Technical Article

WATER SPRAY / MIST EXTINGUISHING SYSTEM FOR MACHINERY PROTECTION: PARTICLE BOARD PRESSES

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PROTECTION OF CHIP BOARD PRESSES (PARTICLE BOARD PRESSES) AND SIMILAR RISKS

1. Introduction

In the timber / lumber industry presses are used to produce chipboards / particleboards, fibreboards (including Medium Density Fibre boards, MBF) or Oriented Strand Board (OSB).

These presses are very important for the companies because of the capital value of the equipment and the disruption that may be caused by damage to them.

These types of presses are a high fire risk. The fire load is always present, wood or wood chips, glue and hydraulic oil, which are all used by these presses, are all in close proximity. Thermo oil is usually used to heat the press. Hot parts of the press provide an ever-present source of potential ignition.

During the production process it is not possible to avoid particles and occasionally oil depositing on the press, potentially in close proximity to the above-mentioned hot parts. In addition volatile components can evaporate, which may be flammable.

2. Protection requirement

A fire in a press should be extinguished as soon as possible to avoid damage to the press and prevent fire spread. The factory is normally equipped with a sprinkler system. Because of the building height and the construction of the press, effective fire fighting with the sprinkler system is not always possible, which may make it difficult to avoid serious damage to the press.

Early activation is required and the water extinguishing system has to be arranged so that the water can hit the fire directly, cool it and extinguish it rapidly.

To minimise possible damage of hot parts of the press the amount of water should be limited.

3. Fine water spray

In the European Technical specification “Fixed Fire Fighting Systems — Water Mist Systems — Design and Installation” (CEN/TS 14972: 2006, final draft) the following definition is included for water mist:

Water spray for which the diameter Dv0,90 measured in a plane 1 m from the nozzle at its minimum operating pressure is less than 1 mm.

The advantage of fine water spray or water mist is that, using the same amount of water; small droplets have a much bigger total surface area than bigger droplets. Because of the greater surface area of these small droplets the heat transfer from the fire to the water is much greater. The water will be more effectively used if the fine water spray hits the fire. The small droplets will heat and evaporate much faster than bigger droplets. Bigger droplets may go straight past the hot area or hit the ground before they are completely evaporated.

Fine mist is applied to critical equipment fires, where heat absorption and cooling of the fire plume are the primary features, whereas sprinklers with larger droplets are applied to penetrate the fire plume and cool the product in combustion. Small droplets will slow down quite quickly because of their low mass. They also have low momentum and therefore have difficulty penetrating a hot plume to cool the fire. Water mist is applied to special applications, where specific protection of equipment and critical components that can be cooled and the fire extinguished quickly and a return to normal operations can be achieved rapidly. Sprinklers, providing larger droplets, protect large fire properties and large high hazard fires.

Figure 1 shows the heat transfer to 1lt. water depending on droplet size and velocity. The influence of the surface is much higher than the influence of the velocity. For the calculation of the heat transfer, the well-known equations of Reynolds and Prandtl can be used.

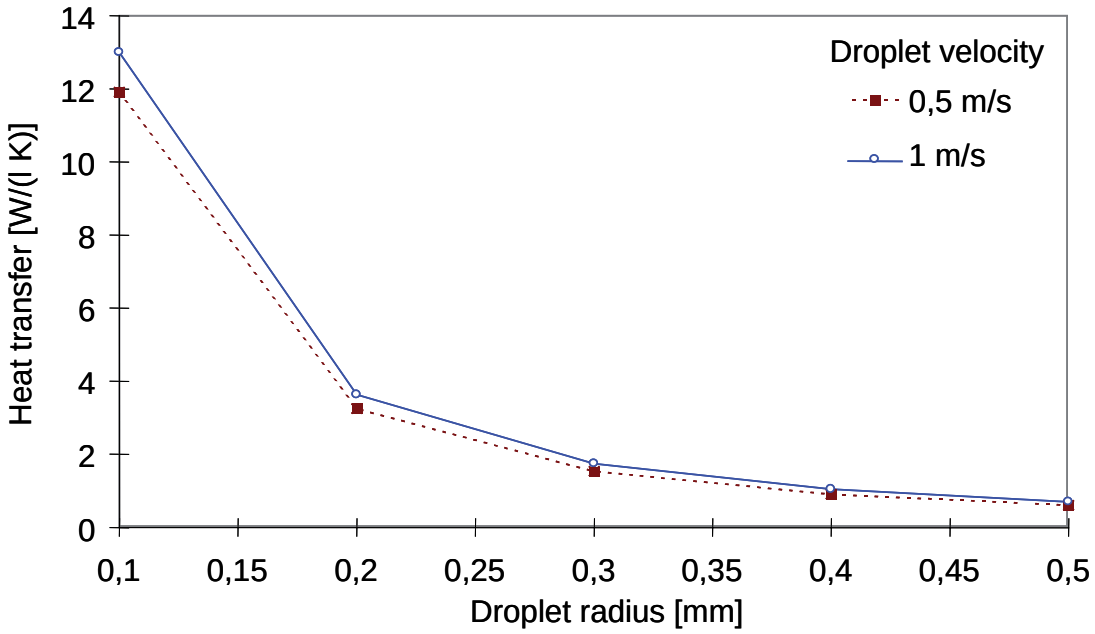

Figure 1: Heat transfer (1lt water at 1 Kelvin temperature difference)

Small droplets will slow down quite quickly and because of the low mass they also have a low momentum. In addition air will be entrained into the spray and velocity of the spray will diminish (see Figure 2).

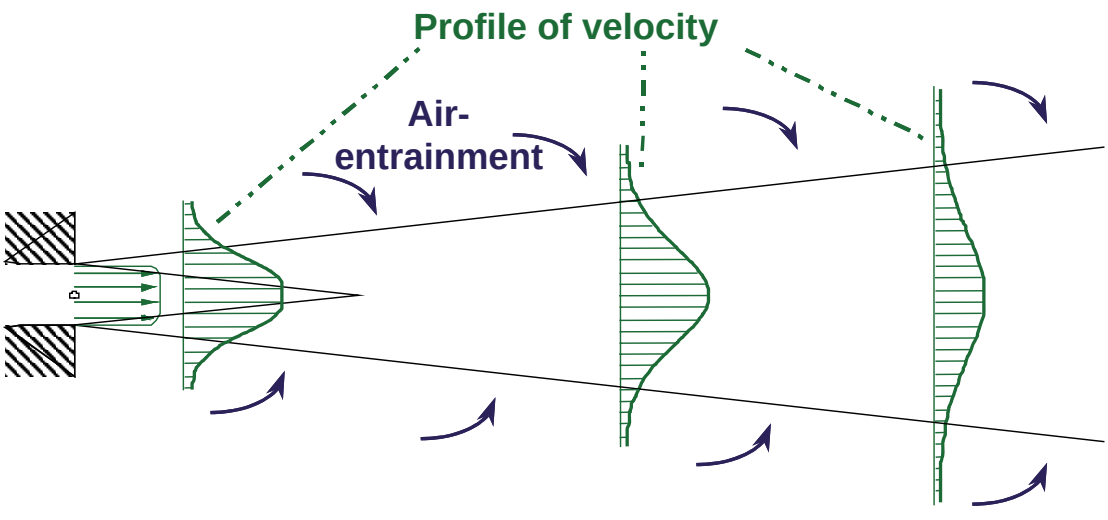

Figure 2: Schematic picture of a spray

As a result the fine water spray can be carried by air current away from the fire plume in a wrong direction. To avoid this situation the nozzles should be installed in such a way that the droplets are able to get to the fire and cover the area, which has to be protected.

4. Approval procedure

For fine water spray and water mist extringuishing systems there are different approval procedures or guidelines. The systems are approved based on fire tests showing the effectiveness in combating the fire and component tests or system tests demonstrating long-term reliability. One basis for the approval is the planning and installation manual from the manufacturer.

The effectiveness of the system for this application has to be shown through a specific fire test.

The German approval body VdS set up a fire test procedure for chipboard presses. The test set up is similar to one frame of a chipboard press.

The fire load is:

- Pan 500 mm × 500 mm × 50 mm; 5 lt diesel with 5 lt wood chips
- Pan 500 mm × 500 mm × 50 mm; 5 lt diesel with 3 lt wood chips
- Pan 500 mm × 500 mm × 50 mm; 5 lt diesel with 3 lt wood chips
- Pan 900 mm × 200 mm × 30 mm; 2 lt diesel on 1 lt water
- Pan 900 mm × 200 mm × 30 mm; 2 lt diesel with 2 lt wood chips
- Insulation mat soaked with 0,5lt diesel

Figure 3 shows the test arrangement:

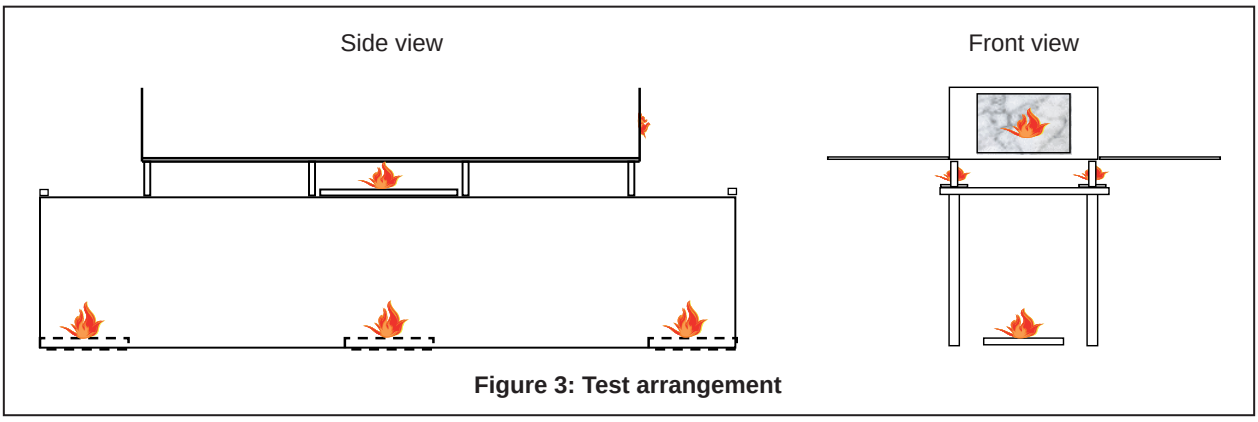

Figure 3: Test arrangement

Figure 4 shows a fire test shortly after activation of the system:

Figure 4: Fire test shortly after activation of the fine water spray system

The test of the nozzle include:

- K-factor test
- Test of the spray angle
- Water distribution tests
- Strength testing
- Different corrosion test
- Heat resistance tests
- Vibration test

After checking the installation manual and testing the components the system will be approved by VdS (see Figure 5).

VdS

Zertifikat

über die

Anerkennung

von

Bauteilen und Systemen

Viking S.A.
Zone Industrielle Haneboesch

LU-4562 Differdange/Niedercorn

Anerkennungs-Nr.	Anzahl der Seiten	Gültig von:	Gültig bis:
G 4060046	4	21.06.2006	20.06.2010

Gegenstand der Anerkennung:
Feinsprühdüse
Model "E" 125° K12

Verwendung:
zum Schutz von Spanplattenpressen

Anerkennungsgrundlagen:
Verfahrensrichtlinien - VdS 2344 (1999-02)

Verfahren für die Anerkennung neuer Löschtechniken
VdS 2562 (06/97) Entwurf

Anforderungen und Prüfmethoden für Feinsprühdüsen
VdS 2498 (Entwurf 11/97)

Köln, den 21. Juni 2006

Schüngel

i. V. Lüttenberg

DAT-ZE 005/92-22

Figure 5: VdS approval certificate

5 Protection concept

5.1 Nozzle arrangement

A. The spray nozzles shall be arranged in such a way that; the fine water spray discharge from the nozzle covers the potential burning surface (see Figure 6),

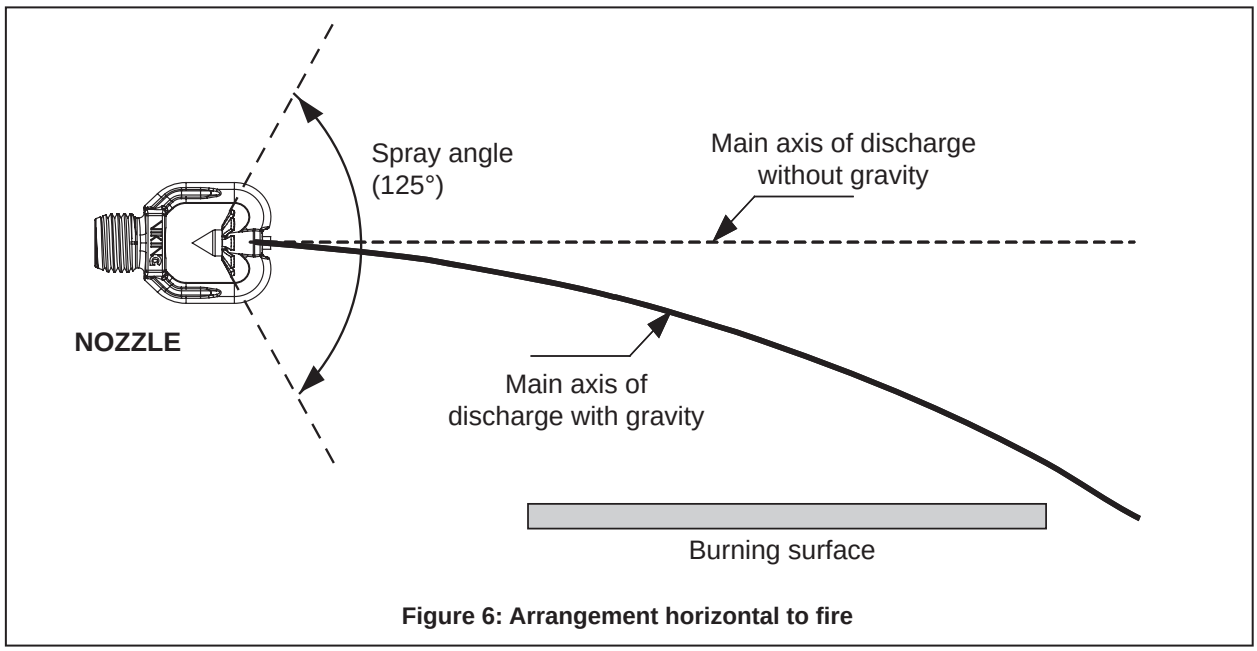

Figure 6: Arrangement horizontal to fire

B. The discharge of adjacent nozzles overlaps as far as possible in a common area to be protected (see Figure 7),

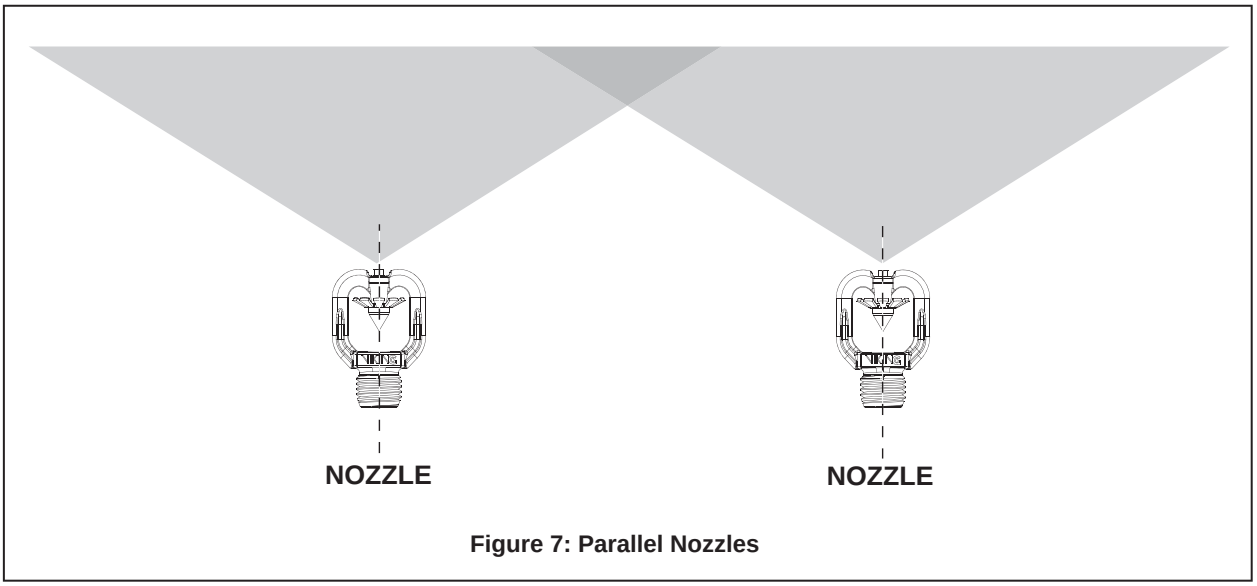

Figure 7: Parallel Nozzles

C. 3-dimensional fire objects are sprayed from as many sides as possible (see Figure 8), if obstructions prevent the spraying of the fire load, additional spray nozzles shall be installed accordingly.

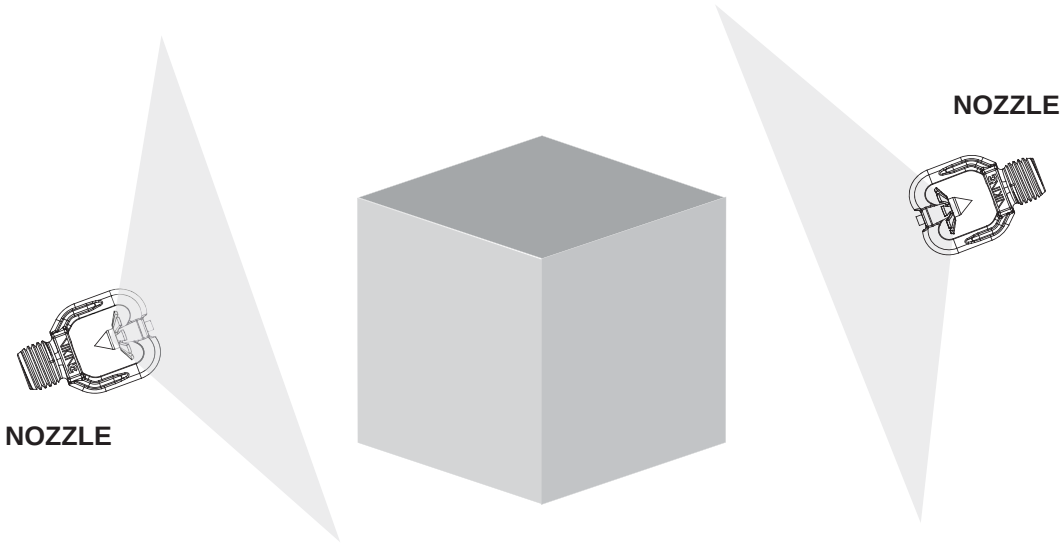

Figure 8: 3-dimensional fire objects

In case of obstructions additional nozzles could be needed to provide the protected area with a sufficient amount of fine water spray.

For chipboard presses the nozzles have to be installed at two levels in each frame of the press. At the press in-feed there should be an additional nozzle installed at the front of the press (see Figure 9). In addition more than two lines of nozzles are needed to protect the mechanics at this part properly.

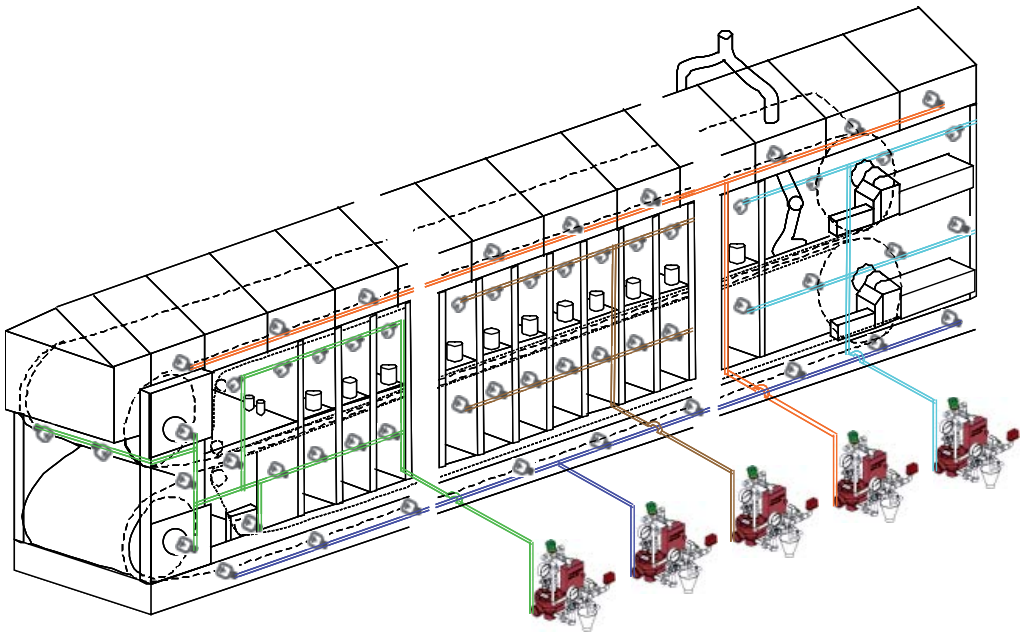

Figure 9: Typical nozzle arrangement (only one side shown)

5.2 Areas of operation

5.2.1 General

Large areas to be protected shall be divided into individual grouped areas of operation. The water supply shall be designed to supply the maximum number of systems within any 5 m radius, excluding any systems, which are separated by a nonflammable fire resisting structure.

5.2.2 Areas to protect at a chipboard press

In the case of a particleboard press, the following five grouped areas of operation shall be planned for:

1. The upper heat duct over the full length.
2. The lower heat tunnel over the full length.
3. The press infeed up to the wipers
4. The part of the press with hydraulic cylinders between the infeed and the runout
5. The press runout

Figure 9 shows the typical areas of operation for a chipboard press.

In the case of long chipboard presses the press between the in-feed and the run-out may be subdivided into different areas of operation.

The water supply shall allow the simultaneous operation of all protected sections in addition to the demand required by other extinguishing systems, such as sprinklers at the ceiling. Moreover, the water supply shall be calculated so that it is possible to operate the two grouped areas of operation with the highest water rate at the same time, in addition to the demand of the sprinkler system at the roof, allowing for a reduced area of operation of 300 m² in accordance with VdS CEA 4001.

5.3 Additional requirements

To limit possible damage to the press the system shall be designed so that the most unfavorable nozzle will deliver water 30 seconds after activation.

The time of operation shall be 30 minutes.

Because the orifice of a fine water spray nozzle is small, clogging has to be avoided by choosing corrosion protected pipes and the installation of strainers. For the pipework, galvanized pipes or material providing better corrosion protection shall be used. The Viking nozzle includes a strainer and shall not protrude into the supply pipe (see Figure 10 on page 10).

An additional basket strainer shall be installed up stream of the deluge valve

To avoid the blockage of the nozzle by dust or dirt, special protective plugs shall be used on each nozzle, which has also to be approved.

The Viking technical datasheet has to be followed for the installation and design.

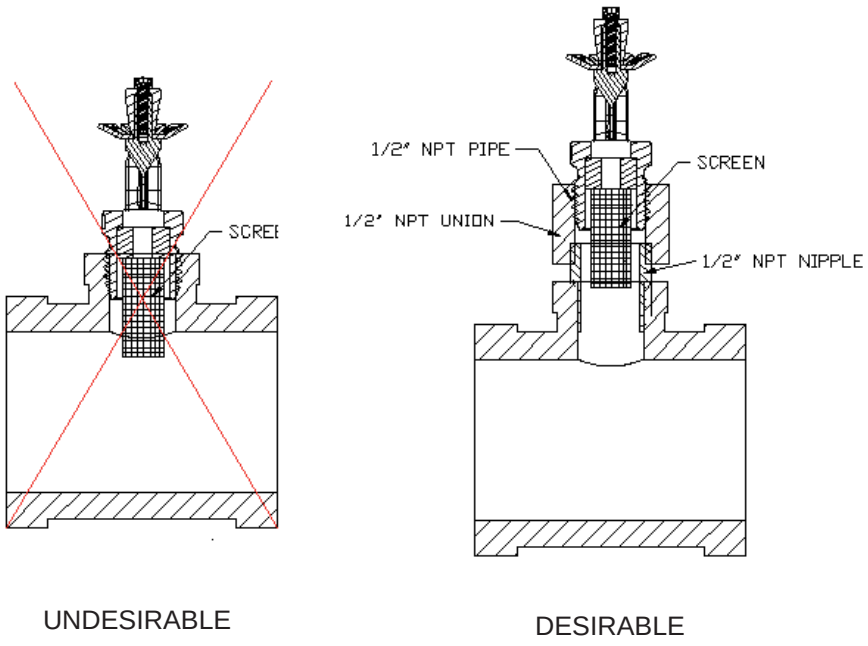

Figure 10: Installation of the nozzle with strainer

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