

Group Practice



GP 58-10

Above Ground Welded Steel Atmospheric Storage Tanks

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Foreword

This is the first issue of Engineering Technical Practice (ETP) GP 58-10. This Group Practice (GP) is based on parts of heritage documents from the merged BP companies as follows:

British Petroleum

RP 58-1	Non-refrigerated Petroleum and Petrochemical Storage.
GS 158-1	Internal Floating Decks for Storage Tanks.
GS 158-2	Vertical Storage Tanks for Non-refrigerated Liquids.

Amoco

A FE-TK-00-E	Fabricated Equipment - Tanks - Engineering Specification.
A FE-TK-650B-P	Fabricated Equipment - Tanks - API 650, Appendix B, Foundation Procurement Specification.
A FE-TK-650E-P	Fabricated Equipment - Tanks - API 650, Appendix E, Seismic Design Procurement Specification.
A FE-TK-650H-P	Fabricated Equipment - Tanks - API 650, Appendix H, Internal Floating Roofs-Procurement Specification.

ARCO

ES 900-97	Welded Oil Storage Tanks.
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1. Scope

- a. This GP provides requirements and guidance for field erected above ground vertical cylindrical welded steel atmospheric storage tanks within the scope of the referenced design codes.

The operational safety and integrity of bulk storage tanks is a significant contributor to BP major accident risk exposure, especially environmental. While management of some of this risk derives from operational and maintenance practices, the application of the principles of inherently safer design, coupled with application of BP and industry learnings related to design, can make a significant contribution to risk reduction at source. This GP describes BP policies for design of tanks within its scope to achieve this objective.

- b. The following types of tanks are outside the scope of this GP:
1. Storage tanks for refrigerated or cryogenic liquid service.
 2. Underground or in ground storage tanks.
 3. Spheres and spheroids.
 4. Rectangular steel tanks.
 5. Bolted and riveted tanks.
- c. Requirements for the following storage tank design aspects are outside the scope of this GP:
1. Tank layout and bunding (GP 44-10 is applicable).
 2. Foundations (GP 04-60 is applicable [GP 04-60 is in development and not currently available]).
 3. Secondary containment and leak detection systems external to the tank (GP 04-60 is applicable [GP 04-60 is in development and not currently available]).
 4. Fire protection (GP 24-40 is applicable).
GP 24-40 specifies requirements for many aspects of fire protection, including:
 - Tank spacing, bunding, and road access.
 - Escape routes, stairways, vertical ladders, gangways, rolling ladders.
 - Handrails.
 - Pontoon covers and gas testing hatches.
 - Fire detection and alarms.
 - Firefighting equipment.
 - Fire retardant materials of construction.
 5. Earthing (grounding) (GP 12-25 is applicable).
- d. This GP does not provide guidance on storage tank operations or in-service inspection, maintenance, or modifications.

2. Normative references

The following referenced documents may, to the extent specified in subsequent clauses and normative annexes, be required for full compliance with this GP:

- For dated references, only the edition cited applies.

- For undated references, the latest edition (including any amendments) applies.

BP

GP 06-25	Design for the Prevention of Corrosion under Insulation and Fireproofing (CUI and CUF).
GP 06-60	Painting of Metal Surfaces.
GP 06-63	Internal Coatings.
GP 06-67	Design Decisions That Affect Corrosion.
GP 12-25	Earthing (Grounding).
GP 24-40	Fire Protection of Atmospheric Storage Tanks.
GP 30-25	Field Instruments - General.
GP 48-03	Layer of Protection Analysis (LOPA).
GP 52-10	Thermal Insulation.
GP 64-03	Static Fluid Measurement Systems.

Air BP

GEN 511	Product Quality Standard for Handling Aviation Fuels at BP Refineries.
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American Petroleum Institute (API)

API RP 575	Inspection of Atmospheric & Low Pressure Storage Tanks.
API RP 651	Cathodic Protection of Aboveground Storage Tanks.
API RP 2350	Overfill Protection for Storage Tanks in Petroleum Facilities.
API Std 650	Welded Tanks for Oil Storage.

European Standards (EN)

EN 14015	Specification for the design and manufacture of site built, vertical, cylindrical, flat-bottomed, above ground, welded, steel tanks for the storage of liquids at ambient temperature and above.
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3. Terms and definitions

For the purposes of this GP, the following terms and definitions apply:

Annular plate

Tank bottom peripheral plate supporting shell and to which shell is welded.

Antirotation device

Guide pole(s) or cable system fixed to shell through pontoon of floating roof to prevent rotation.

Articulated drain

Floating roof internal drainpipe made of hard pipe with articulated swivel joints.

Bitsand

Bitumen or oil mixed with sand, used for supporting floor and removing stress raisers.

Bottom

Floor of tank.

**Bunding**

Arrangement of bund wall or dike enclosing area around tank to provide secondary or tertiary containment.

Coating

Layer painted or otherwise applied to surface for corrosion protection.

Cone up/cone down

Preformed shape of tank floor bottom.

Corrosion allowance (CA)

Thickness of material that can safely be allowed to corrode, having regard for operating environment and applied stresses.

Curb angle (top angle)

Reinforcement angle welded at top of shell.

Design life

Period during which item or component is intended to remain fit for service under specified design and operating process conditions.

Dipping

Measuring product level in tank.

Dome roof

Type of self supporting steel fixed roof.

Double bottom

Tank with two separated floors to provide means of positive leak detection of the upper floor.

Double deck floating roof

Floating roof structure with top and bottom deck and bulkheads forming compartments.

Emergency drain

Drain installed at lowest point of double deck external floating roof designed to discharge rain water directly into the product in the event that the primary drain is inoperative.

Floating suction

Suction pipe that floats near surface of product.

Frangible roof

A fixed roof in which the roof to shell joint will fail prior to the shell to bottom joint under excessive internal pressure.

Guide pole

Pole fixed to top and bottom of tank to guide floating roof.

Hose drain

Floating roof drain system constructed of flexible hose.

Pontoon

Buoyancy chambers or devices for floating roofs.

**Primary seal**

Main sealing device between floating roof and tank shell. The only sealing device or the lower device in a double seal arrangement.

Rim seal

Floating roof peripheral seal.

Roof drain

Device to remove accumulating water from external floating roof deck.

Roof support leg

Support leg on external or internal floating roof.

Sampling device

Device to allow product sampling.

Secondary seal

Additional peripheral seal between floating roof and tank shell to prevent vapour loss and rainwater ingress and deterioration of the primary seal.

Shell

Cylindrical wall of tank.

Shunt

Metal electrical connection between floating roof and tank shell, located on floating roof.

Stilling well/gage pole

Pipe in which dipping device travels up and down.

Sump

Well for drainage in tank bottom or floating roof deck.

Ullage

Free available capacity in a tank.

Vendor

Person or organisation responsible to BP for design and/or supply of goods or services for project or installation.

4. Symbols and abbreviations

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

BAT	Best available technology.
CA	Corrosion allowance.
CP	Cathodic protection.
CUI	Corrosion under insulation.
EFRT	External floating roof tank.



GRE	Glass reinforced epoxy.
HDPE	High density polyethylene.
HSSE	Health, safety, security, and environment.
LOPA	Layer of protection analysis.
TVP	True vapour pressure.
UV	Ultraviolet.
VOC	Volatile organic compound.

5. General design considerations

5.1. Design life

Specification of design life is not a normal requirement for tank design codes but may be required if tank is in cyclic thermal duty.

A design life may be relevant if calculation of corrosion allowances is required.

5.2. Design codes

- a. Tanks shall be designed in accordance with API Std 650 or EN 14015.

Both standards provide safe economic design. The choice between the two depends on site policy, regulatory requirements, previous experience of tank Vendor, and cost.

- b. Use of codes other than API Std 650 and EN 14015 shall be subject to approval by the entity EA.

Guidance on codes is provided in EEMUA 159.

5.3. Environmental requirements

- a. Tanks shall comply with applicable local, regional, or national environmental regulations.

Environmental regulations may place requirements on:

- *Positive leak detection.*
- *Secondary and tertiary containment.*
- *Emissions to the atmosphere.*
- *Overfill protection.*

- b. Requirements for emissions control are normally covered by the use of BAT. In constructing a new facility or upgrading an existing facility, the BAT should be identified and may be used.

BAT will change as technology advances, which avoids the need for prescriptive legislation to be continually updated. What is considered “best” will need to be agreed upon with the local regulator at the planning stage of any new construction.

- c. In absence of local or national regulations, BP local, regional, and/or Group environmental authority should be consulted.

5.4. Design aspects for corrosion mitigation

- a. Mechanical and materials design features to mitigate in service corrosion that are appropriate for the tank duty and location shall be identified in accordance with GP 06-67.

Items for consideration in this GP include:

- *Use of cathodic protection.*
- *Continuous welding of external attachments.*
- *Removable/replaceable stair treads, handrails, and other external fittings.*
- *Drainage from stiffening rings and windgirders.*
- *Design of water drawoff sumps.*
- *Sealing of external floor plate projections.*
- *Sealing of pontoon hatches.*
- *Use of nonmetallic materials for firefighting systems.*
- *Use of corrosion resistant alloys for roof seals.*

- b. If applicable, use of corrosion resistant materials and coatings for jet fuel tanks shall comply with Air BP GEN 511.

Air BP GEN 511 requires copper or copper alloys to be replaced, if possible, by alternative materials, such as stainless steel or aluminium. Zinc and cadmium are two other metals that adversely affect product quality.

- c. Zinc rich (galvanised) coatings, cadmium alloys, and cadmium plating shall not be specified for applications in contact with aviation fuels.

5.5. Corrosion allowance (CA)

Required CA, if any, will be specified by BP responsible engineer.

Requirements for CA depend on tank duty and local experience.

For some duties, such as floating roof crude oil tanks, the provision of uniform CA for roof, shell, and bottom is often neither economically nor technically justified, especially for large tanks. Also, in some areas of the tank, corrosion may be characterised by deep localised attack (e.g., pitting, grooving at welds), and provision of a small uniform CA to uncoated steel would not appreciably extend life.

CA may be specified for uncoated shell, roof, floor plates, and internal structural components for which reasonably uniform corrosion or more general pitting can be anticipated. For example:

- *Floor, shell, and roof plates, for which a CA of 2 mm (0,08 in) to 3 mm (0,12 in) may be an economic alternative to internal coating for improved integrity.*
- *For structural steel components in the vapour space of fixed roof tanks (girders, rafters, etc.), CA will extend the life if the vapour space is corrosive and if the application and maintenance of a protective coating is impractical or uneconomic.*

Guidance on typical types, locations, and rates of corrosion is provided in Annex A.

5.6. Cathodic protection (CP)

- a. Requirements for external CP should be evaluated on an individual tank basis, depending on soil conditions, tank foundation design, and local tank corrosion history.

Use of CP to prevent underside corrosion of floors is not a standard practice throughout BP, and heritage sites have adopted different policies for its application. At many locations, prevention of underside corrosion of the floor has been