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شركة المنشآت ثلاثية الأبعاد المحدودة

SPACE STRUCTURES Company Ltd.

Technical Specifications
for the ME-SSP Space Frame System

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1.0 GENERAL

1.01 Description Of Work:

Furnish all materials required to provide the design, structural engineering, fabrication and erection of an integrated space enclosure system comprising of steel space frame structure and integrated roofing system in accordance to the plans and specification of the project.

1.02 Technical References :-

A - Steel Codes and Standards :-

Comply with appropriate provision of the following except as otherwise Indicated :-

1. AISC "Code of Standard Practice for Steel Buildings and Bridges "
2. AISC" Specifications for Architecturally Exposed Structural Steel"
3. AISC "Specifications for Design, Fabrication and Erection of Structural Steel for Buildings" including the "Commentary " and Supplements as issued.
4. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts "
5. ASCE/ SEI 7-10: Minimum design loads for buildings and other structures.
6. IBC: International building code of international code council (ICC).
7. SBC 301: Saudi building code requirements; loading and forces.
8. ANSI/AISC 360-10: Specification for Structural Steel Buildings.
9. AISC 2005: Steel construction manual.
10. ACI-318/318M-08: Building code requirements for structural concrete.
11. ASTM A36/A36M: Standard specification for carbon structural steel.)
12. ASTM A53/A53M: Standard specification for pipe (welded and seamless).
13. SAES-A-112: Saudi Aramco Engineering Standard (metrological Data)
14. RCSC-04: Specification for structural joints using ASTM A325 or A490 Bolts.
15. 12-SAMSS-014 Pre-Engineering Metal Buildings
16. SAES-M-001 Structural Design Criteria for Non-Building Structures
17. SAES-M-100 Saudi Aramco Building Code
18. HCIS standards (SEC 01 – Security Gates)

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B - ASTM – American Society for testing and Materials

ASTM A 53	Pipe , Steel , Black and Hot Dipped , Zinc Coated Welded and Seamless
ASTM A 36	Structural Steel
ASTM A 123	Zinc [Hot Dip Galvanized] Coating on Iron and Steel Products
ASTM A 153	Zinc Coating [Hot Dip] on Iron and Steel fasteners
ASTM A 307	Carbon Steel Bolts and Studs 60000 PSI Tensile Strength
ASTM A 500	Cold Formed Welded and Seamless Carbon Steel Structure Tubing in Rounds and shapes
ASTM A 501	Hot Formed Welded and Seamless Carbon Steel Structural Tubing.
ASTM A325M	Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength
ASTM F 436	Standard Specification for Carbon and alloy steel washers
ASTM A563M	Standard Specification for Carbon and Alloy Steel Nuts
ASTM F1554	Standard Specification for Anchor Bolts, Steel, 36, 55 and 105-ksi Yield Strength
ASTM A165	Practice for Liquid Penetrant Inspection method [DP test]
ASTM E709	Magnetic Particle Testing [MPI]

C - AWS- American Welding Society

AWS D1.1	Structural Welding Code steel

D - SSPC – Steel Structures Painting Council

SSPC SP 10	Near White Blast Cleaning

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1.03 - Design Criteria :

1. The actual live dead and superimposed loads as defined by the project drawings and specifications shall be used in the design of space frame structure. In the absence of such information, the space frame may be design for the following loading conditions:

   A. Dead load : Actual system self weight (space frame + purlins + covering)
   B. Live load : 60 kg / sq.m.
   C. Service load : as specified by client
   D. Wind load : as per ASCE 7-10
   E. Temperature :+-30 ^{o}C

   All loading specified in the project document documents must be transferred to the space frame through their respective joint connection unless otherwise required.

1.04 Submittals

A. Product Data: Submit the manufacturer's product information, specifications and installation instructions for all space framing components and accessories.
B. Structural Calculations: Prior to fabrication of space frame submit design calculations prepared in accordance with indicated design requirements and current design rules.
C. The engineering calculations shall include an illustrated geometrical layout of the structure identifying support positions, support types, system height and space frame modulation. Calculation shall also include a complete analysis of the system indicating member stresses and forces, modular displacement and deflection /ponding requirements together with axial load, shear load and member stresses envelope. Include analysis for wind and vertical load on members, frame connections to structural supports. Ensure that space frame supporting structure shall safely accommodate all the loads. Reactions and moments induced by the space frame analysis.
D. Submit computer structural analysis provided by space frame supplier, calculations shall be signed by an equivalent engineer and presented in an explanatory report.
E. Test Report: Submit certified Mill test reports covering the chemical analysis and physical properties for each type of steel used in the work.
F. Detailed shop drawings: Submit detailed shop drawings for fabrication, assembly and erection of all members and connections. Shop drawings shall clearly indicate the geometric layout of the space frame. They shall comprise of top, bottom diagonal members, sections, support and connection details and all other relevant connections details between space frame and adjacent building components like roofing.
G. Manufacturer and erectors qualifications.
H. ASTM A165 Practice for Liquid Penetrant Inspection method [DP test]
I. ASTM E709 Magnetic Particle Testing [MPI]

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1.05 Transportation Handling and Storage

A. Factory finished units shall be stored, handled and shipped in a manner that will provide unscratched and undamaged units delivered to the site.
B. Storage handling and shipping procedures shall be stringent as necessary to provide scratch free corrosion free and undamaged delivered units.
C. Label each stand to identify components and include detailed inventory in each stand/crate cross- referenced to component coding or identification system.

D. Store materials to provide easy access for inspection and identification.
E. Store materials off ground by using pallets, platforms or other supports . protect material against corrosion and deterioration.

1.06 Quality Assurance

A. For design of space framing members, comply with the requirements of EN ISO 9001 or the American Institute of space Construction's [AISC] " Specification for the Design, Fabrication and erection of steel structure for Buildings" for Design requirements and allowable stresses.
B. Welded Connections: Comply with the requirements of the American Welding Society [AWS] D1.1.
C. Erector's Qualifications: Space framing shall be erected by a firm that has not less than 5 years successfully experience in the erection of space framing similar to that required for the project.
E. Inspection and Testing: Testing and Inspection frame structure shall be done as per SSC ITP.

2.0 PRODUCT DESCRIPTION

2.01 Product Description :

a) Space frame Structures as primary support system for space enclosure, built up from steel tube member component joined at their ends with a bolted multi-directional connection system, in which members are connected directly to one another, without the use of a central hub component. A minimum of four bolts shall be used for connecting each member. Members shall be hermetically sealed by welding tube ends to prevent corrosion of tube interiors.

b) The roofing panel system shall be fully integrated with the space frame structure by means of intermediate structural components [purlins]. These purlins are joined to the space frame by special purlin stools located preferably at the joints where members meet one another.

c) The ME SSP Space Frame system is capable of providing adequate support mechanism for the installation of various systems, such as : single aluminum or steel corrugated sheeting , insulated sandwich panels, colored polycarbonate or Lexan sheeting. ME-SSP system also

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allows the attachment of fabrics, lighting systems and air conditioning ducts.

2.02 Manufacturer

A. Space frame system shall be Designed, Engineered and Manufactured by :-

SPACE STRUCTURES CO. LTD,
Al-Olaya Centre
Cross 21, Makkah Street,
Akhrabiyah, Al-Khobar
P.O.Box - 31738
Al-Khobar - 31952
Kingdom of Saudi Arabia
Tel : (03) 899 3999, 898 8313
Fax : (03) 898 8323 Email : info@yme.com.sa Web : www.spacestructures.com.sa

2.03 Material

a.) **Pipes and Tubing**
Pipe, Steel, Black and Hot-Dipped, Zinc-Coated
Pipes shall conform to ASTM A53M, Grade B, welded and seamless.
BS1387-85 class A1 or SASO SSA-1011

b) **Cold-Formed Carbon Steel Structural Tubing**
Tubing shall conform to ASTM A500, welded and seamless.

c) **End reducers**: Steel rods and connection elements are made of structural steel grade A/B ASTM A36 or equivalent.

d) **Bolts**: Conforming to ASTM A 325 specification, Nuts to ASTM A563 and Washers to ASTM F 436

e) **Anchor Bolts**, Steel: ASTM A 36 grade Bolts shall conforming to ASTM F1554.

2.04 Fabrication

A. All Welding must be performed at the shop. Exception: Possible site welding of interface supports or footing to support structure or columns.
B. All Shop welding must be performed by licensed fabricator with recognized welding certificate.
C. All field connections are made with bolts.
D. All fabricated parts are to be coded and tagged for easy identification in the field.

2.05 Finishing:

A. Hot-Dipped Galvanizing :

Where exposure conditions and project specifications require high durability, and long term protection from harsh environmental conditions, then hot-dipped galvanization is recommended for all structural space frame elements. This is achieved by :-

1. Drill a 1/4 inch (6 mm) hole near all member ends to allow interior protection of all sealed members.
2. Degrease all members to remove all surface oils.
3. Sand blast surface to near-white metal in accordance to SSPCSP 10 (Steel Structures Painting Council Specs.)
4. Within four hours of sand blasting hot-dipped in galvanizing tank at a slanted position to allow escape of hot air from inside and the full penetration of molten zinc to the interior of pipes.
5. All Steel structures shall be galvanized in accordance to ASTM A123 standard specification. For ASTM Bolts Galvanizing shall be accordance with ASTM A153M.
6. Allow to cool to natural temperature, clean all excess zinc from metal surfaces.

B – Powder Coating / Spray Painting of Members :-

Where specified, Epoxy powder coating is applied to the pre-treated steel surfaces in accordance to the following requirements:-

1. For steel surfaces, sandblasting is recommended prior to powder application; otherwise degreasing and cleaning by chemical agents as specified .
2. For galvanized surfaces, clean with warm water and apply zinc phosphating or chromate conversion.
3. Apply powder-coating as per manufacturer's recommendations and material specifications (eg. Corro-Coat PE series)
4. Spray Painting shall be in conformance with ME-SSP Painting Specification.

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3-0 INSTALLATION (ERECTION)

3.01 General

A. A qualified company certified by space frame manufacturer shall carry out installation works with considerable experience in installation of space frame systems.

B. Installation must proceed with space frame manufactures plans and specifications and under his direct technical guidance.

C. Comply with AISC specifications and code of practice, and any other regulations stipulated by the manufacturer of the space frame.

3.02 Field Assembly

A. Assembly shall be in strict accordance with space enclosure designers plans, specification and recommendations.
B. Structural bolt assemblies shall be tightened to a "snug-fit" condition plus a quarter turn, as defined by the "Specifications for Structural Joints Using ASTM A325 and A 490 Bolts."
C. Verify positioning of space frame as necessary, by appropriate line level and plumb measurements prior to permanent fasting, to insure erection of the completed structure within the required tolerances.
D. All metal panels shall be installed in strict accordance with manufacturers guidance and quality control procedures.

3.03 Cleaning

A. Deliver and maintain space enclosure system in a reasonably clean condition during and after completion of erection.
B. Touch-up damaged components, finish as required using compatible air-dry paint to match original finish.

3.04 Inspection

A. Erection supervisor will perform a final inspection on the space frame structure and roofing panel system on completion of installation to verify compliance with project plans and specifications.

3.05 Guarantee

The space frame manufacturer guarantees that the space frame system shall be free of any defect of finish and general workmanship for a period of ten years from the time of completion of erection.