Grupa LOTOS S.A.	TECHNICAL SPECIFICATION	Spec. No. 2210
	Low Pressure and Atmospheric Storage Tanks	

Contents

1 Subject of specification 3
2 Scope of validity 3
2.1 Deviations 3
3 General provision 3
3.1 Scope of specification 3
3.2 Order of Precedence 4
4 Design Criteria 4
4.1 Code Requirements 4
4.2 Materials 4
4.3 Corrosion Allowance 5
4.4 External Loads 5
4.5 Allowable Stress 5
4.6 Welding 5
4.7 Tank Bottoms 5
4.8 Tank Shells 6
4.9 Tank Roofs 6
4.10 Flanges, Gaskets and Bolts 6
4.11 Anchor Bolts 7
4.12 Insulation 7
4.13 Accessories 8
4.14 Platforms, Ladders, Stairways and Handrails 8
4.15 Venting 8
4.16 Tolerances 8
4.17 Manways 8
4.18 Reinforcement of openings 9
4.19 Inspection and Testing 9
4.20 Corrosion protection 9
4.21 Technical documentation 10
4.22 Marking 10

This document is the property of Grupa Lotos SA.. Coping and giving it to other are forbidden without express written authority by Grupa Lotos SA

5 Relevant documents 10
6 Norms and standards 10
7 Record of changes 12

1 Subject of specification

This specification and other documents referenced herein establish the minimum requirements for the design, fabrication, erection, inspection and tests for low pressure and atmospheric storage tanks.

2 Scope of validity

This specification applies to the preparation of tender documents, inquiries and contracts concerning new investment or modernization projects planned by Grupa LOTOS S.A.

It shall also be a basis for preparing both detailed specifications and inquires for individual or package unit supplies.

2.1 Deviations

Any deviation from this specification and the relevant specifications, standards and related documents including proposals, which the bidder claims to be economically and / or technically superior solutions must be submitted in writing for review and approval by Grupa LOTOS S.A. Non-approved exceptions are not acceptable by Grupa LOTOS S.A.

The supplier must report in writing any ambiguity in this or any other specifications of Grupa LOTOS S.A. or non-compliance with the referred documents / standards and obtain a written explanation from Grupa LOTOS S.A.

3 General provision

3.1 Scope of specification

This specification together with purchase order requirements, data sheets and/or drawings provides requirements for the design, fabrication, erection, inspection and testing of Low Pressure and Atmospheric Storage Tanks to be ready to place into service in Grupa LOTOS S.A. refinery.

Where reference is made to a code, specification or standard, the reference shall be taken to mean the latest edition of the code, specification or standard, including addenda, supplements and revisions thereto.

The referenced codes and standards contain minimum requirements for the design and construction of tanks.

In addition to the requirements of this Specification, the design, construction, erection, and inspection of tanks shall be in accordance with all mandatory requirements of the applicable national, regional, local laws and regulations for the area of installation or as furnished by the client.

3.2 Order of Precedence

In case of conflicts existing between this specification and other documents, the following order of precedence shall govern:

- The current Polish legislation
- Terms of purchase order / contract and other requirements agreed in writing Grupa LOTOS S.A.
- Data Sheets approved by Grupa LOTOS S.A.
- This specification
- Other Specifications
- Drawings and other documents
- Standards

4 Design Criteria

4.1 Code Requirements

Tank design shall comply with requirements of codes, standards, specification and regulation listed under paragraph 5 and 6.

Tank design shall be agreed with Central Office of Measures (Główny Urząd Miar - GUM)

All employed measures equipment shall have suitable Certificate of the Type issued by Central Office of Measures (GUM).

4.2 Materials

All Material shall be selected based on the service, medium, and the design temperature as well as the minimum metal temperature and shall conform to those specified in individual tank data sheets and/or drawings.

All materials shall be new and unused.

Gaskets shall be of asbestos free material suitable for the stored product and service conditions.

All materials used tank construction shall have material mill certificates.

Each plate or forging shall be legibly stamped or stencilled showing grade number and plate or forging heat number. Metal stamping shall preferably be done on the long edge of each component as it leaves the mill. All stamps shall be marked by paint or other legible means in such way that these can easily be noted and read after erection. For bottom plates these shall be done on the inside, for shell and roof plates and other components on the outside

All attachments directly welded to tank shall be of the same P number as material of tank part to which are attached, unless otherwise specified.

Material substitutions prior to tank fabrication commence or during fabrication shall be approved in writing by Grupa LOTOS S.A.. The Manufacturer shall submit for approval, the complete description of the chemical and mechanical properties of all material substitutions proposed prior to purchase.

Materials used for tank construction shall conform to the requirements specified in PN-EN 13015 (or API 620 and API 650). Materials conforming to other standard specifications, equivalent to those specified, are acceptable only when approved in writing by Grupa LOTOS S.A. Equivalent material specifications are those that conform in regard to chemistry, mechanical properties, quality, testing and inspection.

Supplementary requirements will be specified in the tank purchase order documents.

4.3 Corrosion Allowance

Corrosion allowance, when specified, shall be added to the calculated thickness (or minimum practical thickness) of shells, roofs and bottoms plates and nozzles.

Internal parts, which are welded in, shall be provided with extra thickness equal to the specified corrosion allowance, on each surface exposed to tank contents. Internal parts, which for reasons of thermal expansion are part welded and part bolted, shall be considered as non-removable.

4.4 External Loads

External loads especially those resulting from wind, snow shall be in accordance with Polish Norms (PN-EN 1990; PN-EN 1991-1-3 and PN-EN 1991-1-4). Process induced loads must always be taken into account.

Auxiliary equipment or/and accessories loads included those resulting from piping, internal heating coils or other heating cartridges, agitators or other equipment, ladders and platforms supported on tank.

4.5 Allowable Stress

The design allowable stress for construction material used for tanks covered by this specification shall be those specified in tank design codes referenced herein. In case the design code does not specify allowable stress for material that to be used for tank construction the allowable stress as given in the applicable PN / EN norms or ASME Code shall be taken.

4.6 Welding

All welding shall be in accordance with the applicable regulations, codes and standards, unless otherwise specified.

4.7 Tank Bottoms

Field erected tanks shall have lap-welded bottom construction or butt-weld one with backing strip.

Tank design shall cover civil data including tank settlement and ground analysis.

Unless otherwise specified, the bottoms of carbon steel storage tanks shall shell be set on oil-saturated sand bed.

Tanks for liquid flammable materials shall be provided with double bottom equipped with leakage detectors.

4.8 Tank Shells

Tank shells shall be formed such that the plate longitudinal direction (direction of mill rolling) is circumferential.

All shell plates on floating roof tanks shall be fabricated with the inside joints sufficiently smooth to prevent interference with movement of the roof.

The grounding lugs shall be provided on the bottom course of all tanks' shells. The grounding lugs shall be made out of stainless steel for the tanks fabricated from the carbon or low alloy steel, grounding lugs for tanks fabricated from other materials shall be of the same material to which are attached.

The grounding lugs shall be equally spaced around the tank in distances not exceeding 10m, nevertheless the number of grounding clips shall not be less than two (2).

The grounding lugs shall meet requirements of Grupa LOTOS S.A. specification no. 4500.

4.9 Tank Roofs

All tank roofs shall be designed considering uplift due to internal pressure and positive and negative wind pressure.

All tank roofs shall be designed to resist the applicable external loads: snow, insulation, access and maintenance platforms.

All roof's welds shall be continuous type (on both side of roof)

As required by Regulation of Minister of Economy - Journal of Laws No. 21, item 125, year 2008 tanks roofs shall be equipped with special nozzle for tank legalization.

All floating roofs shall be adequately grounded around the periphery of the roof.

Roof support legs shall be adjustable to carry the roof in an upper cleaning position with a 1980 mm minimum clearance and a lower operating position 750 mm. 10 mm minimum thickness pad plates shall be provided under each leg on tank floor. Continuous welds shall be used for welding pads plate to tank floor.

4.10 Flanges, Gaskets and Bolts

Forged steel welding neck flanges or long weld neck flanges are preferred.

Slip-on type flanges shall not be used in sour water service.

Lap joint stub end flanges, studding type connections, and threaded connections are permitted only, if specified in the drawings or after a special permission granted by Grupa LOTOS S.A. in writing.

Flange facings and gaskets for piping and instrument connections shall conform to the requirements of the piping class and instrument specifications.

Unless otherwise specified in datasheets and/or drawings, flanges for all external nozzles 24 inch nominal size and smaller shall be in accordance with ASME B16.5 for the rating and type of facing,

Nozzles nominal size of 26 through 60 inch shall be in accordance ASME B16.47, Series A. Any exceptions to ASME B16.47 require Grupa LOTOS S.A. written approval.

Unless otherwise specified in data sheets and/or drawings tanks' manhole can be according to API 650. This shall not apply to manhole / nozzle for agitators.

The finish of the gasket contact surface of nozzle flange facing shall conform to ASME B16.5, unless otherwise specified. When a "raised face " (RF) is specified, the gasket contact surface roughness shall be 1.6 to 3.2 μm Ra per ISO 4287 (63 to 125 μin. AARH).

External bolting for covers, blind flanges shall be stud bolts, with two (2) heavy hex nuts each.

Bolt sizes (including studs and nuts), threads and marking shall conform to ASME B1.1 with threads Class 2A External and 2B Internal:

- Bolts in 1 inch diameter and smaller shall be coarse threads series (UNC),
- Bolts over 1 inch diameter shall be 8 thread series (8UN).

Stud bolts should protrude two (2) threads beyond nuts.

Hard steel washers shall be provided under studs of 1-½ inches in diameter and larger.

All threads shall be coated with heavy, rust preventive thread grease (e.g. containing molybdenum disulfide) to prevent galling.

All internal bolting shall be of the same material type as the tank interior, unless otherwise specified.

Bolts and gaskets materials for piping and instrument connections shall be in accordance with the piping and instrument specifications.

Nozzle necks shall be of seamless pipe. Rolled plate nozzle neck may be used for nozzle size of DN 16" or larger for carbon steel and DN 8" and larger for other materials.

Davits shall be provided for all openings with nozzles having blind flanges and manholes size DN 12" and larger. Lugs for davits shall be full penetrated welded.

Internal flanges may be ASME B16.5, Class 150 slip-on flange or may be fabricated from steel plate and machine – faced to 12.5mm minimum thickness.

Bolt holes in all flanges shall straddle the natural centerlines.

4.11 Anchor Bolts

Anchor bolts and anchor bolts chairs, if applicable, shall be designed to resist uplift due to internal pressure, and/or wind loads.

When anchorage is required, number of anchor bolts shall be multiply of four (4). It is recommended that their spacing shall not exceed 2700 mm and the minimum anchor bolt diameter shall be 25 mm. Location of anchor bolts shall straddle the natural centerlines of tank.

4.12 Insulation

Storage tanks shall be insulated in accordance with the requirements of Grupa LOTOS specification no. 1191.

4.13 Accessories

The scope of supply of tanks' accessories, intended to be installed on tanks, furnished by tank Manufacturer shall be in line as specified in tank data sheet or / and drawing.

4.14 Platforms, Ladders, Stairways and Handrails

Platforms, ladders, stairways, elevated walkways and handrails shall be in accordance with applicable regulation, codes, standards and the LOTOS Group S.A. requirements.

Fixed roof tanks shall be provided with handrails around the perimeter of tank roof (360° at the edge of fixed roof).

Approach walkways, with the handrail on the both sides, to the top / center of the roof shall be provided on dome roof tanks for the maintenance of roof-installed accessories purpose.

4.15 Venting

The requirements for venting, breathing devices and those that prevent a flame entering a tank gaseous zone shall be in accordance with paragraph 4 § 39 of Journal of Laws No. 243, item 2063, year 2005, as amended - Regulation of Minister of Economy on "w sprawie warunków technicznych, jakim powinny odpowiadać bazy i stacje paliw płynnych, rurociągi przesyłowe dalekosiężne służące do transportu ropy naftowej i produktów naftowych i ich usytuowanie".

Manufacturer shall perform calculation that will be the basis for venting selection for the tanks storing heated products.

The venting capacity required shall be determined in accordance with recommendation and rules specified in API 2000. All other conditions such as: inbreating and outbreating resulting from hydrotest that can lead to damage to the tank shall be also taken into account.

4.16 Tolerances

Tanks' tolerances shall be in accordance with relevant codes PN-EN / API specified in tank data sheet and/or drawing.

4.17 Manways

The minimum number of manways in the shell and in the roof shall be as follows:

Diameter of tank [m]	number and size of shell manways	roof manways
up to 10	one (1) DN 24"	one (1) DN 24"
over 10 up to 30	two (2) DN 24"	one (1) DN 24"
over 30 up to 60	three (3)DN 30"	two (2)DN 24"
over 60	four (4) DN 30"	two (2)DN 30"

In addition each compartment of the floating roof shall be provided with a minimum of one DN 20" manway.

4.18 Reinforcement of openings

The reinforcement of openings in the shell and roof shall be designed in accordance with the applicable code for the specified design pressure and temperature. Each reinforcing pad or segment thereof shall be provided with a ¼" NPT diameter „telltale" hole.

4.19 Inspection and Testing

The materials fabrication and testing of tanks shall be subject to inspection by Grupa LOTOS S.A. authorized representative in addition to any inspection required by the specified code or by local authorities having jurisdiction over the installation.

Inspection by Grupa LOTOS S.A. authorized representative shall in no way relieve the Manufacturer from the responsibility to meet the requirements of the purchase/contract documents.

The Manufacturer shall notify in writing (by e-mail and/or fax) Grupa LOTOS S.A. at least 10 working days in advance of the date when the equipment will be ready for inspection to enable authorized Grupa LOTOS S.A. representative to arrive at Manufacturer's shop and/or jobsite.

Non-destructive examination shall be carried out in accordance with applicable regulations, codes and standards.

Upon completion of entire tank, all tanks shall be hydrostatically tested in accordance with the requirement of the applicable code, drawing or purchase/contract documents in the presence of Grupa LOTOS S.A. authorized representative.

Each reinforcing pad or each segment if more than one (1) piece is used, shall be provided with one (1) with a ¼" NPT diameter "telltale" hole and shall be given an air and bubble solution pressure test before the test of the tank. The test pressure shall be at 30÷50 kPa g. Telltale holes shall be fitted with corrosion inhibiting grease following the tank hydrotest.

Upon completion of hydrostatic tests, the Manufacturer shall clean and remove from the inside of the tank water and all impurities. The tank shall be left in a condition acceptable to Grupa LOTOS S.A.

When materials for tank construction are not covered by the specified code, the design, fabrication, inspection and testing shall be in strict accordance with this specification and the applicable regulations, codes and standards and the Manufacturer will provide certification to this effect.

4.20 Corrosion protection

Cleaning, surface preparation and all painting, if applicable shall be in accordance with Grupa LOTOS S.A. specification no. 1190.

All paintings works, including cleaning and surface preparation shall be carried-out upon successfully completion of hydrotest and inspection by Grupa LOTOS S.A.

Machines surfaces such as flanges face, threads shall not be painted and shall be protected against corrosion and physical damage during painting works. The interior surfaces of tanks shall not be painted unless otherwise specified in tanks data sheet and/or drawings.

Underground and aboveground tanks, the bottom/shell of which has a direct contact with ground, require cathodic protection.

All tank's construction elements design, including supports for accessories installed on tank shall comply with requirements of standard PN-EN-ISO12944-3.

4.21 Technical documentation

Tanks' technical documentation shall comply with requirements of Grupa LOTOS S.A. specification no. 8300 – "Requirements for low-pressure and atmospheric storage tanks subject to UDT/ZDT approval".

4.22 Marking

Tanks shall be provided with nameplate and shall be marked in accordance with relevant regulation and Grupa LOTOS S.A. referenced herein.

5 Relevant documents

Any "Technical Specification" issued by Grupa LOTOS S.A. listed in Contract Files.

6 Norms and standards

Codes and standards listed below form part of this specification. Each publication shall be the latest revision and addendum in effect at the Contract award, unless otherwise specified:

- API Std 650 Welded Steel Tanks for Oil Storage
- PN-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
- PN-EN 1993-4-2 (Eurocode 3) Design of steel structure - Tanks
- ASME B 96.1 Welded Aluminum-Alloy Storage Tanks
- Specification ASTM –Materials
- API Std 620 Design and Construction of Large, Welded, Low-pressure Storage Tanks
- API Std 2000 Venting Atmospheric and Low-pressure Storage Tanks
- API Std 973 Evaluation of the Design Criteria for Storage Tanks with Frangible Roofs
- API RP 651 Cathodic Protection of Aboveground Storage Tanks
- API RP 652 Lining of Aboveground Petroleum Storage Tank Bottoms
- API Std 850 API Standards 620, 650, and 653 Interpretations - Tank Construction and In-Service Inspection
- PN-EN 1990 (Eurokod) Basis of structural design
- PN-EN 1991-1-3 (Eurocode 3) Actions on structures. General – Snow loading
- PN-EN 1991-1-4 (Eurocode 1) Actions on structures. General – Wind actions
- Rozporządzenie Ministra Gospodarki z dnia 18 września 2001 r. w sprawie warunków technicznych dozoru technicznego, jakim powinny odpowiadać zbiorniki bezciśnieniowe i niskociśnieniowe przeznaczone do magazynowania materiałów ciekłych zapalnych - Dz.U. 2001 nr 113 poz.1211, z późniejszymi zmianami (Journal of Laws 2001 No. 113 item 1211)

- Rozporządzenie Ministra Gospodarki z dnia 21 listopada 2005 r. w sprawie warunków technicznych, jakim powinny odpowiadać bazy i stacje paliw płynnych, rurociągi przesyłowe dalekosiężne służące do transportu ropy naftowej i produktów naftowych i ich usytuowanie - Dz.U. 2005 nr 243 poz. 2063, z późniejszymi zmianami (Journal of Laws 2005 No. 243 item 2063)
- Rozporządzenie Ministra Gospodarki z dnia 22 stycznia 2008 r. w sprawie wymagań, którym powinny odpowiadać zbiorniki pomiarowe, oraz szczegółowego zakresu badań i sprawdzeń wykonywanych podczas prawnej kontroli metrologicznej tych przyrządów pomiarowych - Dz.U. 2008 nr 21 poz.125 (Journal of Laws 2008 No. 21 item 125)
- Rozporządzenie Ministra Gospodarki z dnia 16 kwietnia 2002 r. w sprawie warunków technicznych dozoru technicznego, jakim powinny odpowiadać zbiorniki bezciśnieniowe i niskociśnieniowe przeznaczone do magazynowania materiałów trujących lub żrących - Dz.U. 2002 nr 63 poz. 572 (Journal of Laws 2002 No. 63 item 572)

7 Record of changes

Rev.	Date	Description	Introduced by
0		This specification entirely replaces the former LOTOS Group S.A. standard No. PR 07 221 with the same title	B.Kowalewski
1	30-11-2013 (rev. 1)	Review, update, standardize and changes to the Standard within scope of order No. OK/990/2012	Editorial board coordinated by T.Wróbel
-	31-08-2015	Page layout corrections, no contents changes.	T. Wróbel