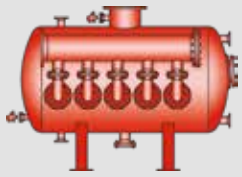
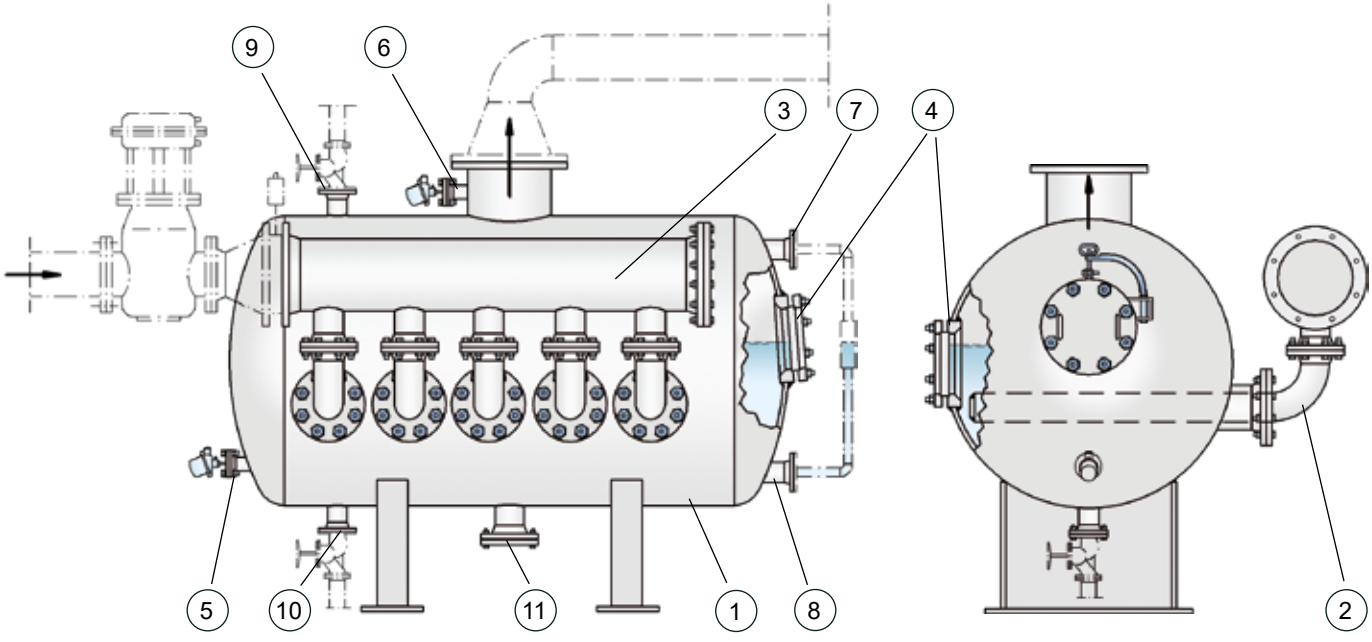


Hydraulic Flame Arresters

Deflagration-proof, detonation-proof and short-time burning-proof

PROTEGO® TS/P, TS/E and TS/W



Function and Description

The PROTEGO® type TS/… series of hydraulic flame arresters are mainly designed to protect process plants which are connected to waste thermal combustion units. Hydraulic flame arresters of the TS/… series are particularly suitable to protect plants which supply heavily contaminated, sticking, polymerizing or even foaming substances into thermal combustion units. Generally, it is necessary to protect the plant against in-line deflagration, stable detonation, and endurance burning hazards, and consider the plant's operating conditions.

The PROTEGO® TS/… series of hydraulic flame arresters guarantees flame transmission protection during short-time burning, deflagration, and stable detonation of gas/air mixtures or product vapor/air mixtures of the relevant explosion groups in all ranges of flammable concentrations with a service temperature of up to +60 °C / 140 °F and an operating pressure up to 1.1 bar / 15 psi (absolute).

Flame arresters of type TS/… are the only hydraulic flame arresters which have been tested and certified for substances of all explosion groups.

Type-approved in accordance with the current ATEX Directive and EN ISO 16852, as well as other international standards.

Hydraulic flame arresters of series TS/… mainly consist of the immersion tank (1) with exhaust air nozzle and connection nozzles for the sparge pipes, the sparge pipes (2) with elbows and connection flanges as well as the manifolds (3) with connection flanges. To allow measurement of the immersion liquid temperature, the tank (1) has a minimum of one nozzle (5) and, for measuring the temperature of the exhaust gas, there is a minimum of one connection for each exhaust air nozzle (6) for inserting temperature sensors. Additionally, the tank has two nozzles (7, 8) for level measurement, two nozzles (9, 10) for level control, and one nozzle (11) for draining. Inspection glasses (4) are included for inspection of the immersion liquid and gas space. The sparge pipes can be pulled out of the hydraulic flame arrester to allow cleaning of the drill holes and pipes. They contain the appropriate flange connections for the supply of exhaust air and, depending on the distribution of the exhaust air flow, the number of nozzles for distribution to the sparge pipes.

In PROTEGO® type TS/… hydraulic flame arresters. the flammable mixtures are passed through a water seal with a defined immersion depth. The mixture flow is divided and supplied evenly to the individual sparge pipes. The sparge pipes have small drill holes, which produce defined bubble columns. In case of an ignition in the flowing gas mixture, the flame is prevented from returning into the inlet line. The following parameters have a significant effect on the flame arresting efficiency of the device in case of deflagrations, detonations, or short-time burning:

- Mixture volume flow
- Immersion depth from the water seal's surface to the upper edges of the drill holes in the sparge pipes,
- Water temperature in the hydraulic flame arrester
- Precise drill hole diameter in the sparge pipes due to size, form, and density of the bubbles

If the mixture ignites under certain operating conditions within the hydraulic flame arrester and burns directly on the liquid surface, prevention of flame transmission can only be guaranteed for a limited amount of time. So, several temperature sensors are installed in the gas space, and, when reaching a specified temperature, they trigger appropriate emergency functions upstream in the connected system (shut down, inerting, etc.).

A high accuracy volume flow meter must be installed as an essential technical safety element. It has to guarantee that the maximum allowable volume flow, on which the design of the hydraulic flame arrester has been based, is recorded and limited so that emergency functions are triggered if the exhaust air volumes exceed the safe level. In addition, a minimum flame transmission-proof immersion height is necessary, i.e. an

adequate water level must be guaranteed by suitable measuring equipment.

The pressure loss of a hydraulic flame arrester at maximum volume flow results from the inlet and outlet losses of approximately 12 to 18 mbar / 4.8 to 7.2 inch W.C. plus the immersion depth, e.g. 350 mm = 35 mbar / 13.8 In = 14.1 inch W.C., so the total is between 47 and 53 mbar / 18.9 and 21.3 inch W.C.

Instrumentation

The efficiency and function of the PROTEGO® TS/… series hydraulic flame arrester requires measurement and control equipment for the filling level, volume flow, and temperature of the system. It is necessary to maintain the minimum operating immersion depth and measure the maximum mixture volume flow, maximum gas temperature, and minimum water temperature. If necessary, automatic emergency functions must be quickly initiated by the MSR technology. The safety devices of the MSR technology must be explosion-protected and approved for zone 0.

MSR technology is not part of the scope of supply.

Maximum Volume Flow

The maximum allowable operating volume flow is calculated by multiplying the number of sparge pipes by the maximum allowable operating volume flow for each sparge pipe at its immersion depth.

In special cases, it may not be necessary to measure the volume flow provided that the volume flow limitation is guaranteed by other components in the system, such as a conveying element and throttle.

Level Measurement and Level Control

The operating immersion depth should be kept constant by a controlled automatic water supply so that the level does not fall below the minimum immersion depth.

Temperature Measurement and Limitation

To prevent endurance burning in the arrester, the exhaust air supply must be stopped automatically when the temperature exceeds T = 80°C / 176 °F at the exhaust air nozzle. Temperature sensors monitor the mixture temperature.

If the water temperature falls below T < 10°C / 50 °F (danger of freezing) or rises above the limiting temperature in the gas space, a quick-acting closing device must close automatically and stop the exhaust air supply.

As an option, temperature sensors can be supplied.

Design Types and Specifications

The hydraulic flame arresters are designated by explosion groups, diameters, and numbers of sparge pipes. They are designed in modules and type tested for the corresponding explosion groups.

For explosion group IIA (NEC group D)
Types TS/P 1000 / 40” or TS/P 2000 / 80”

For explosion group IIB3 (NEC group C)
Types TS/E 1000 / 40” or TS/E 2000 / 80”

For explosion group IIC (NEC group B)
Types TS/W 1000 / 40” or TS/W 2000 / 80”

The number of sparge pipes depends on the design volume

flow.

Example: TS/E-1000-5 is a hydraulic flame arrester for substances of explosion group IIB3 (NEC group C) with a diameter of 1000 mm / 40” and 5 sparge pipes.

Dimensions

Standard diameters of TS/… series hydraulic flame arresters are 1000 mm / 40” and 2000 mm / 80”. Alternatively, diameters from 600 mm / 24” to 3000 mm / 120” are available depending on the exhaust air volume flow. Hydraulic flame arresters with diameters from 2000 mm / 80” and larger have a restriction plate to prevent wave motions in the sparging zone. All outlet and inlet collectors, as well as internal components, are safety-relevant components and, as also with the hydraulic flame arrester, must not be modified in design nor function!

Material Selection

The material selection is determined by the exhaust air process data. Tank designs of steel, stainless steel, coated steel, or steel lined with ECTFE or resin are available depending on the application. The sparge pipes are made of stainless, hastelloy, or plastic.

Flange Connection Type

The standard flange connections are made in accordance with EN 1092-1; Form B1. Alternatively, the connecting flanges can be made in accordance with any international standard.

Selection and Design

The total pressure loss is a result of the static immersion depth and the dynamic flow resistance in the sparge pipes, as well as in the exhaust air supply lines. In any case, the manufacturer’s advice about technical safety is required!

For particularly corrosive mixtures, the hydraulic flame arrester may be coated. The materials of tank, installations, and sparge pipes have to be selected according to the corrosive properties of the mixture.

Data Necessary for Specification

The following operational data is required for the technical safety of the hydraulic flame arrester design:

Exhaust air volume flow, considering the maximum possible volume flow (m³/h or CFH)

Exhaust air composition (vol.%)

Operating temperature (°C or °F)