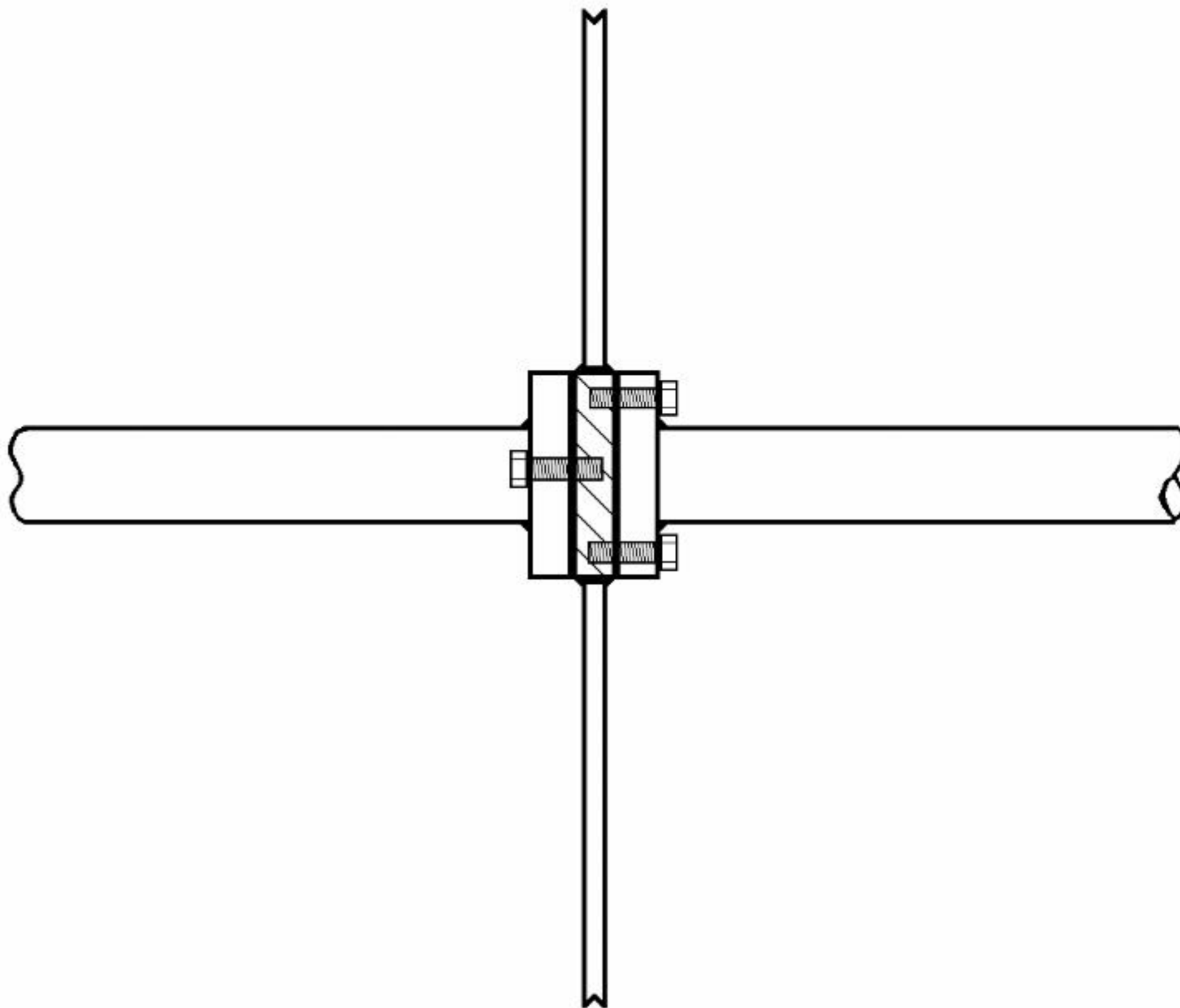
#### 1.3.2 Pressure test requirements.

Fire rated pipe penetrations to be used in watertight divisions shall be of approved type and tested at a pressure at least 1.5 times the design pressure.

Penetrations to be used in the boundaries of tanks shall be tested to at least 2.5 times the design pressure of the tank.

#### 1.3.3 Acceptable alternatives.

Pipes to be continuously welded to the division or flanged by non-penetrating boltholes on alternating sides to an insert plate welded into the division (*See figure 5*).



*Fig. 5 Pipe penetration in watertight divisions*



## 2 Pipe penetrations through class B divisions

### 2.1 Type approved pipe penetrations

Type approved pipe penetrations for use in class B rated fire divisions may be installed in compliance with manufacturer's recommendations.

Class A rated penetrations may also be used when properly fixed to the division.

Pipes should pass through the division in the same direction/angle as tested.

Attention should be paid to possible limitations to the Type Approval.

### 2.2 Alternative acceptable pipe penetrations

#### 2.2.1 Penetrations by pipes of material with melting point higher than 850°C.

The pipe should be fitted with a collar on one side of the penetrated division. The collar should be made from the same material as the division and be tight fitting around the pipe (See figure 6).

The collar should have a diameter at least 150 mm larger than the cutout in the penetrated division and be adequately fixed to the division by screws. Joints in the piping should be positioned at least 450 mm from the division on either side to avoid loss of integrity in case of pipe movement and joint separation.

For class B-15/30 divisions, the pipe should be insulated with approved class A-15/30 insulation for 450 mm along the pipe.

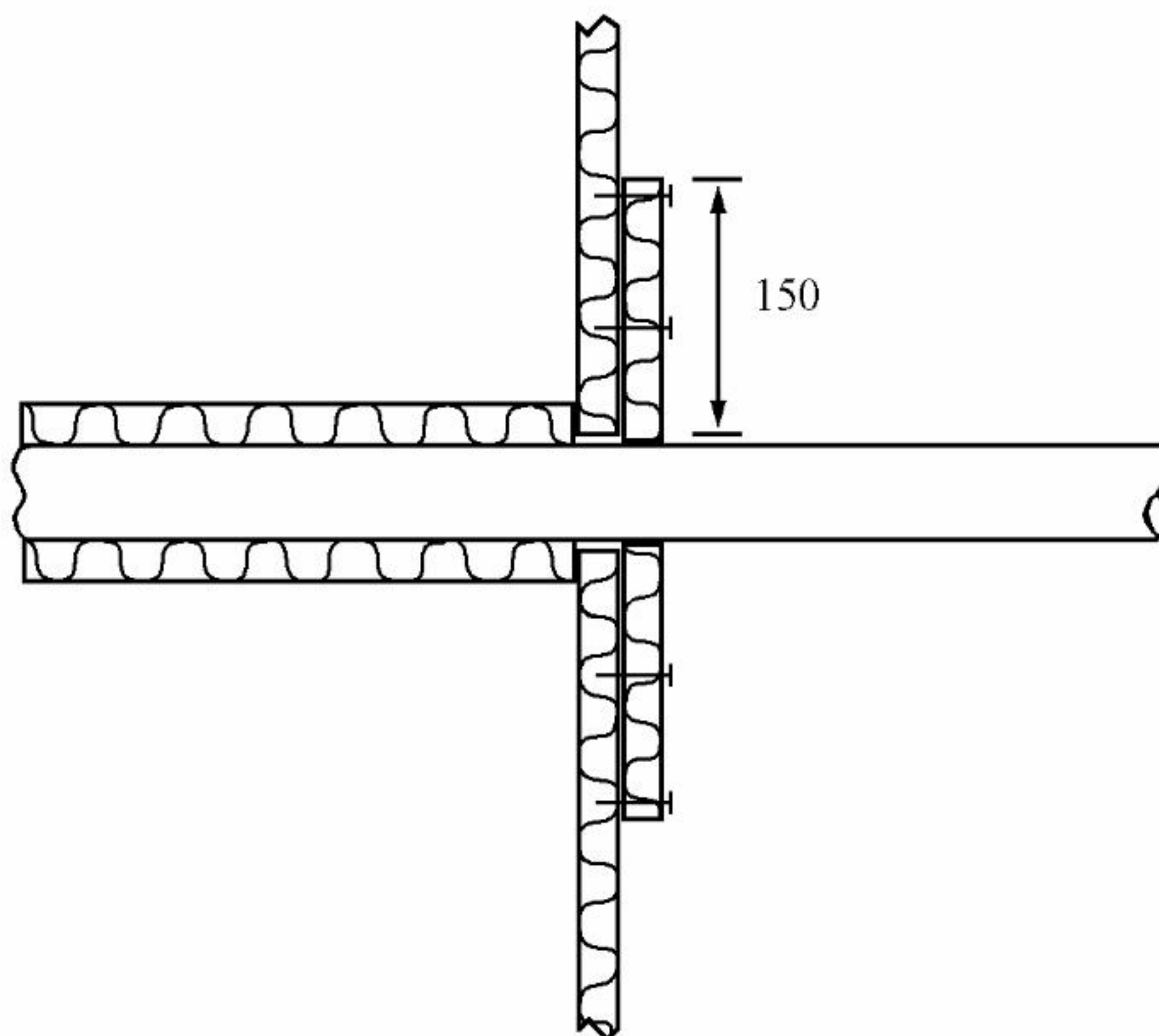


Fig. 6 Pipes with melting point higher than 850°C in class B divisions

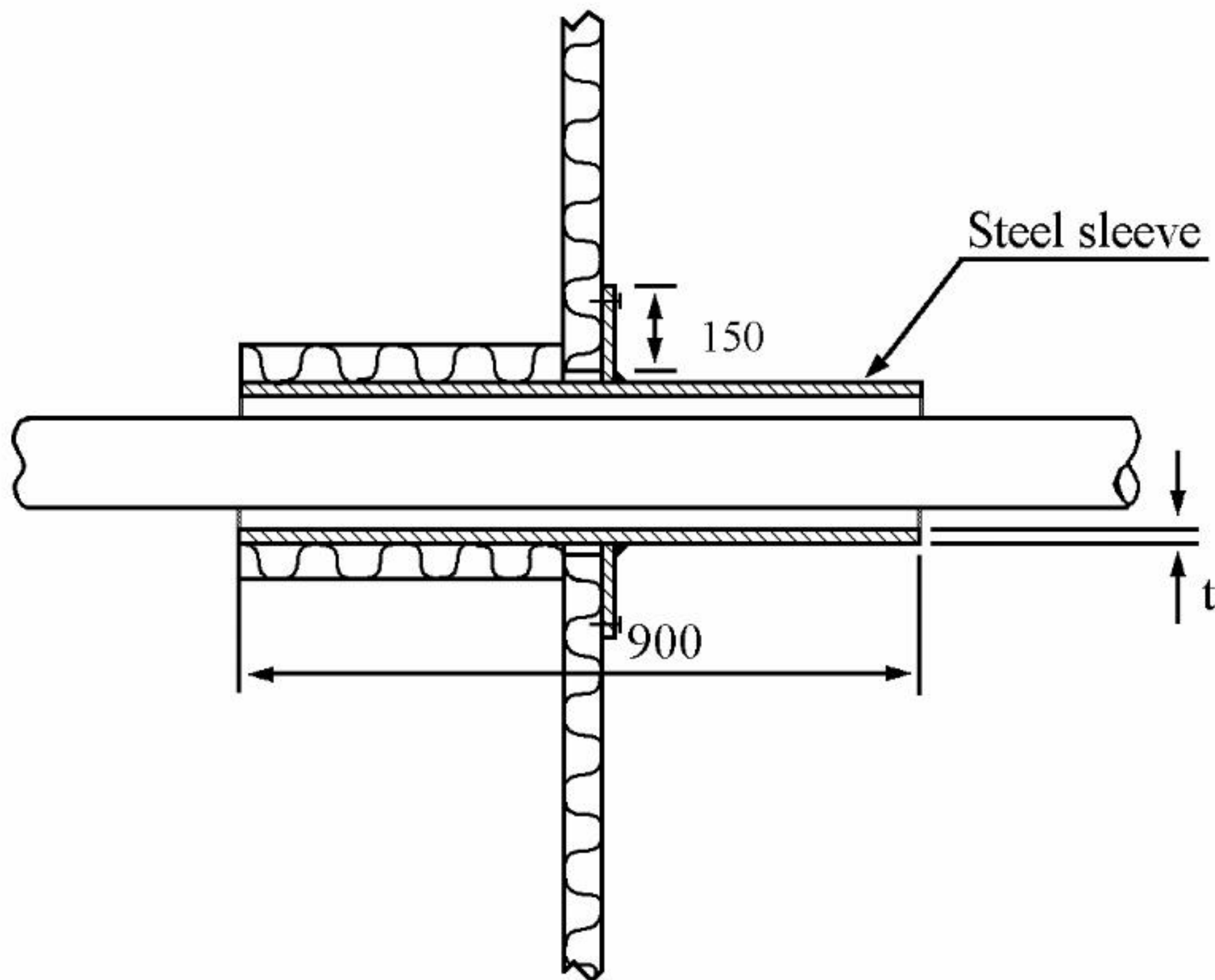


### 2.2.2 Penetrations by pipes of material with melting point lower than 850°C.

These pipes should be passed individually through a steel sleeve of at least 1.8 mm thickness (t) and 600 mm length. Pipes with outer diameter larger than 150 mm should have a sleeve length of at least 900 mm (*See figure 7*).

The sleeve should be tight fitting to the cutout in the division and have a steel collar continuously welded at about mid length. The collar should have a diameter at least 150 mm larger than the cutout in the penetrated division and be adequately fixed to the division by screws.

For class B-15/30 divisions, the sleeve should extend at least 450 mm on the fire-exposed side and be insulated with an approved class A-15/30 insulation for 450 mm along the pipe. Clearance between pipe and sleeve should not exceed 2.5 mm and should be sealed in both ends with a suitable flexible sealant. Non welded piping joints should not be positioned within the sleeve or inside the normally required 450 mm insulation.



*Fig. 7 Pipes with melting point lower than 850°C in class B divisions*