Contents

1 Subject of specification 2
2 Scope of validity 2
2.1 Deviations 2
2.2 Exclusions 2
3 Hierarchy of documents 2
4 Description 2
4.1 General requirements 2
4.2 Technical documentation 3
4.3 Loads acting on building structures 4
4.4 Combinations of loads 6
4.5 Materials 7
4.6 Basic criteria for designing and execution of building structures 7
5 Related documents 8
6 Standards and regulations 8
7 Record of changes 10

1 Subject of specification

This specification used in conjunction with other technical specifications of LOTOS Group S.A., establishes minimal requirements regarding designing and execution of steel and concrete structures.

2 Scope of validity

This specification shall be used when preparing both quotations and Purchase Orders concerning planned Grupa LOTOS S.A.new investments and modernizations.

It shall also be a base for preparation of other detailed specifications and quotations relevant for package units or other equipment deliveries.

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 SA. 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 SA or non-compliance with the referred documents / standards and obtain a written explanation from Grupa LOTOS SA.

2.2 Exclusions

This specification does not include transportation structures (bridges, viaducts) as well as chimney stacks, which have been covered in separate study.

3 Hierarchy of documents

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 with GLSA
- Data Sheets approved by GLSA
- This specification
- Other Specifications
- Drawings and other documents
- Standards

4 Description

4.1 General requirements

Technical documentation of steel and concrete structures shall be prepared according to valid regulations and standards (which are listed in further part of this specification).

The specification deals also with additional requirements valid within Grupa LOTOS S.A.terrain.

If binding regulations and standards are imposing more stringent requirements than this specification, increasing safety, operational qualities and durability of structure, priority should be given to such requirements.

Completed stages of construction and erection works, as well as any elements that are covered in course of further works (excavations, reinforcement, steel structures delivery), require technical acceptance concluded with report of acceptance.

Introducing of changes in course of construction requires prior approval of project author, Orderer, as well as including them in as-built documentation.

4.2 Technical documentation

Technical documentation should be numbered on each stage according to documentation numbering procedure valid in LOTOS Group S.A.

Scope of documentation elaboration:

- building project (in order to obtain building permit)
- technical projects of objects (execution)
- workshop drawings
- as-built documentation

Required contents of building project:

- in accordance with Minister of Transport, Construction and Marine Economy order of April 27th 2012 (Rozporządzenie Ministra Transportu, Budownictwa i Gospodarki Morskiej z dnia 27kwietnia 2012r (Dz. U. poz. 462) w sprawie szczegółowego zakresu i formy projektu budowlanego z późniejszymi zmianami).

Required contents of technical projects (execution):

- technical description of structure
- static analyses (including statement of loads)
- dynamic analyses (for machinery load-bearing structures)
- catalogue sheets for system elements
- statements of steel used for reinforced concrete structures
- solutions of anti-corrosion, anti-vibration, fungi-proofing, anti-noise protections, as well as other protective measures, including environment protection.
- drawings:
  - situational
  - structural designs or execution drawings for structural designs of objects, including:
    - plans for excavations protections, water pumping, etc.,
    - structural designs of foundations and waterproof insulation,
    - projects of basic structural elements as well as other load carrying elements and covers,

- projects of independent elements of structure, such as: foundations for machines and process equipment along with acoustic and anti-vibration protections
- loading platforms, stairs, umbrella roofs, tanks, chimney stacks, etc.,
- projects of supporting structures, load carrying structures and other, related to basic technology, transport technology, storage, reloading, warehousing, services (auxiliary facilities), etc.,
- possibly assembly projects of structural members, thermal insulation, facades, woodwork, metalwork, etc.

- formwork (plans of shuttering)
- concrete reinforcing,
- assembly – erection of steel structures
- details of structures and joints
- preliminary statement of structural steel shapes
- orders regarding protections (corrosion, fire)
- drawings or designs connected with alteration of underground utilities system or liquidation of building objects interfering with building object or project.

Workshop drawings of steel structures:

Elaboration of workshop documentation comes within Contractor's duties, however they should be approved by author of static analyses prior to being directed for production.

Scope of elaboration:

- assembly and erection diagrams
- elements of structure
- calculations of joints
- Material estimate of structural steel including connections

As-built documentation:

As-built documentation includes the full set of assembly and workshop drawings, with plotted in changes that have been introduced during manufacturing, assembling and execution of building structures.

4.3 Loads acting on building structures

Building structures are subjected to influence of sets and combinations of following loads:

- static loads
- variable (climatic loads, dynamic loads, live loads, superimposed loads, etc.) loads
- accidental loads.

Values of loads result from weights of equipment and pipelines as well as orders contained in valid standards.

Essential comments to be utilised for statements of loads are given in subject specification, namely:

- Static loads
  Static loads are made up of real weights of all fixed components of structure and process equipment located on these structures, as well as weight and thrust of ground.
- Equipment weight load
  The following variants of loads should be taken into consideration in structural analyses:
  - weight of empty equipment
  - operational weight, i.e. weight of equipment together with weight of filling during unit operation
  - weight during hydrostatic test (if such test will be done)

If more than one equipment is based on specific supporting structure, then in static and strength analyses one should assume hydrostatic test for single device only, while the remaining are empty or in operation.

- Minimum characteristic values of superimposed loads:
  - operating platforms - 2,50 kN/m2
  - repair platforms - 5,00 kN/m2
  - staircases - 5,00 kN/m2
  - horizontal load of railings - 0,30 kN/m
  - concentrated load on platforms - 1,5 kN (0,1 x 0,1 m)
- Equipment loads
  Equipment loads (tanks, overhead cranes, hoists, etc.) should be each time individually set on the grounds of their technical characteristics.
  Additionally, effect of impact should be taken into account in analyses, by increasing loads at least by 30%.
- Maintenance loads (heat exchange bundle pull loads)
  During designing stage of foundations or structures supporting heat exchangers, one should take into consideration longitudinal (horizontal) forces resulting from pulling out of inserts (jointly with impact effect), in amount of 100% of specific insert weight.
- Friction loads
  Vertical forces resulting from thermal displacement of equipment should be determined with assumption of the following friction factors:
  - teflon versus teflon 0,08
  - steel versus steel - 0,30
  - steel versus concrete 0,50
- Vehicle loads
  Action of motor vehicles on building structures (excluding communication objects) should be taken into account by including the following loads into analyses:
  - on direct contact of vehicle with a structure: wheel load in amount of 50,0 kN
  - in remaining cases: uniformly distributed load in amount of 15.0 kN/m^2.

- Ground load
  Load on buildings sunk in ground should include weights of pavement, overlay, as well as ground thrust and uplift pressure of underground water.
- Snow load should be determined basing on valid standard for IIIrd zone.
  For umbrella roofs and non-heated buildings the load should be increased by 20%.
- Wind load should be determined with assumption of IInd zone according to valid standard. Additionally one should assume: terrain of A type (few obstacles).

Dimensions of equipment (vessels, exchangers) being assumed for wind action area determination, should be increased by 0,50 m (in order to allow for fittings and pipelines).

Wind load on pipeline bunch on pipe racks should be determined with assumption of outer diameter for insulation of largest pipe. Determined load should be increased by 15% (wind action on remaining pipelines).

- Temperature load

  In course of building structures designing it is necessary to allow for temperature influence. Design temperature difference is equal to ± 30°C in relation to temperature of structure assembly t_o = 10°C.
  If temperature of specific structure exceeds 70°C, then design strength of material should be reduced.
  Climate temperature influence can be omitted if length of object or expansion joints spacing will not exceed the following distances:

  - concrete walls: 5,0 m
  - reinforced concrete walls: 20,0 m
  - reinforced concrete frameworks: 30,0 m
  - steel frameworks: 120,0 m

- Dynamic loads
  For foundations and supporting structures of machines, inducing forces should be determined (which in turn are taken for determination of vibrations amplitudes as well as for checking of resonance state according to below listed standard).
- Accidental loads
  If there exists a possibility of such loads occurrence, as for example:

  - vehicle impact
  - equipment failure
  - non-uniform ground settlement, etc.,

  then they should be taken into account in analyses of ultimate limit state of structure.

4.4 Combinations of loads

Combinations of loads should be determined depending on considered limit state of structure work (ultimate or serviceability).

One should assume such set of static loads, dynamic loads and possibly accidental loads, which is the most disadvantageous for structure work, namely:

Item	Type of load	State of structure work				Remarks
		assembly	test	operation	maintenance	
1	dead weight of structure	•	•	•	•	
2	weights of equipment and pipelines dead-weights	•		•	•	
	operational			•		
	during hydrostatic test		•			
3	friction forces			•		
4	superimposed loads			•	•	
5	snow loads			•		
6	wind loads	•	•	•	•	
`7	temperature loads			•		
8	ice loads			•	•	
9	ground (burden) loads		•	•	•	Depending on construction type
10	vehicle loads	•		•	•	
11	machine loads	•		•	•	
12	maintenance loads				•	
13	accidental loads	•		•	•	

4.5 Materials

Classes of construction materials (concrete, steel, shaped steel, bolts) which are recommended for building structures should be adjusted to occurring loads (combinations of loads).

4.6 Basic criteria for designing and execution of building structures

Foundations for equipment and structures should be settled on depth of at least 1,00 m below ground surface.

Foundations should not be located directly on underground installations and facilities. Protections (protective tubes, etc.) should be used when necessary.

For deep settled foundations, and those settled below ground water level, it is necessary to prepare method of excavations securing.

For structures endangered with direct influence of chemical agents, it is necessary to design adequate protective insulation.

Equipment or structures that are based on foundations must be anchored according to orders given in PN-B-03215 standard.

Minimum distances from anchor bolt axis to foundation edge are:

- for foundations of structures and pumps: 150 mm
- for foundations of columns: 300 mm

Support places of structures and equipment on foundations should be filled with grout. For grouting one should use mortars of adequate strength and anti-shrinkage properties.

Structures over roads and rail tracks must ensure maintaining of adequate clearance gauges, clearance gauge over main roads should be 5,50 m.

All works executed on Grupa LOTOS S.A. terrains, should be led in accordance with Minister of Infrastructure order of February 6th 2003, on health and safety at work during execution of construction works (Journal of Laws N° 47 pos. 401 of 2003)

5 Related documents

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

6 Standards and regulations

List of relevant standards valid in course of designing and execution of building structures:

- Standards regarding loading of building:

PN-EN 1991-1-1:2004	Actions on structures – Densities, self-weight and imposed loads
PN-EN 1991-1-3:2005	Actions on structures– Snow loads
PN-EN 1991-1-4:2008	Actions on structures – Wind actions
PN-EN 1991-1-5:2005	Actions on structures – Thermal actions
PN-EN 1991-1-7:2008	Actions on structures – Accidental actions
PN-EN 1991-3:2009	Actions on structures – Actions induced by cranes and machinery
PN-EN 1991-4:2008	Actions on structures – Silos and tanks

- Standards regarding designing and execution of structures:

PN-EN 1992-1-1:2008	Design of concrete structures – Common rules for building and civil engineering structures
PN-EN 1992-1-2:2008	Design of concrete structures – Common rules – Structural fire design
PN-EN 1992-3:2008	Design of concrete structures – Silos and tanks
PN-EN 1993-1-1:2006	Design of steel structures – General rules and rules for buildings
PN-EN 1993-1-3:2008	Design of steel structures – General – Cold formed thin gauge members and sheeting
PN-EN 1993-1-5:2008	Design of steel structures – Plate griders.
PN-EN 1993-1-8:2006	Design of steel structures – Design of joints
PN-EN 1993-1-9:2007	Design of steel structures – Fatigue strength
PN-EN 1993-3-1:2008	Design of steel structures – Towers and masts
PN-EN 1993-4-1:2009	Design of steel structures – Silos

PN-EN 1993-5:2009	Design of steel structures – Piling
PN-EN 1993-6:2009	Design of steel structures – Crane supporting structures
PN-EN 1994-1-1:2008	Design of composite steel and concrete structures – General – Common rules and rules for buildings
PN-EN 1994-1-2:2008	Design of composite steel and concrete structures – General – Structural fire design
PN-EN 1996-1-1:2010	Design of masonry structures – General – Rules for reinforced and unreinforced masonry.
PN-EN 1996-1-2:2010	Design of masonry structures – General – Structural fire design
PN-EN 1996-3:2010	Design of masonry structures –Simplified calculation methods for masonry structures
PN-EN 1997-1:2008	Geotechnical design – General rules

- Standards regarding materials:

PN-EN 10025	-	Hot rolled products made of non-alloy constructional steels
PN-ISO 6935-1	-	Concrete reinforcing steel, smooth bars
PN-ISO 6935-2	-	Concrete reinforcing steel, ribbed bars
PN-EN 206-1	-	Concrete
PN-EN 288-1	-	Requirements regarding welding technology
PN-EN-ISO 4016	-	Bolts
PN-EN-ISO 4034	-	Nuts
PN-EN-ISO 7091	-	Washers

7 Record of changes

No.	Date	Description	Introduced by
0		This specification entirely replaces the former Grupa LOTOS S.A.standard No. PR 07 510 with the same title.	Miłosz Puzio
1	17-11-2006	Change in item 3.5	Miłosz Puzio
2	27-11-2009	Change item 3.6, 4 –actualization of the nomenclature and legal status. Change item 3.3 - actualization of the snow loads zone	Miłosz Puzio
3	30-11-2013 (rev.3)	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