

DEP SPECIFICATION

**FIELD ERECTED ABOVEGROUND VERTICAL STORAGE
TANKS (AMENDMENTS/SUPPLEMENTS TO
API STANDARD 650)**

DEP 34.51.01.33-Gen.

February 2017

DESIGN AND ENGINEERING PRACTICE

DEM1



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PART I INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the design and construction of field erected aboveground vertical tanks intended for the storage of hydrocarbon products.

The DEP is based on API Standard 650. Part III of this DEP amends, supplements and deletes various clauses of API Standard 650. Part III follows the clause numbering of API Standard 650 for easy reference.

All clauses of API Standard 650 not modified by this DEP remain valid as written.

This DEP is intended for global use. Users of the DEP are advised to exercise due care and sound engineering judgement to ensure interpretation and application of any of the provisions under the DEP does not result in conflict with applicable local jurisdictional and legislative requirements.

This DEP does not cover shop fabricated vertical storage tanks. Shop fabricated welded vertical storage tanks are covered by DEP 34.51.01.36-Gen. Shop fabricated, welded, vertical storage tanks intended for upstream production facilities, including onshore gas production facilities, are covered by DEP 34.51.01.35-Gen.

This DEP contains mandatory requirements to mitigate process safety risks in accordance with Design Engineering Manual (DEM) 1 – Application of Technical Standards.

This is a revision of the DEP of the same number dated February 2015; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorization to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to oil and gas production, gas handling, oil refining, chemical processing, gasification, distribution and supply/marketing. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases, the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

Purchaser is the term used in API Standard 650. For the purposes of this DEP, the term Purchaser shall be understood to mean Principal.

The word **shall** indicates a requirement.

The capitalized term **SHALL [PS]** indicates a process safety requirement.

The word **should** indicates a recommendation.

The word **may** indicates a permitted option.

1.3.2 Abbreviations

Term	Definition
SME	Subject Matter Expert
TA	Technical Authority

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section or clause number is shown in brackets (). Other documents referenced by this DEP are listed in (Part IV).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a major revision of the DEP of the same number dated February 2015.

Section/Clause	Change
2.1	Restructured requirement
2.2	Restructured requirement
2.3	Restructured requirements
2.4	Restructured requirements, identified non-normative text.
2.5	Restructured requirements, identified non-normative text.
2.6	Restructured requirements, identified non-normative text.
2.7	Restructured requirements, identified non-normative text, eliminated non-specific requirement.
2.8	Restructured requirements, identified non-normative text.
2.9	Restructured requirements, identified non-normative text.
2.10	Restructured requirements , identified non-normative text.
2.11	Restructured requirements , identified non-normative text.
2.12	Restructured requirements , identified non-normative text.
2.13	Restructured requirements , identified non-normative text.
2.14	Restructured requirements , identified non-normative text.
2.15	Restructured requirements, removed reduntant text
2.16	Restructured requirement
2.17	Eliminated section. Outside the scope of this DEP.
2.18 through 2.22	Renumber sections
2.18	Clarified requirement
2.19	Clarified requirement
2,21	Identified non-normative text
2.22	Restructuredd requirements, identified non-normative text, eliminated redundant requirements
PART III Section	
4.7	Clarified requirement
5.2	Restructured requirements
5.3	Restructured requirements
5.4	Restructured requirements, identified non-normative text
5.7	Restructured requirement
5.8	Restructured requirements, eliminated redundant requirement
6.1	Restructured requirements, identified non-normative text
7.2	Clarified requirement, eliminated redundant wording.

Section/Clause	Change
7.3	Eliminated incorrect cross reference, restructured requirement
8.1	Restructured requirement
9.1 & 9.2	Placed requirement in section 9.2
PART IV	
Shell Standards	Added reference DEP 80.45.10.11-Gen

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
DEP Feedback System (Users with access to Shell Wide Web)	Enter comments directly in the DEP Feedback System which is accessible from the Technical Standards Portal http://www.shell.com/standards . Select "Submit DEP Feedback", fill in the online form and submit.
DEP Standard Form (other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

1.8 NON NORMATIVE TEXT (COMMENTARY)

Text shown in italic style in this DEP indicates text that is non-normative and is provided as explanation or background information only.

Non-normative text is normally indented slightly to the right of the relevant DEP clause.

1.9 ACTION REQUIRED BY PURCHASER/PRINCIPAL

The API Std 650 document uses a bullet (•) at the beginning of a paragraph to indicate that there is an expressed decision or action required of the Purchaser/Principal. The Purchaser/Principal's responsibility is not limited to these decisions or actions alone. When such decisions and actions are taken, they are to be specified in documents such as requisitions, change orders, data sheets, and drawings.

Within Part III of this DEP, the use of the bullet notation is shown to be consistent with API Standard 650.

PART II GENERAL REQUIREMENTS

2.1 GENERAL

1. Part III of this DEP is written as amendments and supplements to API Standard 650, Twelfth Edition, March 2013. Wherever reference is made to API Standard 650, it shall be understood to mean API Standard 650 as amended/supplemented by this DEP.
2. For ease of reference, the clause numbering of API Standard 650 has been used throughout Part III of this DEP.
3. Clauses in API Standard 650, which are not mentioned in this DEP, shall remain valid as written.
4. If a discrepancy is noted between this DEP and API Standard 650, the discrepancy shall be brought to the attention of the Principal, who shall initiate a review by the Principal's Technical Authority – Storage Tanks, and provide a resolution

2.2 DATA SHEETS

1. The contractor shall develop a project specific data sheet for each individual storage tank.
2. The tank data sheet shall conform to the instructions outlined under Annex L of API Standard 650.

2.3 DOCUMENTATION SUBMITALLS/APPROVALS

1. The guidelines given under API Standard 650 Annex W (Commercial and Documentation Recommendations) shall be followed.
2. Project specific documentation required for review and approval by the Principal shall include, but not necessarily be limited to, the following:
 - a. tank data sheets;
 - b. construction quality assurance plan;
 - c. general arrangement drawings;
 - d. material selection reports;
 - e. tank design calculations;
 - f. floating roof buoyancy design;
 - g. tank venting calculations;
 - h. nozzle load computations;
 - i. seal material selection;
 - j. foundation detail design;
 - k. tank construction drawings;
 - l. floating roof construction drawings;
 - m. PWHT requirements;
 - n. Weld Procedure Specifications (WPSs);
 - o. Procedure Qualification Records (PQRs);
 - p. non Destructive Inspection & Test Plan;
 - q. welder testing records;
 - r. hydrostatic test procedure;
 - s. tank strapping tables;
 - t. coating quality assurance plan;
 - u. as built details;
 - v. tank data book/post construction handover package.
3. Review and approval by the Principal of any project documentation shall not relieve the Manufacturer of its obligation to fully comply with local legislative requirements, relevant design codes and project specifications.
4. All project documentation shall conform to local regulatory requirements for engineering authentication and sign offs.
5. Where requirements for engineering authentication and sign offs are not locally regulated, good engineering practices shall be followed.

2.4 OVERFILL PROTECTION

1. Provisions for tank overfill protection shall include an allowance in the tank fill level that will provide additional storage capacity above the design maximum working level.

The additional storage capacity is above the maximum working level, where the required additional tank volume is calculated based on an estimated operations response time, the maximum product inflow rate, and the hazard associated with tank overfill for each specific tank installation.

See API Standard 2350 for additional guidance regarding tank overfill prevention.

2. Unless approved by the Principal, the minimum response time shall be 15 minutes.

The selected response time is normally based on a detailed estimate of the time needed to respond to an alarm, considering the estimated time required for operations to diagnose a high-level alarm, and the time required to complete the response actions, including a factor of safety.

Subject to approval by the Principal, the response time can be adjusted either upwards (higher) or downwards (lower), if site specific operating experience substantiates a proven case for use of a different response time, including consideration of the risk associated with tank overfill for each specific tank installation.

See API 2350 for additional guidance regarding selection of an appropriate response time.

3. For small diameter storage tanks that are filled via a high flow pipeline, the response time may be reduced subject to a detailed risk assessment that is reviewed and approved by the Principal.
4. For each individual tank design, the additional product storage capacity provided for overfill protection shall be set as follows:

- a. High Level (HL);

High Level (HL) is the liquid elevation set above the maximum working level to provide a minimum response time of fifteen minutes (15), or the Principal approved alternative response time, based on the maximum product inflow rate.

- b. High High Level (HHL).

High High Level (HHL) is the liquid elevation set above the high level (HL) to permit a minimum response time of fifteen minutes (15), or the Principal approved alternative response time, based on the maximum product inflow rate.

5. To establish the overall shell height, the following are minimum requirements for each tank design:
 - a. the perimeter seal systems of an internal floating roof shall not collide with the underside of the rafter members of a fixed roof tank;
 - b. the perimeter seal systems of an external floating roof tank shall not ride over the open top shell course;
 - c. the shunts of an external floating roof seal system shall always be in contact with the tank shell;
 - d. for a fixed roof tank, where an overflow nozzle or foam chamber is provided, the maximum design liquid height shall remain 50 mm (2 in) below the inlet elevation of the overflow nozzle or the foam chamber.