

DEP SPECIFICATION

**VERTICAL STEEL STORAGE TANKS – SELECTION
DESIGN AND CONSTRUCTION
(AMENDMENTS/SUPPLEMENTS TO EN14015)**

DEP 34.51.01.31-Gen.

February 2011

(DEP Circular 27/12 has been incorporated)

DESIGN AND ENGINEERING PRACTICE

DEM1



© 2011 Shell Group of companies
All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, published or transmitted, in any form or by any means, without the prior written permission of the copyright owner or Shell Global Solutions International BV.

PREFACE

DEP (Design and Engineering Practice) publications reflect the views, at the time of publication, of Shell Global Solutions International B.V. (Shell GSI) and, in some cases, of other Shell Companies.

These views are based on the experience acquired during involvement with the design, construction, operation and maintenance of processing units and facilities. Where deemed appropriate DEPs are based on, or reference international, regional, national and industry standards.

The objective is to set the recommended standard for good design and engineering practice to be applied by Shell companies in oil and gas production, oil refining, gas handling, gasification, chemical processing, or any other such facility, and thereby to help achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to Shell companies for their consideration and decision to implement. This is of particular importance where DEPs may not cover every requirement or diversity of condition at each locality. The system of DEPs is expected to be sufficiently flexible to allow individual Operating Units to adapt the information set forth in DEPs to their own environment and requirements.

When Contractors or Manufacturers/Suppliers use DEPs, they shall be solely responsible for such use, including the quality of their work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, the Principal will typically expect them to follow those design and engineering practices that will achieve at least the same level of integrity as reflected in the DEPs. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the Principal.

The right to obtain and to use DEPs is restricted, and is typically granted by Shell GSI (and in some cases by other Shell Companies) under a Service Agreement or a License Agreement. This right is granted primarily to Shell companies and other companies receiving technical advice and services from Shell GSI or another Shell Company. Consequently, three categories of users of DEPs can be distinguished:

- 1) Operating Units having a Service Agreement with Shell GSI or another Shell Company. The use of DEPs by these Operating Units is subject in all respects to the terms and conditions of the relevant Service Agreement.
- 2) Other parties who are authorised to use DEPs subject to appropriate contractual arrangements (whether as part of a Service Agreement or otherwise).
- 3) Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) or 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, Shell GSI disclaims any liability of whatsoever nature for any damage (including injury or death) suffered by any company or person whomsoever as a result of or in connection with the use, application or implementation of any DEP, combination of DEPs or any part thereof, even if it is wholly or partly caused by negligence on the part of Shell GSI or other Shell Company. The benefit of this disclaimer shall inure in all respects to Shell GSI and/or any Shell Company, or companies affiliated to these companies, that may issue DEPs or advise or require the use of DEPs.

Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, DEPs shall not, without the prior written consent of Shell GSI, be disclosed by users to any company or person whomsoever and the DEPs shall be used exclusively for the purpose for which they have been provided to the user. They shall be returned after use, including any copies which shall only be made by users with the express prior written consent of Shell GSI. The copyright of DEPs vests in Shell Group of companies. Users shall arrange for DEPs to be held in safe custody and Shell GSI may at any time require information satisfactory to them in order to ascertain how users implement this requirement.

All administrative queries should be directed to the DEP Administrator in Shell GSI.

TABLE OF CONTENTS

PART I	INTRODUCTION	5
1.1	SCOPE.....	5
1.2	DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS	5
1.3	DEFINITIONS	5
1.4	CROSS-REFERENCES	6
1.5	SUMMARY OF MAIN CHANGES	6
1.6	COMMENTS ON THIS DEP	6
1.7	DUAL UNITS.....	6
PART II	GENERAL REQUIREMENTS	7
2.1	GENERAL	7
2.2	REQUISITION SHEETS	7
2.3	FITTINGS AND ACCESSORIES	7
2.4	DRAWINGS AND CALCULATIONS	7
2.5	MATERIAL CERTIFICATES	7
2.6	LIQUID-LEVEL INDICATORS	7
2.7	DIP PLATES	7
2.8	DIP HATCHES	7
2.9	LEVEL ALARMS/INDICATION SYSTEM	8
2.10	SPECIAL FITTINGS FOR FIXED ROOF TANKS.....	9
2.11	SPECIAL FITTINGS FOR FLOATING ROOF TANKS	10
2.12	SELECTION OF ABOVE GROUND STORAGE TANK TYPE	10
2.13	HEATING COILS	11
PART III	AMENDMENTS/SUPPLEMENTS TO EN 14015.....	12
3	TERMS, DEFINITIONS, SYMBOLS AND ABBREVIATIONS	12
5	DESIGN	13
6	MATERIALS.....	13
7	DESIGN LOADS	13
8	TANK BOTTOMS.....	13
8.2	MATERIALS.....	13
8.3	ANNULAR PLATES	14
8.4	FABRICATION	14
9	SHELL DESIGN	14
9.4	SHELL PLATE ARRANGEMENT	15
10	FIXED ROOF DESIGNS	16
10.3	DESIGN OF ROOF PLATES AND ROOF SUPPORTING STRUCTURE	16
10.4	ROOF PLATING WITHOUT SUPPORTING STRUCTURE (MEMBRANE ROOFS)	16
10.5	COMPRESSION AREA AT THE JUNCTION OF THE SHELL AND ROOF	16
10.7	FLOATING COVERS	17
12	TANK ANCHORAGE	17
13	MOUNTINGS	18
13.1	SHELL NOZZLES O/D 80MM AND ABOVE	18
13.2	SHELL NOZZLES LESS THAN O/D 80MM (3-1/8 in).....	18
13.3	ROOF NOZZLES	18
13.6	FLUSH TYPE CLEAN-OUT DOORS AND WATER DRAW-OFF SUMPS	18
13.11	STAIRWAYS AND WALKWAYS	18
13.14	EARTHING CONNECTIONS.....	19
15	SHOP FABRICATION OF TANK COMPONENTS	19
15.5	PLATE PREPARATION AND TOLERANCES.....	19
16	SITE ERECTION AND TOLERANCES	20
18	WELDING	22
18.2	SEQUENCE OF WELDING	22
18.3	WELDING OF BOTTOM.....	22
18.4	WELDING OF SHELL TO BOTTOM	23
18.5	WELDING OF SHELL.....	23
18.9	PREHEATING.....	23
19	TESTING AND INSPECTION.....	23

19.13	HYDROSTATIC AND PNEUMATIC TESTS.....	24
20	DOCUMENTATION AND NAME-PLATE	24
ANNEX A	(NORMATIVE) INFORMATION AND REQUIREMENTS TO BE DOCUMENTED	25
ANNEX B	(INFORMATIVE) OPERATIONAL AND SAFETY CONSIDERATIONS FOR STORAGE TANKS AND STORAGE INSTALLATIONS	26
ANNEX D	(NORMATIVE) REQUIREMENTS FOR FLOATING ROOFS	26
ANNEX E	(NORMATIVE) REQUIREMENTS FOR RIM SEALS FOR FLOATING ROOFS	27
ANNEX F	(NORMATIVE) SELECTION OF CARBON AND CARBON MANGANESE STEEL PLATE TO ALTERNATIVE SPECIFICATIONS TO THOSE IN 6.1	28
ANNEX L	(NORMATIVE) REQUIREMENTS FOR VENTING SYSTEMS	28
ANNEX R	SURFACE FINISH	30
PART IV	REFERENCES	31

APPENDICES

APPENDIX A	WORLD MAP SHOWING STRONG WIND AREAS AND MAXIMUM GUST VELOCITIES	33
APPENDIX B	DETERMINATION OF TANK STABILITY IN STRONG WINDS FOR TANKS WITH DIAMETER SMALLER THAN OR EQUAL TO 15 m (49 ft).	34
APPENDIX C	FITTINGS FOR STANDARD VERTICAL FIXED ROOF TANKS.....	35
APPENDIX D	FITTINGS FOR STANDARD VERTICAL FLOATING ROOF TANKS.....	37
APPENDIX E	HYDROSTATIC TESTING PROCEDURE	39

PART I INTRODUCTION

1.1 SCOPE

This DEP specifies the minimum technical requirements for the selection, design, fabrication, construction, erection and testing of standard vertical steel storage tanks based on European Standard EN 14015:2004. It is intended to be used in conjunction with standard requisition sheets.

This DEP is written in the form of amendments and supplements to EN 14025. All clauses of EN14015 not modified by this DEP remain valid as written.

Although EN 14015 gives design rules for very high pressure tanks [design pressure/vacuum +500/-20 mbar (ga)], this DEP is not intended to cover design rules for these tanks.

Site preparation and foundation aspects of the design are covered in DEP 34.11.00.11-Gen.

The design and construction of aboveground storage tanks in accordance with API 650 is covered in DEP 34.51.01.33-Gen.

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

This DEP is a revision of the DEP of the same number and title dated January 2010, and now contains the scope of former DEP 64.51.01.31-Gen (Vertical Tanks - Erection and Testing based on EN14015). 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 should 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.

The word **shall** indicates a requirement.

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

The word **should** indicates a recommendation.

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets. Other documents referenced by this DEP are listed in (13).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated January 2010. The contents of former DEP 64.51.01.31-Gen (Vertical Tanks - Erection and Testing based on EN14015) has now been incorporated into this DEP. The following are the main, non-editorial changes.

Old section	New section	Change
General		Where appropriate and possible references to EN14015 are made and text from DEP deleted. DEP is in format of amendment to EN14015.
-	Various	DEP 64.51.01.31-Gen. is included in this DEP.
2	Various	Type and selection of vertical tanks: TVP is included as selection criteria
8	-	Foundation section is moved to DEP 34.11.00.11-Gen.

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be sent to the Administrator at standards@shell.com, using the DEP Feedback Form. The DEP Feedback Form can be found on the main page of "DEPs on the Web", available through the Global Technical Standards web portal <http://www.shell.com/standards> and on the main page of the DEPs DVD-ROM.

1.7 DUAL UNITS

**Amended per
Circular 27/12**

Dual units have been incorporated throughout this DEP.

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.

PART II GENERAL REQUIREMENTS

2.1 GENERAL

Part III of this DEP is written as amendments and supplements to EN 14015:2004. Wherever reference is made to EN 14015, it shall be understood to mean EN 14015:2004, as amended/supplemented by this DEP.

For ease of reference, the clause numbering of EN 14015 has been used throughout Part III of this DEP. Clauses in EN 14015, which are not mentioned in this DEP, shall remain valid as written.

2.2 REQUISITION SHEETS

This DEP shall be used in conjunction with standard requisition sheets.

2.3 FITTINGS AND ACCESSORIES

Unless otherwise specified in the requisition, tanks shall be provided with the standard range of fittings and accessories as listed in Appendix C of this DEP for fixed roof tanks and Appendix D of this DEP for floating roof tanks. Shell Standard Drawings, group S 51, as listed in Part IV of this DEP are available as a reference and guide for standard tank fittings and accessories.

Fittings and accessories may be supplied in accordance with standard designs of the tank Manufacturers subject to the approval of the Principal.

2.4 DRAWINGS AND CALCULATIONS

Contractor's drawings and calculations shall be based on EN 14015 and this DEP. Shell Standard Drawings, group S 51, as listed in PART IV, are available as a reference and guidance for details on standard tank calculations, fittings and features. However, it remains the Contractor's responsibility to satisfy the requirements outlined in this DEP.

2.5 MATERIAL CERTIFICATES

Materials used in the fabrication of tanks designed in accordance with this DEP shall be supplied with material certificates in accordance with EN 10204, type 3.1.B. Material certificates shall be submitted to the Principal prior to commencement of fabrication.

2.6 LIQUID-LEVEL INDICATORS

Liquid-level indicators or automatic liquid-level gauges shall be fitted to all tanks.

Unless otherwise specified on the requisition, level indicators or automatic level gauges shall be supplied separately. However, the tank Manufacturer shall include the required nozzles, gauge poles, etc. to suit the level indicators to be fitted.

The construction of the gauge poles depends on the operational conditions and the required measurement accuracy of the level gauges. The deformation of the tank shell during filling/emptying shall be taken into account in the design of the gauge poles for tank contents subject to custody transfer.

2.7 DIP PLATES

A 6 mm (1/4 in) thick dip plate shall be provided and welded to the tank bottom or lowest shell course directly under the dip fittings (i.e. dip hatches, slot dipping devices and combined vent and dip hatches).

2.8 DIP HATCHES

Tanks shall be supplied with one dip hatch unless specified otherwise in the requisition. Local regulations may require that additional dip hatches be provided

2.9 LEVEL ALARMS/INDICATION SYSTEM

For fixed cone roof tanks, the tank maximum liquid level is the overall height of the shell excluding the rim angle or top angle.

Where an overflow or surface foam nozzle is installed, the tank maximum liquid level is measured to the underside (invert) of the overflow or surface foam nozzle.

For fixed cone roof tanks with internal floating roof, the tank maximum liquid level is the overall height of the shell measured up to the side overflows or to the underside of the circulation vents or the bottom edge of rafter members whichever is lowest **minus** the dimensional clearance required for the internal floating roof seal system above liquid level.

For internal floating roof tanks, the dimensional clearance for the seal system above the liquid level is dependent on the seal configuration. This dimension is provided by the floating roof seal manufacturer and is a critical parameter allowed in the height of the tank shell to ensure the seal system does not collide with the underside of the rafter members or ride over the circulation vents when the tank is filled to maximum liquid level during routine operations.

For external floating roof tanks, the tank maximum liquid level is the overall height of the tank shell excluding the rim angle or top angle **minus** the clearance required for the external floating roof inclusive of seal system.

Preventing storage tanks from being overfilled is an important safety and environmental concern. The safe operation of a storage tank is dependent on the receipt of product into the intended storage tank within its defined capacity. Tank overfills can be effectively reduced by developing and implementing practical and safe operating procedures for storage facilities and by ensuring the careful selection and use of equipment, scheduled maintenance programs, and employee training. In some cases a risk assessment is required to identify safeguarding against tank overfill.

Therefore all tanks SHALL [PS] be provided with at least two independent level alarm systems as follows:

- Low, Low/Low, High and High/High level alarm systems with independent transmitters for the High and High/High levels.
- For normal operation the liquid-level indication system, with its own independent transmitter, is to be used.

The following setting levels shall be considered as minimum requirements. The Principal should be consulted in order to establish the anticipated time needed by an operator to take corrective action in the event of an overfill. If the following minimum requirements do not provide sufficient "operator reaction time" then the setting shall be adjusted accordingly.

The tank high level is the maximum normal liquid operating height i.e. the maximum level to which the tank is filled during routine operations.

Tank high-level shall be set at a level:

- to provide a minimum of twenty minutes (20) response time between high level and tank normal operating liquid level, in case product diversion is operated manually
- 95% of the tank maximum liquid level where automatic controls are in place

The response time shall be based on the maximum flow rates at which product will be introduced into the tank with no liquid outlet.

Where automatic inbound pipeline shutdowns are available together with automatic tank gauging or monitoring systems, the Principal may elect to provide a lower response time.

High-level alarms shall be triggered at the tank high level.

For fixed roof tanks:

- The High/High operational product level shall be set so that the maximum filling height is limited to 200 mm (8 in) below the top of the shell or lower when the response time to stop inflow requires this. The response time to prevent overflow shall be based on the maximum flow rate at which the product will be introduced into the tank.

For fixed roof tanks with an internal floating cover (IFC):

- The High/High level shall be set so that at least 200 mm (8 in) clearance remains between any moving part of the IFC and any obstruction fixed to the shell, including the roof supporting structure.
- The Low-level alarm shall be set so that the IFC still remains floating with its supports at least 100 mm (4 in) above the tank bottom. In addition, the Low/Low alarm shall guarantee a clearance of at least 100 mm (4 in) between the IFC (including moving parts) and any internal structure (e.g. mixer) or piping in the lower part of the tank.

For floating roof tanks:

- With the roof in its High/High position a free clearance of 50 mm (2 in) shall still remain between moving parts of roof and seal, and any of the parts fixed to the shell. The shunts of the roof seal shall be in contact with the shell at this roof level.
- The Low-level alarm shall be set so that the roof still remains floating with its supports at least 100 mm (4 in) above the tank bottom. In addition, the Low/Low level alarm shall guarantee a clearance of at least 100 mm (4 in) between the roof (incl. moving parts) and any internal structure (e.g. mixer) or piping in the lower part of the tank. The Low/Low level alarm should be set at a lower position than the Low-level alarm.

For tanks with a mixer and a floating roof (IFRT, EFRT or CFRT):

- Providing the mixer with a trip function should be considered in order to avoid mixer or floating roof damage when landing the floating roof.

For tanks operating at elevated temperature with heating coils:

- The minimum fluid level in the tank shall be set to ensure that heating coils are always submerged in the product during normal operation. The Low/Low level alarm settings for tanks equipped with heating coils depend on many factors, such as coil layout, tank dimensions, heat capacity, product stored, etc. Operational and safety engineers shall specify the final settings. A temperature or a level trip function of the heating coil system shall be considered.

2.10 SPECIAL FITTINGS FOR FIXED ROOF TANKS

Class I and Class II products

For fixed roof tanks used for storage of these products shall be provided with the following additional fittings:

Slot dipping devices are required for all tanks operating under pressure, so that dips and samples may be taken without excessive pressure loss.

Manometers or pressure/vacuum gauges. If specified in the requisition, manometers shall be supplied for pressurised tanks in order that the working of the breather valves may be checked. The manometers are normally mounted at ground level for easy reading

A floating suction (a form of swing pipe fitted with floats to the outlet) may be provided on tanks used for storing for instance aviation fuels. The main purpose of this fitting is to minimize the risk of extracting water-contaminated product.

This assembly shall never be connected to the inlet connection.

Class III + Unclassified products

Fixed roof tanks used for storage of these products shall be provided with one dip hatch unless specified otherwise in the requisition. Local regulations may require that additional dip hatches be provided.

2.11 SPECIAL FITTINGS FOR FLOATING ROOF TANKS

Special fittings for floating roof tanks are described in Annex D of EN14015 and the additions indicated in this DEP.

2.12 SELECTION OF ABOVE GROUND STORAGE TANK TYPE

The selection of the most suitable storage tank(s) is influenced by various parameters.

The main parameters are the TVP (True Vapour Pressure) and the flash point of the liquid stored.

Table below provide guidance for the selection of tank types in relation with the flash point and the tank diameter. Unless otherwise stated within project documentation the selection of the tank type shall be in accordance with table 1 and the guidelines 2.12.1.

Table: 1 Selection of tanks based on flash point and tank diameter

	TANK DIAMETER, METRES (FEET)																								
Class of product	3 (10)	4 (13)	6 (20)	8 (26)	10 (33)	12.5 (41)	15 (49)	17.5 (57.5)	20 (65.6)	22.5 (74)	25 (82)	27.5 (90)	30 (98.5)	33 (108)	36 (118)	39 (128)	42 (138)	45 (148)	48 (157)	54 (177)	60 (197)	66 (217)	72 (236)	78 (256)	
Class I, flash point less than 21°C (70°F)	FRT (L,H) IFRT (N,L,H)						FRT (L,H) IFRT (N,L,H) EFRT (double deck) CFRT			FRT (L) EFRT (preferred) IFRT (N) CFRT						EFRT CFRT									
Class II, flash point 21°C (70°F) and higher but less than 55°C (131°F)	FRT (L) IFRT(N)						FRT(L) IFRT(N) EFRT CFRT			FRT(L) EFRT (preferred) IFRT(N) CFRT						EFRT CFRT									
Class III + unclassified, flash point 55°C (131°F) and higher	FRT(N)						FRT(N)			FRT(N)						EFRT CFRT									

NOTE: 1. Tanks up to 39 m (128 ft) incl., storing certain class I and II products, may be connected to a vapour recovery system, or a fixed roof with floating cover may be used (especially as an alternative to the BOF type) where rain water penetrating between shell and seal may have an adverse effect on the quality of the product stored.

Some typical product examples;

Class I

Crude, Gasoline, Tops (light gas oil), Untreated Kero, Mogas, Slops

Class II

Kero, Kerosine, Cut Back bitumen, Cut back drum filling

Class III

Light gas oil, Heavy gas oil, Automotive gas oil (AGO),

Unclassified

Residue, Bitumen, Refinery fuel

2. The above selections are recommended, but other selections may be made if approved by the Principal.
3. (N)=Non Pressure, (L)= Low Pressure, (H)= High Pressure fixed roof tanks with either a cone or dome roof (see 3.1).

2.12.1 Selection of storage tanks bases on emissions

To minimize volatile emissions to the atmosphere, within Shell facilities, the following guidelines shall apply for the selection of tanks for the storage of hydrocarbon products.

- The true vapour pressure (TVP) for hydrocarbons stored in fixed roof tanks without an internal floating roof, shall not be greater than 100 mbar (10.34 kPa or 1.5 psi).
- Floating roof tanks shall be used for the storage of volatile hydrocarbons with vapour pressures greater than 100 mbar (10.0 kPa or 1.5 psi) or any products that require storage in this type of tank for environmental or public health reasons.
- TVP for hydrocarbons in conventional storage tanks with internal or external floating roofs shall not exceed 860mbar (86.0 kPa or 12.5 psi). Hydrocarbon products with a higher TVP shall be stored in low-pressure refrigerated storage tanks, or in pressurised storage vessels.
- For tanks with diameter <15m (49 ft) or >50m (164 ft) either double deck floating or CFRT tanks roofs are recommended. The lower limit is introduced because a single deck roof has an increased chance of getting stuck in a smaller diameter tank. The upper limit is related to the increased risk of fatigue cracking to a single deck floating roof in areas with strong winds conditions (>32 m/s [105 ft/s]).
- For tanks used for the storage a hydrocarbons with a TVP greater than 625 mbar (62,5 kPa or 9 psi) a double deck floating roof or a Combi Tank shall be used.

2.13 HEATING COILS

In tanks where a water layer may be present on the bottom (e.g. crude oil tanks) the heating coils shall be at a height sufficiently above the tank bottom (at least above the product/water interface) to prevent heating of the water.

PART III AMENDMENTS/SUPPLEMENTS TO EN 14015

3 TERMS, DEFINITIONS, SYMBOLS AND ABBREVIATIONS

Add to this clause:

DEFINITIONS

The various types of standard tanks used within Shell, are designated by a reference code, which consists of a three-letter prefix indicating the tank type, followed by a numerical group indicating the dimensions of the tank (diameter and height in meters).

The following letter prefixes are used to identify the standard tanks described in this specification. The initial letter B of the prefix indicates that the shell is butt-welded.

BHC	=	High-pressure Cone roof tank
BLC	=	Low-pressure Cone roof tank
BNC	=	Non-pressure Cone roof tank (atmospheric tank)
BHD	=	High-pressure Dome roof tank
BLD	=	Low-pressure Dome roof tank
BND	=	Non-pressure Dome roof tank (atmospheric tank)
BOT	=	Open Top tank (only for fire water/cooling water)
BOF	=	Open top tank with Floating roof

Examples of the use of the code are as follows:

- BHC 15/12 means High-pressure cone roof tank, 15 m (49 ft) diameter and 12 m (39 ft) high.
- BND 36/18 means Non-pressure dome roof tank, 36 m (118 ft) diameter and 18 m (59 ft) high.

The abbreviations in Table 2 are used in this DEP to identify a specific type of tank.

Table 2 Abbreviations applicable for different types of tank

International abbreviation	Description	Standard tank
FRT	Fixed Roof Tank	BNC / BND BLC / BLD BHC / BHD
IFRT	Fixed Roof Tank with Internal Floating Cover (IFC)	BNC / BND + IFC BLC / BLD + IFC BHC / BHD + IFC
EFRT	External Floating Roof Tank	BOF
CFRT	Covered Floating Roof Tank	BOF + Geodesic dome roof

5 DESIGN

Add to this clause:

A tank requisition sheet shall be completed for the design of the aboveground storage tank.

The structural and functionality integrity of the tank shall be based on the most severe possible combination of the load conditions as specified in the EN 14015:2004 Clause 7.

6 MATERIALS

Add to this clause:

Structural bolts shall have metric threads to ISO 898, grade 8.8 and shall be hot dip galvanized. The allowable design stress shall not exceed the lower of one-half of the yield strength or one-third of the tensile strength.

6.1 CARBON AND CARBON MANGANESE STEELS

Add to this clause:

Notch ductility SHALL [PS] be in accordance with EN 14015 Clause 6 Table 9.

7 DESIGN LOADS

7.2.10 WIND

Add to this clause:

Appendix A shows a world map marked with local maximum 3-s wind gust velocities, (up to 10 m [33 ft] height). The values are approximate and should be taken only as a rough indication of the winds gusts that may be encountered.

7.2.12 LOADS RESULTING FROM CONNECTED PIPING AND ATTACHMENTS

Add to this clause:

The settlement of the tank, the outward movement of the shell and the inclination of the nozzle under full hydrostatic load shall be taken into account.

For nozzles DN 500 (NPS 20) and more in diameter the use of bellows and balanced supports should be considered.

7.2.13 FOUNDATION SETTLEMENT LOADS

Add to this clause:

The minimum tank foundation design requirements are addressed in DEP34.11.00.11-Gen.

8 TANK BOTTOMS

8.2 MATERIALS

Add to this clause:

Irrespective of tank diameter a ring of annular plates shall be applied in all cases.

In addition tank bottoms shall be designed with the following minimum plate thickness:

- *Tanks up to and including 12.5 m (41 ft) diameter:*
Bottom plates shall be at least 6 mm (1/4 in) thick and bottom annular plates shall be at least 8 mm (5/16) thick excluding any specified corrosion allowance.
- *Tanks exceeding 12.5 m (41 ft) diameter:*