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**TECHNICAL
SPECIFICATION
DSF-SPC-CIV-009**

Doc No: DSF-SPC-CIV-009

Rev. 1

Page 1 of 12

HIGH PRESSURE (HP) TRANSMISSION SYSTEMS

STRUCTURAL STEEL WORK

JUNE 2021

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Rev. 1

Page 3 of 12

Table of Contents

1	SCOPE	4
2	REFERENCES	4
3	ACRONYMS	5
4	MATERIALS	6
5	PROTECTIVE COATINGS	7
6	FABRICATION.....	9
7	HANDLING OF SHOP-PAINTED STEELWORK.....	9
8	INSPECTION AND TESTING	10
9	FIREPROOFING.....	11
10	QUALITY ASSURANCE	11



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DSF-SPC-CIV-009**

Doc No: DSF-SPC-CIV-009

Rev. 1

Page 4 of 12

1. SCOPE

This specification covers the minimum requirements for the design, where required, shop detailing, fabrication, coating and inspection of structural steel works.

2. REFERENCES

2.1 REFERENCE DOCUMENTS

- Tech Spec No DSF-SPC-MEC-012[Fire Proofing]

2.2. REFERENCE CODES AND STANDARDS

- EN 14731 [Welding Co Ordination. Tasks Responsibilities]
- EN 1011-2 [Welding Recommendations for Welding of Metallic Materials. Arc Welding of Ferritin Steel]
- EN 1991 (Eurocode 1) [Actions of Structure]
- EN1993 (Eurocode 3) [Design of Steel Structures]
- EN 10025 [Hot rolled products of structural steel. General technical delivery conditions.]
- EN 10034 [Structural Steel I and H Sections. Tolerances On Shape And Dimensions.]
- EN 10055 [Hot rolled steel equal flange tees with radiused root and toes - Dimensions and tolerances on shape and dimensions]
- EN 10056-1 [Structural Steel Equal and Unequal Leg Angles. Dimensions]
- EN 10058 [Hot Rolled Flat Steel Bars and Steel Wide Flats for General Purposes. Dimensions and Tolerances On Shape and Dimensions.]
- EN 10279 [Hot Rolled Steel Channels Tolerances On Shape, Dimensions, Mass.]
- EN 10163 [Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections]



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Doc No: DSF-SPC-CIV-009

Rev. 1

Page 5 of 12

- EN 10240 [Internal and/or external protective coatings for steel tubes - Specification for hot dip galvanized coatings applied in automatic plants]
- EN 13479 [Welding, Consumables. General Product for filler metals and fluxes for fusion welding of metallic materials]
- EN 14122-1 [Safety of machinery -- Permanent means of access to machinery -- Part 1: Choice of fixed means and general requirements of access]
- EN 14399 [High Strength Structural Bolting Assemblies for Preloading]
- EN 1461 [Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods]
- EN 20273 [Fasteners - Clearance holes for bolts and screws]
- EN 20898-2 [Mechanical Properties of Fasteners. Nuts with Specified Proof Load Values. Coarse Thread.]
- EN ISO 898-1 [Mechanical Properties of Fasteners made of Carbon Steel and Alloy Steel. Bolts, screws and studs with specified property classes. Coarse thread and fine pitch thread]
- EN ISO 3834-1 [Quality Requirements for Welding. Fusion Welding of Metallic Materials. Guidelines for Selection and Use.]
- EN 8504[reparation of steel substrates before application of paints and related products. Surface preparation methods. Abrasive blast cleaning]
- EN 1090[Structural Steel]
- ISO 888 [Fasteners-Bolts-Screws-Studs- Nominal Lengths.]
- EAK-2003 ΦEK 781B/18.06.2003[Greek Seismic Design Code 2003]

3. ACRONYMS

DN	Nominal Diameter
PN	Nominal Pressure Rating
NG	Natural Gas
PED	Pressure Equipment Directive



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Rev. 1

Page 6 of 12

4. MATERIALS

4.1 STRUCTURAL STEEL

Structural steel profiles shall be according to the relevant European Standards:

- ELOT EN 10034[Beams and Columns]
- ELOT EN 10279[Channels]
- ELOT EN 10056[Angles]
- ELOT EN 10055[Tees]
- ELOT EN 10058[Plates]

Structural and miscellaneous steel including anchor bolts shall be Grade S275JR according to EN 10025, or higher.

Grating shall be galvanized steel welded, non-skid grating. Bearing bars shall be 30 x 3 mm, mesh 30 x 50 mm. Min design load 500 kg/m². High strength steel bolts shall be 10.9 or 8.8 (ELOT EN ISO 898-1). Bolts for minor connections shall be 4.6 such as ladders, pipe supports, handrails, purlins, girts and grating clips (ELOT EN ISO 898-1). Minimum design load shall be 5.0 KN/m² or 1.5kN point load. Maximum permitted deflection of grating under the above loads shall be limited to $l/200$ or 4mm, whichever is less.

All bolts, nuts and washers shall hot dip galvanized in conformance with EN ISO 10684. Embedded anchor bolts shall be galvanised or otherwise they shall have a 3mm corrosion allowance applied on nominal diameter. The maximum allowable stresses to steel elements due to the load combinations shall be in accordance with ELOT EN 1993 (Eurocode 3) and the Greek Seismic Design Code 2003.



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Rev. 1

Page 7 of 12

4.2 PLATFORMS AND STAIR STEPS

Access ways shall have a minimum width of 750 mm. All operating and service platforms shall have a minimum width of 1000 mm. Stair landing shall be a minimum of 750 mm in the direction of the stairways.

Stair steps shall be manufactured from welded rectangular bar anti-slip steel grating to the specifications of section 4.5 above.

Steps shall include carrier plates minimum 3 mm thick or carrier angles of the same minimum thickness. Steps shall have anti slip chequered plate no sings.

Stair steps shall be hot-dip galvanised in accordance with EN ISO 1461. Damage of the protective galvanised coating during erection and site welding or cutting shall be repaired by the Contractor with at least two coats of cold-applied galvanising paint.

4.3 FIXED VERTICAL LADDERS

Ladders shall be provided with landings not more than 9 m height intervals. Where landings are provided, the ladder shall be placed "vice versa" continuously. A safety cage shall be provided when the flight of the ladder exceeds 3m or where ladders are near by a platform edge or handrails to prevent of falling hazards. Safety swing gates (safety chains are not acceptable) shall be provided at every ladders entrance.

All steel components shall be hot-dip galvanised in accordance with EN ISO 1461. Damage of the protective coating during erection and site welding or cutting shall be repaired by the contractor with at least two coats of cold-applied galvanising paint.

5. PROTECTIVE COATINGS

All steelwork and minor metalworks shall be delivered shop-painted or shop-coated. Painting, coating or finishing of steel elements on site, except repairs of damaged coating, shall generally not be allowed unless written permission is obtained from the Client. Painting system shall be designed and specified



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Doc No: DSF-SPC-CIV-009

Rev. 1

Page 8 of 12

by the Contractor in compliance with this specification and shall be submitted for Client's approval prior to steelwork fabrication.

Where successive coats have to be applied, a different colour shade shall be used for each coat. Colour of the finish coat shall be according to Architectural design and Client approval.

5.1 SURFACE PREPARATION

Steel surfaces to be coated shall be thoroughly dry and cleaned from dust, oil, grease, dirt, rust, weld deposits and loose paint.

Prior to application of any coating system steel surfaces shall be blast-cleaned according to EN ISO 8504.

Coating application shall commence as soon as possible after surface preparation in order to prevent rust formation on the exposed steel surface. For the same reason sandblasted steel surfaces shall be protected from humidity and water until application of primer or hot-dip galvanising.

5.2 HOT DIP GALVANISING

Where hot dip galvanising is specified for steel members, it shall be performed in compliance to the provisions of EN ISO 1461 and EN ISO 14713.

Minimum coating thickness for hot-dip galvanized steelwork shall be 85µm.

5.3 PAINTING

Where fireproofing of steelworks or metalworks is not required, or where hot dip galvanising is not specified, all steelwork and minor metalworks shall be shop-painted for corrosion protection and architectural purposes.

Painting will be executed indoors in a dry environment protected from wind. Painting of steelwork will not take place when the ambient or steel temperature is lower than 5°C, or



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Doc No: DSF-SPC-CIV-009

Rev. 1

Page 9 of 12

when the ambient or steel temperature is higher than 35°C. Application of painting shall not be permitted when ambient humidity exceeds 75%. Application of painting shall not be permitted if the surface temperature of the steel substrate to be painted, is less than 3 degrees °C, above the Dew point.

Paint application may be by spray, brush or roller according to paint manufacturer instructions. In any case full surface coverage shall be ensured. The final surface shall have uniform colour and texture and shall be free from runs/sags, brush marks, and blistering.

6. FABRICATION

6.1 CUTTING AND PREPARATION FOR WELDING

Cutting and preparation for welding shall conform to EN 1090 and the requirements specified herein.

Members to be joined by welding shall be cut accurately to size. The edges of the member shall be sheared, flame cut or machined to suit the type of welding.

Contact faces of steel members shall be prepared in such a way that full contact is ensured after assembly. The cut surfaces shall expose sound metal free from defects. Slag on flame cut surfaces shall be removed prior to welding. Surfaces to be welded shall be free from rust, paint, grease, and other foreign matter except for special primers designed for welding.

7. HANDLING OF SHOP-PAINTED STEELWORK

Following the application of any paint coat, and until the paint is completely cured, surfaces shall be protected from dust. Care shall be exercised during loading, transportation and erection of painted steelwork to avoid any damage to the body of paintwork.

The Contractor is required to implement protective measures and appropriate care during the transport, storage and erection of painted steel structures.



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Rev. 1

Page 10 of 12

Coatings shall be sufficiently dry before handling and members shall be lifted at designated lifting points or by using lifting brackets where available. The use of lifting chains in contact with coated steel is preferred to webbing slings as the former cause only minimal damage that is normally easy to rectify. Single lift shall be used unless specially designed multi-lift cradles are available.

The loading of trailers shall be carefully planned, with timber supports positioned, where possible, in uncoated contact areas (e.g. areas to receive bolted connections). Where contact of supports with coated areas is unavoidable, members shall be supported on their toes to minimise the contact area.

Where site storage can not be avoided, similar care shall be taken in the handling and support of the coated steel using the same lifting and support points as those used in transportation. Possible members shall not be stacked and water ponding shall be avoided using localised protection, where necessary. The Contractor, Site Representative and Operatives shall be made fully aware of the importance of good handling practice and storage areas shall be roped off with signage, clearly explaining the need to avoid contamination and mechanical damage to the coating finishes.

Similar care shall be taken during the erection phase, with any lifting activities making use of strategically positioned holes, lifting lugs and brackets etc to minimise damage to the body of the paintwork.

8. INSPECTION AND TESTING

Fabrication of steelworks and metalworks, including welding, preparation for welding, painting and surface preparation for painting shall be supervised by a qualified Engineer.

Fabricated steelworks shall comply to EN 1090. All testing required for conformance to this specification shall be Contractor' responsibility and shall be performed at Contractor's cost.

The work shall be inspected by the Contractor at the place of fabrication. Inspection on Client's behalf may be done at the shop or on site, by Client's representatives or certified 3rd party inspector.



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Doc No: DSF-SPC-CIV-009

Rev. 1

Page 11 of 12

Contractor shall issue and submit for Client's approval a detailed Test & Inspection Plan in accordance with EN 1090. All inspection and testing undertaken and associated corrections shall be documented.

9. FIREPROOFING

The fireproofing design shall be performed as per ELOT EN 1993 (Eurocode 3), Part 1-2: Supplementary rules for structural fire design.

The thermal and mechanical loads shall be obtained from ELOT EN 1991 (Eurocode 1), Part 2-2: Actions on structures exposed to fire.

In addition, the fireproofing of steel structures shall follow the principles specified in Job Specification DSF-SPC-MEC-012 for "Fireproofing" while the thickness of fireproofing material specified in this specification shall be regarded as the minimum one.

10. QUALITY ASSURANCE

It is Contractor's responsibility to properly complete quality forms, which are applicable for the execution of said works, in accordance with the specifications and applicable standards.

After completion of works, the relevant quality forms and certificates shall be submitted to the Client's Representative for approval and acceptance of the works.

Client's representatives shall have the right to review all the relevant documentation and audit the relevant quality procedures, as considered necessary, in order to ensure that the quality system is functioning satisfactorily.

The whole package of quality records shall be part of the final documentation package of this project and shall be checked by the Client's Representative.



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Page 12 of 12