Fire Fighting System for Local Applications*

— Low Pressure Alternative

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Introduction

New requirements regarding local application fire fighting systems have been introduced by IMO through SOLAS Ch.II-2 Reg.7.7 and IMO MSC/Circular 913 to enhance the safety level in machinery spaces onboard ships. The system should be a fixed water-based or equivalent local application system. This document will describe the features for a low-pressure water system whose fulfils these new requirements.

Design

A fixed local application fire fighting system (LAFFS) using low pressure when spraying water on a protected object, is probably the most simple and reliable alternative. The system can use already installed pumps onboard, share pumps with other traditional systems onboard, or use its own dedicated pump. This is possible as the pressure required on the water spraying nozzles is normally in the range of 4 to 6 bar. This is a pressure where

* 原稿受付 平成16年2月25日
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all ships can provide from almost any pumps onboard. These pumps need only to be supplied by the main power onboard, which makes it even more convenient.

Simple and robust nozzles, easy to understand by the crew without any fancy “propellers” or “deflector pins”, eliminate the possibility of clog-

ging of foreign materials or any rupture in the spraying pattern. The remaining items to get a complete system are the distribution valves, piping and control system, as well as a fire-detection system when applicable. The valves are either manual or remote operated, depending on the classification of the machinery space and are usually supplied as butterfly valve with pressure class PN 10/16. Piping leading to respective protected object/area have the same pressure class as the valves and can be supplied in either black steel or with an internal/external protection dependent on the aggressiveness in the atmosphere. As the system can either use sea- or fresh water as a fire-fighting media, it is recommended to use components where can withstand corrosion. The control system is required to remote operate the pump and valves. In addition, there are locally situated control panels for each protected object to secure a quick release of water to any protected object or area.

The Unitor low-pressure system can also come with a foam additive, which definitely gives an extra safety level. It has through tests shown that spray fires are easier put out and pool fires are absent. The foam alternative can also act as a preventive if oil leakages occur but not ignited yet, by making a

foam blanket and impede a pool fire. The Unitor system comes unassembled, which makes it flexible for installation onboard as the builder can move around the equipment to places where space is sufficient.

The local fire-fighting system from Unitor is tailor-made for combination with our total flooding high-expansion foam system. The control panels for the two systems are carefully designed to operate in a correct manner, not disrupting each other, as could be the case when two different fire-fighting suppliers are chosen. This alternative will give the local fire-fighting the ability of using foam with all its safety features.

The design feature of the low-pressure alternative makes this system easy and understandable.

The Unitor system carries Type Approval for the system from all major classification societies as well as acceptances from numerous national authorities. The system complies and carries a Marine Equipment Directive (MED) approval, which is now mandatory in order to allow such an installation onboard a European Flag vessel (or other countries affiliated the agreement).

Installation

Usually pump, valves and controls are located outside the machinery space (other side of an A-class division) to maintain the safety level of these vital components. In some cases it has been opened up from approval bodies to let pump and distribution valves to be located inside, as long as they are placed on a certain safety distance from the protected object and can withstand the elevated temperatures where could occur in a fire (fire resistance).

It is important that nozzle location is within the limits tested as far as possible. A common practical view must of course be used if physical obstructions are impossible to relocate or remove. The nozzles are usually positioned in a matrix above engines and in straight row above purifiers and

other single burners. A practical installation challenge is for nozzles located above the main engine, as it is required that these nozzles and piping should not be located to prevent operation of overhead hoists or other moving equipment. It is important to choose system solutions where can cope with the large heights which can occur in container, VLCC and gas tankers. Unitor has passed tests up to 16 metres installation height for the nozzles, which will suit all commercial ships.

Inclined nozzle arrangements could be an alternative, but test criteria will certainly be different compared to what the intention of the circular was from the start, and the results should be carefully evaluated as this will result in design that is more complicated and installation critical.

Concerns are also raised whether the problem has only been relocated from the overhead hoist down to lower levels around the main engine top and their platforms. Another concern is the angled spraying of water, which could result in easier ingress of water (spraying from side) in electrical equipment such as control boxes, causing enclosures to be upgraded to at least IP44 or above. Nozzles installed pendent (90° projected on the object) gives a more gentle apply of water from above and is a preferred solution and is in line with IP22 protection standards.

Automatic release of system - Detectors

Basic requirements for the system state that one detector is enough to release the system. There are concerns about such configuration as false alarm or malfunction of one detector may occur, and will result in an unwanted release of water. To avoid this, it is recommended to install a minimum of two detectors. Most common is to use a combination of smoke and flame detectors. Other combinations may be accepted by approval bodies, but has to be agreed upon.

Below guidelines are intended to assist system designers and installers avoid common errors when sitting the detectors. If the detectors are incorrectly sited, the system could fail to activate or the wrong zone could be activated whereas the correct positioning of the detectors will result in the prompt activation of the correct zone of the fixed local application fire fighting system.

The equipment to be protected is as follows :

<u>Equipment</u>	<u>Item</u>
Internal combustion engines	Fuel injectors
Boilers	Burners
Incinerators	Burners
Purifiers	Heaters

The regulations require both flame and smoke detectors to be activated before the system discharges.

Flame detectors

Flame detectors are activated when a flickering infra red source is in front of the detector. The detector is most sensitive along the axis perpendicular to the sensor i.e. directly in front of the window. The directional sensitivity commonly falls by 30% at an angle of 50° to the perpendicular. Using the information it is possible to site detectors so that they cannot 'see' other protected

equipment apart from the specific hazard that it is protecting. When it is not possible to site a detector where equipment from only one zone is visible, a shield must be installed using a simple sheet of metal to restrict the view of the flame detector.

Some shipyards are requesting that up to four flame detectors are to be fitted above main engines to ensure correct activation of the system. The flames are expected to come from the fuel lines, injectors, and heaters. The flames will stay in one position so designers are able to accurately predict the position of the flames. It is not consider necessary for additional flame detectors as the flame detector will detect a very small fire providing it is correctly sited.

Main Engines

In normal fire detection systems, flame detectors are normally sited directly over main engines on the deck head. For local fire fighting systems, this may not be an ideal location as overhead cranes or uptake pipes could obscure the view. The main risk is considered the high-pressure injector hoses

and nozzles. This 'plane of protection' is above the cylinder head but below the top of the injector hoses. A location is required where the detector has a clear view of this area. The best location may be on a bulkhead looking horizontally at the side of the engine.

Generators

Where small generators are sited close to each other it may not be possible to position the flame detector with a view of one generator only so the design may have to be modified to include 2 or 3 small generators in one zone.

Generators and flame detectors Using 1 flame detector to detect fires on all generators

Generators and flame detectors Shields may need to be fitted to restrict view

Boilers

Many LNG vessels use a twin boiler/twin turbine configuration and the boiler burners are to be monitored by the local fire fighting system. The two boiler burner plates face each other looking inboard. The problem with this type of configuration is that the boiler burners cannot easily be monitored by the local detection system because they are so close together. The flame detectors must be fitted with shields to prevent the line of sight 'seeing' the burner window of either boiler.

Incinerators

There are no serious problems with incinerators as this item of equipment is normally situated away from other items being monitored. Positioning the detector to the side of the incinerator.

Purifiers

Purifiers have the same type of problems as generators. It may be difficult to arrange a good view of one set of purifiers only. In this case, can the zone be modified to include all the purifiers ?

Smoke detectors

The first question for designers is " what " direction is the airflow over the equipment ?

The rules require that there is no direct vent onto the engine but there should be an airflow path towards the inlet manifold. The detector(s) should

be sited where the airflow would carry any smoke resulting from a fire at the engine, boiler, purifier, and incinerator. In some cases, it may be quite simple, as there is a ventilation duct and exhaust vent in a closed compartment. In other cases, the airflow may be very turbulent and there is no clear inlet, or outlet arrangement. In these situations, a good design is one where the detectors are positioned around the equipment to be protected to ' catch ' smoke from any direction. Note that in these turbulent airflow environments it is unlikely that smoke will raise straight upwards to the deck head.

Many are asking for additional smoke detectors beyond the class requirement to be fitted around the equipment. This is supported because the smoke response is not as predictable as flame detection :

Main Engines

Fit smoke detectors either side of the engine in the airflow path.

Generators

If the generators are in enclosed spaces the smoke will be contained so positioning is not so crucial. Fit smoke detectors either side of the engine in the airflow path.

Boilers

Boilers will be in open space and knowledge of the airflow direction is needed before detectors can be positioned.

Incinerators

Again, like boilers, it will be in open space and knowledge of the airflow direction is needed before detectors can be positioned

Purifiers

Purifier rooms should be quite straightforward, as any smoke would be contained in the compartment. Place the smoke detectors either side of the centre of the compartment.

Heat Detectors

There are two types of heat detectors. Fixed temperature heat detectors and rate of rise heat detectors. The fixed temperature type indicates the alarm when the temperature rises above a threshold value, typically 60°C or 90°C. The rate of rise detector indicates an alarm when the temperature rises faster than a certain rate, typically 2°C/min. If the temperature is rising more quickly, e.g. 10°C/min or 15°C/min then the alarm is made in a shorter time. A rate of rise detector will also have a set temperature to indicate the alarm irrespective of the rate of temperature increase. The set temperature or static temperature will typically be 60°C or 90°C. Heat detectors are not considered ideal for the fixed local fire fighting system fire detection because the response time of a heat detector is slower than a flame or smoke detector. The purpose of the system is to be a first response system; any delay waiting for a heat detector to rise to the threshold temperature could reduce the effectiveness of the fire fighting system.

The static temperature must be chosen so that the detector alarm temperature is safely above the normal operating temperatures found in the compartment. For example, the engine room may normally be 10 to 15°C above the external temperature. If the vessel is operating in the Middle East during the summer an engine room temperature of 60°C are quite likely. A 60°C setting would create false alarms and a higher setting is required.

We believe that there may be some value using heat detectors where it proves impossible to position smoke detectors effectively.

Operation

For continuously manned machinery spaces there are no requirements to have an automatic operated system. This means if a fire occurs, the system will be manually released from a control panel where pump and valves are operated. It is important that these control panels have the possibility of testing

each and every function of a system, as individual valves or pump. This will make the operation more flexible, both under commissioning and start-up, as well as for regular test operation and service. In addition, there are locally situated control panels for each protected object along the normal access ways or escape routes. Their function is to release the system for a particular zone as soon as a fire has occurred, without using the main control panel outside the machinery space. Above features are all covered in the Unitor system.

For unmanned machinery spaces, there are requirements in addition to above for automatic release of the system if a fire occurs. This is maintained by use of fire-detection equipment specifically designed for the system.

There are certain concerns with regards to spraying water onto the protected object or areas. The main concern is related to the water entering the turbochargers. Precautions may be taken by locate the nozzles as far as possible away from the air intake or use some form of shrouding. Another concern is spraying water on electrical equipment such as cabinets and rotating electrical equipment with low IP ratings. Low-pressure water system has the advantage by utilizing large droplets (around 1000 micron) and low-pressure resulting in less chance of water penetration in equipment. The main concern is related to high-pressure system whose has small droplet size (around 50-200 micron), where it has been found that moisture ingress is much greater in above equipment.

Another factor is that large droplets are not affected in the same way by the air movements from the fans inside machinery space as they are heavier and will hit the targeted object.

To comply with all the requirements in the circular, it has been interpreted to carry out a full-scale water test on a running engine. Results have shown from these tests that low-pressure systems do not interfering with the rotating or the electrical equipment. Engines under test are still performing well after 20 minutes applying of constant spray.

Service and maintenance

For a system supplier, it is of vital importance to design, produce and deliver a long term lasting system, which is easy to install for the builder and easy to understand how to operate and maintain for an end-user. By using basic knowledge of fire fighting and put your in the situation of a builder and an end-user, simple and reliable components should be used to make the safest system. If something needs to be serviced or repaired, the components should be available wherever in the world to not hold back any ships. By choosing Unitor, this is covered and you will get a long lasting relationship with a professional supplier.