



Exploration & Production

GENERAL SPECIFICATION

SAFETY

GS EP SAF 311

Rules for the selection of fire-fighting systems

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1. Scope

1.1 Purpose

The purpose of this General Specification is to determine if an active fire-fighting system is necessary to protect the installation and, if it is, to define the type(s) of active fire-fighting system(s) to be installed and where.

This General Specification is mainly based on an approach where the selection of the type(s) of fire-fighting system(s) is/ are determined by an evaluation of the hazards of the installation.

It shall be used as a guideline for the drafting of the Safety Concept and also, later, during the basic (preliminary) engineering phase.

The main objectives of an active fire-fighting system are:

- to control fires and limit escalation;
- to reduce the effects of a fire to enable personnel to undertake emergency response activities or to evacuate;
- to extinguish the fire where it is considered safe to do so;
- to limit damage to structures and equipment.

It is sometimes necessary to refer to passive fire protection systems in order to ease understanding, however passive fire protection is not addressed in this document (refer to [GS EP SAF 337](#)), which is strictly limited to fire-fighting systems.

1.2 Applicability

This General Specification applies to all hydrocarbons processing or production facilities, both onshore and offshore (fixed and floating), such as:

- Offshore Processing and Production Installations (both fixed and floating) including Risers
- Onshore Hydrocarbon Processing Plants / LPG storage plants – Excluding LNG (*)
- Oil Loading Installations (Jetties)
- Accommodation Block, Evacuation Routes and Muster Area
- Heliport and Helideck
- Manned Technical and Control Rooms
- Unmanned Technical Rooms

(*) For LNG projects refer to [NFPA 59A](#).

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.



Standards

Reference	Title
ISO 13702:1999	Petroleum and Natural Gas Industries - Control and Mitigation of Fires and Explosion on Offshore Production Installations – Requirements and Guidelines

Professional Documents

Reference	Title
API RP 14G:2007	Recommended Practice for Fire Prevention and Control on Fixed Open-type Offshore Production Platforms
API Publ 2510A	Fire Protection considerations for the Design and Operation of Liquefied Petroleum Gas (LPG) Storage Facilities – second edition
API RP 2001	Fire Protection in Refineries – eighth edition
API STD 2510	Design and construction of LPG Installations – eighth edition
IMO SOLAS	International Convention for the Safety Of Life At Sea (SOLAS), 1974 and subsequent amendments
IP 15	Area Classification Code for Installations Handling Flammable Fluids: Part 15 of the IP Model Code of Safe Practice in the Petroleum Industry, third edition, July 2005
ISGOTT	International Safety Guide for Oil Tankers and Terminals, fifth edition (OCIMF)
NFPA 10	Standard for Portable Extinguishers
NFPA 11	Standard for Low-, Medium-, and High-Expansion Foam
NFPA 12	Standards on Carbon Dioxide Extinguishing Systems
NFPA 13	Standard for the Installation of Sprinkler Systems
NFPA 15	Standard for Water Spray Fixed Systems for Fire Protection
NFPA 16	Standard for the Installation of Foam - Water Sprinkler and Foam-Water Spray Systems
NFPA 17	Standard for Dry Chemical Extinguishing Systems
NFPA 24	Standards for the Installation of Private Fire Service Mains and their Appurtenances
NFPA 59A	Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)
NFPA 750	Standard on Water Mist Fire Protection Systems

Regulations

Reference	Title
Regulation EC No 842/2006	Regulation EC No 842 of the European Parliament and of the Council of 17 May 2006 on certain fluorinated greenhouse gases

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP MEC 290	Rotating machines packages
GS EP SAF 227	Safety rules for fired heaters
GS EP SAF 261	Emergency Shut-Down and Emergency De-Pressurisation (ESD & EDP)
GS EP SAF 321	Fire pump stations and fire water mains
GS EP SAF 322	Fixed fire water systems
GS EP SAF 331	Carbon dioxide fire extinguishing systems
GS EP SAF 332	Water mist and gaseous fixed fire extinguishing systems
GS EP SAF 334	Foam fire extinguishing systems
GS EP SAF 337	Passive fire protection: Basis of design
GS EP SAF 341	Location and protection of onshore hydrocarbon storage
GS EP SAF 351	Escape, evacuation and rescue from fixed installations

3. Terms and definitions

There are three types of statements in this General Specification: “shall”, “should” and “may”. They shall be understood as follows:

- Shall** Is to be understood as mandatory. Any deviation from a "shall" statement requires a derogation approved by the COMPANY.
- Should** Is to be understood as strongly recommended to comply with the requirements of the specification. Alternatives shall provide a similar level of protection and this shall be documented.
- May** Is used where alternatives are equally acceptable.

For the purpose of this document only, the following terms and definitions apply.

- Enclosed area** Any building room or enclosed space within which, in the absence of failure of artificial ventilation, the ventilation is not sufficient to avoid persistence of flammable atmosphere within the area (COMPANY from [IP 15](#)).
- Fixed fire water system** Fixed system (by opposition to "mobile" or "portable") such as deluge, water curtain, monitor, hydrant, etc. installed for active protection in case of fire and supplied by a specific fire water network, with pumping set and sufficient quantity of water (water storage or inexhaustible supply) (COMPANY).
- Isolated (remote) room** Room where personnel are not normally present and where access time for intervention would take more than 5 minutes (COMPANY).

These definitions for rooms can be summarized as follows:

Personnel presence	Time to access	
	≤ 5 minutes	> 5 minutes
No routine requirement	Unmanned	Isolated
Routine checks ▫ once per day or ▫ once per shift	Not permanently manned	Isolated
Permanent occupancy ▫ 50 % of total time per day or ▫ 25% of total time per week	Permanently manned	NA

- Manned/Permanently manned installation** (or platform) Installation on which people are routinely accommodated or which is occupied continuously during normal operations (COMPANY from [ISO 13702:1999](#)).
- Not permanently manned installation** (or platform) Installation that is not manned all the time, but that is frequently visited during normal operations. It shall have facilities to support planned overnight stays. As a guideline, personnel are routinely accommodated for less than 12 hours per day, or less than 40 hours per week (COMPANY).
- Not permanently manned room** Room which does not require the presence of personnel for normal operations, but where entrance for maintenance or control activities

	is frequent (e.g. switch-room, instrument room). The access is limited to qualified personnel and it is recognized that the intervention is quick (less than 5 minutes) in case of fire alarm (COMPANY).
Open area	Open air situation where vapours are readily dispersed (COMPANY from IP 15).
Permanently manned room	Room which is continuously manned or where personnel are present most of the time, e.g. control room, radio room (COMPANY).
Sheltered or obstructed area	An area within or adjoining an open area (which may include a partially open building or structure) where, owing to obstruction, natural ventilation is restricted and less than in a true open area (IP 15).
Unmanned installation (or platform)	Unmanned installations or normally unattended installations are not manned on a 24-hour basis although they can be frequently visited. No facilities are provided for planned overnight stays, although emergency facilities are provided for personnel stuck overnight due to unforeseen circumstances (COMPANY).
Unmanned room (or enclosure)	Room (or enclosure) where personnel are not normally present and could not enter (except with difficulty) in case of fire, e.g. diesel engine or turbine enclosure (COMPANY).

4. General principles

Since there are three essentials for the occurrence of fire: fuel, air (Oxygen) and a source of ignition, fire prevention procedures mainly involve identification and elimination or separation of these 3 essentials.

Fuels may then be conveniently grouped as per the type of fire they create on the basis of the materials which are burning or which have the potential to burn.

To facilitate the proper use of extinguishers on different types of fires, the National Fire Protection Association (NFPA) has classified fires as follows.

4.1 Fire Classes

Class A: fires in ordinary combustible materials, such as wood, cloth, paper, rubber and many plastics.

Examples of such materials commonly found on offshore platforms are the following:

- Construction materials and supplies: wood decking, framework, and skids; shipping containers and fibre ropes.
- Operational materials and supplies: cleaning rags and tarpaulins.
- Waste materials: used paper and rags.

Class B: fires in flammable liquids, gases, and greases.

Examples of such materials commonly found on offshore platforms are the following:

- Produced fluids: oils and condensates, gases and vapours, residues from produced or stored hydrocarbons.
- Construction materials and supplies: paints, welding and cutting gases.
- Operational materials and supplies: heat transfer fluids, glycols, hydraulic fluids, lubricants, and fuels.
- Miscellaneous: cleaning compounds and cooking oils and greases.

Class C (Class E in the UK): fires that involve energized electrical equipment. In this situation, electrical non-conductivity of the extinguishing agent is of importance. When electrical equipment is de-energized, the fire becomes Class A or B.

Class D: fires of combustible metals, such as Magnesium, Zirconium, Sodium and Potassium.

Class K (Class F in the UK): fires in cooking appliances that involve combustible cooking media (vegetal or animal oils and fats).

Class D fires are beyond the scope of the present specification.

4.2 Fire-fighting systems

4.2.1 Water

Water is an excellent fire suppression agent due to its high specific heat and high latent heat of vaporization. It has no effect on the ozone layer or global warming.

Water is used to fight Class A fires or to control Class B fires: its mechanism is to cool fire below the ignition temperature. The different application methods in offshore and onshore facilities are:

- fire main (hoses and monitors),
- deluge,
- sprinklers,
- hand portable appliances.

The advantage of water is a rapid cooling and unlimited supply in offshore installations.

The main disadvantages are that:

- the system maintenance requirements are high (it requires 2 or more people to properly manage hoses);
- there is risk of equipment corrosion;
- there is risk of freezing.

Fire water systems are installed in offshore installations to provide exposure protection, control of burning, and/or extinguishment (with foam addition) of fires. The system design shall be based on good engineering principles and may include coverage of platform equipment such as compressors, glycol regenerators, storage facilities, shipping and process pumps, wellheads, etc.

The fire water pumping rate should be sufficient to perform all functions required by the fire control design.

Fixed fire water systems (with the exception of fresh water mist) are not required for hydrocarbon handling equipment and associated drivers installed in enclosed areas (compressors, turbine package, etc.).

Water shall not be used on electric fires (because of conductivity), LPG or LNG fires (because it would accelerate vaporization) and in some parts of the world where cold climatic conditions prevail. Special precautions shall be taken when water is used on hydrocarbon fires because the difference of density can produce an extension of the initial hazard.

Water is not efficient against jet-fire, but water deluge is used to cool down equipment containing hydrocarbons and piping. Water shall not be used on flammable liquid fires, as it is likely to cause additional hazards (extension of initial fire, boil over or froth over on hydrocarbon fires).

For further details refer to [GS EP SAF 321](#) and [GS EP SAF 322](#).

4.2.2 Foam

Foam is used to fight Class A and B fires.

Fire in liquids hydrocarbons shall be extinguished by foam application.

Foam extinguishes flammable liquids fires by forming a floating blanket on the burning liquid surface: this prevents the liquid from forming combustible vapours (in a flammable liquid only the vapours actually burn).

The advantage of foam is that it is an excellent re-flash protection when containment integrity is maintained.

The main disadvantages are that:

- it requires water for application;
- premixed volumes shall be periodically tested and replaced;
- there is risk of freezing;
- there is risk of foam degradation by heat (foam storage shall be protected from sun radiation or shall be insulated).

Foam can be applied from a foam- or water/foam- monitor (dual tube system), foam chambers, by external mobile fire-fighting equipment (fire truck, fire-fighting boat, etc.) or through fixed standard foam-water sprinkler systems (for CAF for instance).

The CAF (Compressed Air Foam) is a homogenous foam produced by the combination of water, foam concentrate, and air or Nitrogen under pressure.

Reference is made to amendments of the [NFPA 11](#), for the design, installation, operation, testing and maintenance of CAF systems.

The compatibility of foam and combustible materials shall be checked before use. It shall also be ensured that sufficient foam quantity is available to cover the entire area of a pool fire at one go; otherwise the partial foam blanket is destroyed by heat and the fire is out of control.

Foam application shall be limited on hydrocarbon and polar solvent pool fires or for isolating hydrocarbons from air.

Foam systems are not effective on gas pressure fires. Fire-fighting foam shall not be used to extinguish LPG jet fires. High-expansion foam can be used on LNG pool to limit evaporation.

Fire-fighting foam shall not be used to extinguish LPG fires: the effective use of foam is questionable because the applied foam may be a source of heat and may promote LPG vaporization from the refrigerated pool (see [API STD 2510](#)).

Typical uses of foam systems are protection of retention areas, injection inside storage tanks, application on the rim of floating roof storage tanks and total flooding of sheltered areas (not considered as fully open) with oil processing equipment inside (e.g. oil shipping pump building).

On FPSOs, foam shall be provided for:

- deluge systems, monitors and hydrants serving process areas;
- deluge systems, monitors and hydrants serving the hull deck (i.e. top of the tanks);
- hydrants where liquid pool fires can be anticipated;
- monitors in diesel and methanol loading areas;
- foam system for the helideck monitors;
- foam/ water monitors to cover the forward and aft mooring lines in case of a spread moored FPSO;
- fixed foam/water deluge system and/or foam/water monitors to cover the moon-pool and gantry areas in case of a turret moored FPSO.

For further details refer to [GS EP SAF 334](#) (foam systems design shall be in accordance with [GS EP SAF 334](#)) and [GS EP SAF 341](#).

4.2.3 Gaseous systems

Gaseous agents are especially suitable for Class C fires because they are electrically non-conductive and are also suitable for fires involving flammable liquids and other special hazards where water is undesirable.

CO₂ and halogenated hydrocarbons have been commonly used in fire-extinguishing systems. Halogenated hydrocarbons are being phased out due to environmental concerns and should not be used in new applications.

In enclosed areas of a relatively small volume such as gas turbines, diesel or gas engine enclosures, technical rooms, etc., fire extinguishing shall be achieved by inert gas injection into the premise or into the equipment itself if it is suitable to do so (e.g. electrical cabinet).

Automatic discharge of gaseous extinguishing agents shall be inhibited when personnel are in an area, if there is a likelihood of harm to the personnel as a result of the discharge.

Means of initiating the systems shall be readily accessible and simple to operate.

Where systems are arranged for remote and/or automatic release, they should be installed so as to be manually operated with manual release points located at strategic locations, generally at the control valves and the entries to the protected space.

When using CO₂ and/or other gases in places where there is a possibility that personnel get stuck in or enter into atmospheres that became hazardous by their discharge, suitable safeguards should be provided to:

- ensure prompt evacuation of personnel,