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## TECHNICAL SPECIFICATION

Doc No: DSF-SPC-CIV-010

Rev. 1

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# HIGH PRESSURE (HP) TRANSMISSION SYSTEMS

## STEEL FABRICATION DETAILS

JUNE 2021

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### **1. SCOPE**

This specification covers the minimum requirements for the designs, shop detailing, fabrication, inspection, supply and erection of structural steel, where is appropriate.

### **2. REFERENCES**

#### **2.1 Reference Codes and Standards**

- EN ISO 14731 [Welding Co-Ordination Tasks and Responsibilities]
- EN 1011 [Welding]
- EN 10056-1 [Structural Steel Equal and unequal leg Angles]
- EN 10058 [Hot Rolled Flat Stainless Steel]
- EN 10279 [Hot Rolled Steel Channels]
- EN 13479 [Welding Consumables]
- EN 14399 [High Strength Structural Bolting Assemblies for preloading]
- EN 892-2 [Mechanical Properties of Fasteners]
- EN 898-1 [Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel]
- EN ISO 3834 [Quality Requirements of Welding]
- EN 1991 [Eurocode1-Basis of Design and Actions on Structures]
- EN 1993 [Eurocode3-Design of Steel Structures]
- EAK 2003 [Ελληνικός Αντισεισμικός Κανονισμός-Hellenic Anti-Seismic Regulation]

### **3. DESIGN AND CONSTRUCTION**

#### **3.1 Materials**

Reference Technical Specification for Structural Steel Materials shall be DSF-SPC-CIV-009, Chapter 4.



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### **3.2 Details of Construction Requirements**

For welded truss-work shall be used working lines not greater than 15mm of the offset to the gravity axis of the member.

On welded trusses, splices to ship the largest possible section as shop assembled units shall be detailed. Splices for bolted joints shall be detailed also. Field welding shall not be used for splices unless shown and noted specifically on the arrangement drawing.

Grating shall be banded at all ends and cut outs. All banding bars shall be of the same size as the bearings bars. Grating shall be fastened to supporting members by bolts and clip assemblies designed not to protrude above the deck elevation. At least two grating hold down clips shall be installed at each end of a grating section.

Grating penetrations for pipes, electrical, etc, shall be as follows:

- Field cut, but do not band, all holes smaller than 200 mm in diameter.
- Shop cut and band all holes 200 mm in diameter and larger.
- For holes greater than 400 mm in diameter, split grating and band.

In general, the grating shall be carried out according to the requirements of DIN24537.

Gratings out of no corrosion resistant metallic materials receive a galvanizing as corrosion protection system.

All platforms, including circular platforms, ladders and cages shall be shop assembled including posts, handrail, mid-rail and toe plate, to the maximum extent permitted by shipping limitations.

Where shipping limitations prevent the shop attachment of handrail assemblies to platforms, both straight and bent sections of top rail, mid-rail, toe plate and posts shall be supplied in shop fabricated assemblies for field bolting to platform steel resulting in minimum field work.



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### **4. SHOP CONNECTIONS**

Generally, shop connections shall be welded. For galvanized steel, welding shall be done prior to galvanizing.

All welds shall be in accordance with latest revision of the relevant European Standards. In particular, ELOT EN 13479, EN 3834, EN 719 14731 shall be complied.

### **5. FIELD CONNECTIONS**

Field connections shall be made with high strength steel bolts, except for the following minor connections where unfinished bolts shall be used or where field welding is indicated on the arrangement drawings:

- Removable handrail and ladder cage assemblies and attachments to structures.
- Removable floor plate or structural members.
- Purling and girds.
- The minimum size of bolts shall be 16 mm diameter.
- Field connections using high strength bolts shall be bearing type connection.
- No friction type connection shall be used unless approved by the Owner.
- Where field welding is required, the Fabricator shall provide erection clips as required.
- All field welding shall be indicated on the erection drawings.

Overages on field bolts shall be 5% on both high strength steel and unfinished bolts, Hardened washers, including bevel washers, shall be provided where required.

### **6. PROTECTIVE COATINGS**

Galvanizing, painting and other coatings shall be used as protective coatings.

### **7. FIREPROOFING**

Fireproofing shall be noted F.P. on the arrangement drawings and on erection drawings.

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

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



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In addition, the fireproofing of steel structures shall follow the principles shown in Technical Specification DSF-SPC-MEC-012 for "Fireproofing" where the thickness of fireproofing material shown in this specification shall be regarded as the minimum necessary.

### **8. FABRICATORS DRAWINGS**

Erection plans shall be drawn by the Fabricator with erection marks shown thereon in letters at least 3 mm high. Reproductions of Owner Arrangement drawings shall not be used as erection plans. Any deviation from the above shall be made only with the written consent of Owner.

Each structure shall have an index sheet to the steel details. On small jobs, the index may be added into the erection plan, where convenient.

An Erector's bolt list specifying the number, size, type of connector, grip and ordered length of connector for each connection shall be furnished by the Fabricator. This listing shall be broken down by categories and tiers, as outlined below.

Beam to column connections. Beam to beam connections. Column splices. Bracing to column connections. Bracing to beam connections e.t.c. A summary of all field connectors by size and length shall also be included.

Where a standard bill of material form is not an integral part of the detail drawing, separate bills of material listing all main material and fittings with space for convenient "weighing up" of the structure shall be furnished by the Fabricator. Profiles tolerances shall comply with ELOT EN 10056-1, ELOT EN 10055.

### **9. ERECTION MARKING SYSTEM**

The first letter of the mark shall be the prefix letter assigned to a particular structure and noted as such on the arrangement drawing.

The second letters of the mark shall indicate the type of structural framing in accordance with the table below. There shall be a dash between the first and second letters of the mark. The Fabricator shall use:

"B" - for rolled beams and channels.

"C" - for column, post, or strut not designated by a coordinate system on the



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arrangement drawing. Where a column is given with a coordinate the coordinate must be used as the mark.

- "D" - for vertical bracing of skewed bracing.
- "F" - for frames shipped in one piece.
- "G" - for girts.
- "H" - for hangers.
- "K" - loose gussets.
- "L" - ladders safety cages, or lintels.
- "M" - for bolsters, shims, and miscellaneous material.
- "P" - for floor plates, plain or checkered.
- "R" - for hand failing and rail posts.
- "S" - for sag rods.
- "T" - for trusses.
- "X" - for horizontal bracing.
- "BK" - for brackets.
- "BP" - for loose base plates or bearing plates.
- "CS" - for casing plates.
- "HB" - for header box on heaters.
- "PG" - for plate girders.
- "SS" - for stair stringers.
- "TB" - for trolley beams.
- "TS" - for tube sheets on heaters.

Beam marks shall be painted on beams at the same and as they are shown on this plan view of the Fabricator's framing plan. The numerical portion of the beam mark shall identify the floor or tier thus: beam 1 to 199 on first or lowest tier, beams 200 to 299 on 2nd tier, 300 to 399 on third tier, e.t.c. On a structure having one or both dimensions over 30 m. in plan view, all erection marks shall be suffixed with the derrick suffix letter shown on the arrangement drawing.

All unsymmetrical beams, girders, or trusses, shall have a direction painted on one end, preferably north or east.

All members to be marked "top", where possibility of erecting the member inverted exists.





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All columns to have the mark painted on the outside face of the flange and marked "North" or "East".

Column marks shall carry a tier suffix for spliced columns. On vertical bracing the mark shall be painted on the lower end.

Where a member is shipped in two or more pieces, each piece shall have a different mark. The use of R or L suffixes for opposite hand marks will not be permitted.

Examples of typical marks for a structure prefixed "A" is given below :

A-B402,        Beam 402 in 4th tier.

A-D-6(0-2)    Column at coordinate D-6, from grade to 2nd tier.

A-D6,         Vertical brace (note no hyphen between C & 6).

A-C1-NW,     Column 1 (not coordinated since no hyphen between C & 1), with derrick suffix NW (northwest) for a large square structure.

A-G17, B,     Girt 17 in a long structure with derrick suffix B.

All marks shall be painted on the steel in legible fashion, with letters and numerals a minimum of 37 mm high.

All rods, turnbuckles, clevises, etc, are to tagged and marked with the tag wired firmly to the member.

All bolts, washers, etc shall be shipped in kegs or crates and tagged or clearly marked as to size, diameter, and length.

On duplicate units, color coding shall be used where called for on the arrangement drawing. Where color coding is required, the Fabricator shall paint a one inch wide band all around each member at one end, including kegs, or crates, etc., in the color designated by the arrangement drawing.

Galvanized members shall be tagged with a metal plate having raised letters so that the mark shall be visible after galvanizing. This metal plate shall be tack-welded to the member prior to galvanizing. The Fabricator may submit alternate proposal for marking galvanized members, subject to the Owner's Engineer written approval.



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### **10. INSPECTION**

The material and workmanship covered in this Specification shall be subject to inspection in the field or shop by a qualified Inspector. However, such inspection shall not relieve the Contractor of his responsibility to furnish materials and workmanship in accordance with the contract requirements.

The Inspector shall have the option to make, but shall not be limited to, the following types of tests and inspections, at Fabricator expenses.

Determine chemical composition of steel. Determine mechanical properties of steel.

Inspect shop-fabricated structural steel members and assemblies for conformance with the requirements specified. Inspection of shop assembled.

Make inspection of shop welds as follows:

- Visual inspection of all shop welds.
- Liquid penetrant inspection.
- Magnetic particle inspection.
- Radiographic testing.
- Ultrasonic testing.

### **11. SHIPMENT**

All shipments, including partial shipments, shall be accompanied by sufficient bolt or connectors of the proper size and length to suit the material shipped with each shipment.

Prior to shipment, the Fabricator shall transmit the necessary detail drawings.

Ladders with ladder cages, handrails, platforms and trusses shall be shop assembled as permitted by shipping limitations and with assurance of no damage.

### **12. ERECTION REQUIREMENTS**

All steel erection shall be carried out without delay in a first class workmanlike manner. The Construction Contractor shall plumb level, thoroughly fasten, brace and guy the structure before welding or bolting starts so as to keep it plumb and true during erection.