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Guidance on Practice for Welded Steel Atmospheric Tanks for Oil Storage

GP 58-10

BP GROUP
ENGINEERING TECHNICAL PRACTICES

Foreword

This is the first issue of Engineering Technical Practice (ETP) BP GP 58-10. This Guidance on 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 Guidance on Practice (GP) provides information about vertical atmospheric tanks for hydrocarbon storage. These tanks have the following characteristics:
 1. Carbon steel or carbon manganese steel composition.
 2. Diameter greater than 15 m (50 ft).
 3. Uniformly supported base with annular plates incorporated in base to shell junction.
- b. The following are excluded from the scope of this GP:
 1. Vertical cylindrical flat bottom storage tanks containing refrigerated or cryogenic liquids.
 2. Underground or inground storage tanks.
 3. Spheres.
 4. Rectangular steel tanks.
- c. This GP does not provide guidance on modifications, repairs, or retrofits to existing tanks. For these items, refer to GIS 58-401.

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 06-25	Guidance on Practice for Design for the Prevention of Corrosion Under Insulation and Fireproofing (CUI and CUF).
GP 24-10	Guidance on Practice for Fire Protection – Onshore.
GP 30-25	Guidance on Practice for Field Instruments - General.
GP 52-10	Guidance on Practice for Thermal Insulation.
GIS 58-101	Guidance on Industry Standard for Welded Steel Atmospheric Tanks for Oil Storage.
GP 58-70	Guidance on Practice for Tank Foundations.
GIS 58-401	Guidance on Industry Standard for Tank Inspection, Repair, Alteration, and Reconstruction (API 653).

[Process Safety Booklet 12 Tank Farm and \(Un\) Loading Safe Operations.](#)

American Petroleum Institute (API)

API RP 575	Inspection of Atmospheric and Low Pressure Storage Tanks.
API RP 651	Cathodic Protection for Aboveground Petroleum Storage Tanks.
API Std 650	Welded Steel Tanks for Oil Storage.
API Std 653	Tank Inspection, Repair, Alteration, and Reconstruction.



British Standards Institute (BSI)

BS 2654 Manufacture of Vertical Steel Welded Non-refrigerated Tanks with
Buttwelded Shells for the Petroleum Industry.

Engineering Equipment and Materials Users' Association (EEMUA)

EEMUA 159 Users' Guide to the Inspection, Maintenance and Repair of Aboveground
Vertical Cylindrical Steel Storage Tanks.

3. Terms and definitions

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

Anchor ring

Ring of bolted connections between tank shell and ring beam to fix tank on foundation. Usually installed on:

- a. Fixed roof tanks operating at high internal pressure.
- b. Tanks subject to seismic loads.
- c. Tall tanks subject to wind loads.

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.

Automatic bleeder

Floating roof vent that opens and closes automatically when roof is landed after initial floating.

Bitsand

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

Bottom

Floor of tank.

Bottom bumpers

Bars fitted to periphery of floating roof to maintain concentricity of roof in shell.

BP

BP p.l.c., associate, subsidiary, or other organisation as defined in conditions of contract for project.

Bund/bund wall (dike/firewall)

Wall enclosing area around tank to provide tertiary containment.

Bunded area

Area bounded by bund wall surrounding tank.



Coating

Layer painted or otherwise applied to surface for corrosion protection.

Cone up/cone down

Preformed shape of tank floor bottom.

Corrosion allowance

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 device (port for strapping tape)

Device for measuring product level in tank.

Dome roof

Type of self supporting steel fixed roof.

Double deck floating roof

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

Earthing lug/grounding lug

Earth connection fitted to provide protection against static discharge.

Emergency drain

Drain with upstand pipe on external floating roof tank to accommodate primary drain failure or overload, or with flanged nozzle when roof is in landed position.

Floating suction

Suction pipe that floats near surface of product.

Foam filled seal (foam log seal)

Type of floating roof rim seal.

Fabric seal

Part of mechanical shoe seal.

Gaging platform

Platform on top of open top tank for access to tank gaging instruments.

Geodesic dome

Fixed roof or cover of geodesic construction.

Guide pole

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



Hose drain

Flexible floating roof drain pipe.

Internal floating cover

Floating roof fitted inside fixed roof tank.

Lining (coating)

Installed for internal corrosion protection on floor or shell.

Pontoon

Tank roof flotation device, usually annular.

P/V valve

Pressure/vacuum relief valve.

Primary seal

Main sealing device between floating roof and tank shell.

Quality assurance

Planned and systematic actions necessary to provide adequate confidence that product or service will satisfy given requirements for quality.

Quality plan

Document setting out specific quality practises, resources, and sequence of activities relevant to particular product, service, contract, or order.

Quality system

Organisation, structure, responsibilities, resources, and actions that provide procedures and methods of implementation to ensure capability of organisation to meet quality requirements.

Ring beam

Concrete annular foundation ring.

Rim seal

Floating roof peripheral seal.

Rim space

Gap between floating roof and tank shell filled by rim seal.

Rim vent

Vent for rim space between product and sealing member.

Roof drain

Device to remove accumulating water from floating roof deck.

Roof leg

Support leg on external or internal floating roof.

Sampling device

Device to permit product sampling.



Secondary seal

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

Shell

Cylindrical wall of tank.

Shunt

Metal electrical connection between floating roof and tank shell, located on floating roof. Usually refers to stairs on outside of tank leading to roof.

Stilling well/gage pole

Pipe in which dipping device travels up and down.

Side entry mixer

Mixer mounted on shell of tank.

Sump

Well for drainage in tank bottom or floating roof deck.

Tank pad

Foundation below tank.

Ullage

Vapour space in tank.

Vendor

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

Weldment

Consists of:

- a. Weld.
- b. Heat affected zone (HAZ).
- c. Adjacent parent metal.

4. Symbols and abbreviations

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

CA	Corrosion allowance.
CUI	Corrosion under insulation.
EFRT	External floating roof tank.
HAZ	Heat affected zone.
HDPE	High density polyethylene.
MIC	Microbiologically induced corrosion.



NDT	Nondestructive testing.
RBI	Risk based inspection.
SRB	Sulphate reducing bacteria.
VOC	Volatile organic compound.

5. General

5.1. Tank life

Design life of tank will be specified by BP.

This is principally to determine corrosion allowances (see 7.1).

5.2. Codes

- API Std 650 and BS 2654 both provide safe economic design. Choice between them depends on site policy, regulatory requirements, previous experience of tank Vendor, and cost.
- Guidance on codes is provided in EEMUA 159.
- Use of codes other than API Std 650 and BS 2654 shall be subject to BP approval.

5.3. Operational safety

Guidance on operational safety is in BP Process Safety Booklet 12.

5.4. Environmental requirements

- Emissions from tank shall be kept to minimum throughout design life of tank.
Requirements for individual components are specified in this GP.
- Applicable environmental regulations shall be complied with.
- If there is conflict between applicable regulations and this GP, more stringent shall apply.
- In absence of local or national regulations, BP HSE shall be consulted.

6. Selection of tank type

- Tank and roof types will be specified by BP.
- Tank and roof selection shall be based on true vapour pressure as specified on data sheet for stored liquid, taking into account location, seismic activity, climate, and applicable codes and regulations.
- Unless required otherwise by applicable environmental regulations, tank type (i.e., type of roof construction) shall be based on true vapour pressure of liquid under actual storage conditions as specified on data sheet.

Nature of product may also determine tank type.

- Fixed roof tanks may be used for storage of nonvolatile materials with true vapour pressure less than 100 mbara (1,5 psia) under all operating conditions, providing they meet applicable construction codes and environmental regulations.
- In locations with heavy snowfall, fixed roof tank is preferred.

Natural breathing loss from fixed roof tank occurs due to temperature difference between day and night. Losses may also occur during filling and discharging.



- f. If true vapour pressure is between 100 mbara and 750 mbara (1,5 psia and 11,1 psia), inclusive, tanks should have external or internal floating roof.

Vapour containment by external floating roof with double deck is similar to that from fixed roof tank with internal floating roof. If there is high level of seismic activity, damage may occur with floating roof that may not be sustained by fixed roof tank.

- g. If true vapour pressure is greater than 750 mbara (11,1 psia), tank shall have vapour recovery system to provide at least 95% reduction in hydrocarbon emission, or storage shall be in low pressure vessels or refrigerated tanks.

In U.S. regulations, no vapour is permitted in tank. In Europe, vapour is allowed if temperature is low enough to avoid ignition.

Gas blanketing is not preferred because of expense and complexity.

- h. If ground settlement in service is likely, internal floating roof should not be specified for new fixed roof tank with column support.

Internal floating roof cannot be drained and offers very little opportunity for visual inspection when operating.

For crude service, deposits may build up on walls of tank and slump onto roof. These may be easily removed from external floating roof at full height but are much more difficult to remove within confined space of fixed roof tank with internal floating roof.

7. Corrosion allowances and coatings

7.1. Corrosion allowances

- a. Separate corrosion allowance (CA) shall be specified for roof, shell, and tank bottom.

Provision of uniform CA for roof, shell, and tank bottom is neither economically or technically sound. This is because tanks corrode preferentially in selective areas. Also, in some areas of tank, form of corrosion may be mostly by pitting (see Figure 1), and provision of small uniform corrosion allowance would not appreciably extend tank life.

- b. Table 1 contains recommended methods for determining corrosion allowance of different components. Change of service (i.e., change to different stored product) may result in different corrosion rates that may alter life of tank.

- c. Table 2 provides data on typical corrosion rates. Change of service (i.e., change to different stored product) may result in different corrosion rates that may alter life of tank.



Figure 1 - Internal corrosion pitting on shell



Uncontrolled

