



Document No.	GP 52-20
Applicability	Group
Date	12 December 2005

Guidance on Practice for Passive Fire Protection (PFP)

GP 52-20

**BP GROUP
ENGINEERING TECHNICAL PRACTICES**

Foreword

This is the first issue of Engineering Technical Practice (ETP) BP GP 52-20. This Guidance on Practice (GP) is based on parts of heritage documents from the merged BP companies as follows:

BP

RP 24-1 Fire Protection – Onshore.

Amoco

A NM-F-00-E Non-metallic Materials—Fireproofing—Engineering Specification.
PTA NM-F-00-G Non-metallic Materials—Fireproofing—Guide.
PTA NM-F-00-E Non-metallic Materials—Fireproofing—Engineering Specification.

Arco

Standard 803. Rev 3 Fireproofing.

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1. Scope

- a. This GP defines minimum technical requirements for selection of materials, methods, and designation of passive fireproofing of structures, piping, equipment, and control systems.
- b. This GP does not cover fireproofing of buildings.

2. Normative references

The following normative documents contain requirements that, through reference in this text, constitute requirements of this technical practice. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this technical practice are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

BP

GP 06-60	Guidance on Practice for Onshore and Offshore Paints and Coatings
GP 44-80	Guidance on Practice for Design Guidelines for Relief Disposal Systems
GIS 52-201	Guidance on Industry Standard for Installation of Passive Fire Protection (PFP).
GP 52-10	Guidance on Practice for Insulation.
BP Group Fire booklet series;	Passive fire protection: types and applications (Jan 2004) Link to Booklet

American Petroleum Industry (API)

API 2218	Fireproofing Practices in Petroleum and Petrochemical Processing Plants.
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British Standards Institute (BSI)

BS 5950: Part 8	Structural use of steelwork in building: Code of practice for fire resistant design.
BS 8110: Part 1	Structural use of concrete.

National Fire Protection Association (NFPA)

NFPA 30	Flammable and Combustible Liquids Code.
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Underwriters Laboratories (UL)

UL 1709	Fire Resistance Directory Volume 1.
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3. Symbols and abbreviations

For the purpose of this GP, the following symbols and abbreviations apply:

ESD	Emergency shutdown.
FRA	Fire risk analysis.
MI	Mineral wool insulated.
OSBL	Outside battery limits.



P&ID	Piping and instrumentation diagram.
PFP	Passive fire protection.

4. General

- a. Fireproofing shall be used to provide primary protection of:
 1. Structures directly or indirectly supporting significant hydrocarbon inventories or emergency systems.
 2. Structures supporting heavy loads that, if they were to fail, would lead to significant hydrocarbon release, catastrophic failure, or loss or damage to control centre or emergency system.
 3. Class 0 hydrocarbon storage vessels or other plant that could fail catastrophically or lead to further significant releases.
- b. Fireproofing may be applied to critical equipment and structures to protect investment and production.
- c. Fireproofing extent, material type, and configuration shall be specified by:
 1. Defining extent of fireproofing for structural steel and equipment support on fireproofing plans consisting of plot plan and elevation drawings.
 2. Detailing member fireproofing requirements on structural steel design drawings.
 3. Detailing equipment support fireproofing on equipment drawings.
 4. Specifying materials and installation methods within GIS 52-201.
- d. References to flammable or combustible liquids shall comply with NFPA 30.

Decision to use fireproofing and what areas to fireproof in facility is made by BP based on full assessment of particular processing facility. Once area to be fireproofed has been defined by BP, designers can complete details based on this GP.

API 2218 as recommended practice for fireproofing in petrochemical industry was withdrawn by API in 1995. Commentary in this GP is consistent with API 2218 and is conservative. Lesser degrees of fireproofing may be acceptable depending on relative risks involved and may represent significant savings in fireproofing cost. Recommendations for reasonable reductions in fireproofing are encouraged and will be evaluated by BP.

5. Criteria

- a. Decision to fireproof and extent of fireproofing at facility shall involve assessment of risk to personnel and equipment in case of fire.

Intent of fireproofing is to:

- *Permit emergency shutdown of unit.*
- *Restrict addition of fuel to fire.*
- *Protect personnel and major equipment from effects of support failure or rupture during fire.*

This GP, along with consultation with local facility operations and safety personnel, should be used to:

- *Define areas as low, medium, or high fire potential.*



- Determine areas to be fireproofed and special consideration of extent.

Other resources for determining fireproofing needs are risk management and insurance personnel.

Once decision has been made to fireproof, definition of low, medium, high fire potential areas, special considerations of extent of fireproofing as defined later in this GP, and preference for fireproofing installation materials and methods should be passed on to Vendors performing fireproofing design.

b. The following shall be obtained from BP:

1. Areas of medium fire potential where structures shall be fireproofed in accordance with this GP.

Medium fire potential areas should be defined as areas within facilities in which flammable or combustible liquids are likely to pool and have potential ignition source.

Size of pool area should be defined based on source volume, potential leak rate and pressure, surface drainage area and capacity of drainage system, fuel burning rate, and heat of combustion.

2. Areas of high fire potential where additional equipment shall be fireproofed in accordance with this GP.

High fire potential areas should be, but are not limited to, areas within 6 m (20 ft) of equipment defined as follows:

- *Fired heaters that charge liquid or mixed phase flammable or combustible liquids under the following conditions:*
 - *Operation at temperature and flow rates capable of causing coking within tubes.*
 - *Operation at pressures and flow rates high enough to cause large spills before heater can be shut in.*
 - *Charging of flammable or combustible liquids that are potentially corrosive.*
 - *Incorporation of high level of automation and complex peripheral equipment, such as combustion air preheaters.*
- *Pumps operating at high enough pressure or flow rate that upon seal failure may accumulate pool or spray adjacent equipment handling flammable or combustible liquids above their flash (at atmospheric conditions) or auto ignition point.*
- *Reactors that operate at high pressure or are likely to produce exothermic reactions.*
- *Compressors and seal oil systems with potential prolonged release of flammable materials.*

3. Emergency shutdown equipment or control systems that require fireproofing in accordance with this GP.

Control systems should be reviewed in BP approved hazards analysis to identify equipment that would need to operate during emergency shutdown to isolate facility. Such equipment and its control wiring should be identified to fireproofing designer.

4. Definition of process areas and outside battery limits (OSBL).

Low fire potential areas are areas where leakage of significant quantities of pooling hydrocarbons from equipment or piping is unlikely or areas where only non-flammable liquids are handled. These areas need not be fireproofed.



In refineries and chemical plants, process facilities that have medium fire potential should have structures fireproofed because these facilities cannot usually be evacuated.

Facilities handling gaseous materials only may not require fireproofing.

In production sector, decision to fireproof is based on location fire fighting philosophy, ability to evacuate personnel, risk to personnel and public, and evaluation of other fire protection options. Most common fire fighting philosophy is to fight only incipient fires. In event of major fire, facility is shut down and abandoned. Under this philosophy, fireproofing is normally only used on emergency shutdown equipment.

6. Extent of fireproofing

6.1. General

6.1.1. Passive fire protection range

- a. Passive fire protection (PFP) may be used to protect plant, equipment, and structures against radiant heat or flame impingement from fires.
- b. BP PFP booklet can be used in conjunction with this GP.
- c. In all cases, guidance may be subject to results of site specific fire scenario analysis.
- d. This GP specifically addresses PFP against effects of pool fires. Jet fires or vapour cloud explosion scenarios have special considerations. In such cases, BP group technology fire advisor should be contacted.

6.1.2. Fireproofing of structures

- a. Fireproofing shall extend 10,7 m (35 ft) above base of potential fire.
- b. Fireproofing of pipe supports, if required, shall:
 1. Extend up to and include first pipe support bank.
 2. Include both columns and pipe support beams.
- c. Spandrel beams need not be fireproofed.
- d. In addition to ground level, horizontal surfaces that can accumulate flammable liquids shall be identified and reviewed for consideration as fire base.

6.1.3. Fireproofing of equipment

- a. Equipment containing flammable or combustible liquids located in upper levels of structures shall be identified and reviewed for consideration as fire base.
- b. Structures for air coolers more than 10,7 m (35 ft) above base of potential fire shall be reviewed for potential fireproofing.
- c. Fireproofing for storage vessels shall ensure that through predicted duration of fire:
 1. Carbon steel plate sections in vessel vapour space:
 - a) Of non-pressurised storage vessels do not exceed 593°C (1100°F).
 - b) Of pressurised storage vessels do not exceed 400°C (750°F).
 2. Alloy plate sections in vessel vapour space shall have appropriate maximum temperature established.
- d. Fireproofing for structural columns and beams shall ensure that permitted deflections in BS 5950: Part 8 are not exceeded through predicted duration of fire.



- e. Hydrocarbon and non hydrocarbon areas
 1. In hydrocarbon areas, fire resistance ratings for jet or engulfment fires or radiative heat shall be determined by internationally approved high intensity hydrocarbon test.
 2. In non hydrocarbon areas, fire resistance rating may be selected from standard time versus temperature test programme.

6.2. Structures

6.2.1. General

- a. Structural members supporting equipment and piping in areas identified as medium or high fire potential shall have fireproofing.

Generally, all structures supporting equipment in medium and high fire potential areas designated for fireproofing should be fireproofed. Minor piping supports may not require fireproofing as determined in fireproofing review.

Structures not supporting piping and equipment or supporting piping or equipment that would not contribute fuel to fire and contain non toxic material need not be fireproofed, even in high or medium fire potential areas. Before deciding not to fireproof, consequences should be considered of these structures falling on adjacent equipment and causing damage that would contribute to fire or compromise fire fighting efforts.

Fireproofing for structures supporting equipment is normally installed to 10,7 m (35 ft) above fire source. Fireproofing for pipe racks is normally installed up to and including first pipe support bank including both columns and beams but not spandrels.

Issues that should be considered when deciding extent of fireproofing include:

- *Extending fireproofing to load bearing level of major pieces of equipment (reactors, vessels, exchanges) in multilevel structures regardless of height.*
- *Including pipe rack fireproofing to full load bearing height if such structures support air coolers containing hydrocarbons that are located above medium or high fire potential areas. This is due to induction of fire envelope by fan.*

- b. If predicted fire duration in hydrocarbon areas is greater than 10 min, structures and equipment outside flame but exposed to high radiation levels may require PFP.

6.2.2. Concrete structures

- a. Unless specified otherwise, reinforced concrete structures should not normally require fireproofing.
- b. Prestressed concrete structures in fire exposed areas should be fireproofed to prevent relaxation.
- c. Reinforced and pre-stressed concrete members shall be designed in accordance with BS 8110: Part 1 or agreed upon equivalent.

6.2.3. Steel structures

6.2.3.1. General

- a. 6.2.3.2 through 6.2.3.7 are guidance for application of PFP to steel structures but may be subject to results of fire scenario analysis.
- b. In medium or high fire potential areas, the following equipment shall have fireproofing:

