SPECIAL SPECIFICATION

SECTION 05550S

STEEL STACKS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes design, fabrication and erection of steel stacks as shown on drawings.

B. Supply and installation of chemical resistant lining inside stacks.

C. Related Sections: Refer to the following sections for related work:

1. Division 3, Section "Cast-In-Place Concrete" for anchor bolt and reinforcing steel installation in concrete.

2. Division 9, Section "Painting"

3. Coated Stainless Steel Ductwork 15890-S.

1.02 REFERENCES

A. American Society of Testing and Materials (ASTM)

A36 Specification for Structural Steel

A307 Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

A325 Specification for High-Strength Bolts for Structural Steel Joints

C1107 Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

E94 Guide for Radiographic Testing

E142 Method for Controlling Quality of Radiographic Testing

E164 Practice for Ultrasonic Contact Examination of Weldments

E165 Practice for Liquid Penetrant Inspection Method

E709 Practice for Magnetic Particle Examination

B. American Society of Civil Engineers (ASCE)

Minimum Design Loads for Buildings and Other Structures

Specification for the Design of Cold-Formed Stainless Steel Structural Members.

C. American Institute of Steel Construction (AISC)

M020L LRFD Manual of Steel Construction

M021 ASD Manual of Steel Construction

D. American Concrete Institute (ACI)

318-99 Building Code Requirements for Reinforced Concrete

E. International Code Council

IBC 2000 International Building Code 2000

F. Steel Structures Painting Council (SSPC)

SP-1 Solvent Cleaning

SP-2 Hand-Tool Cleaning

SP-3 Power Tool Cleaning

SP-6 Commercial Blast Cleaning

G. American Welding Society (AWS)

D1.1 Structural Welding Code - Steel

1.03 DESIGN REQUIREMENTS

A. General: Design steel stacks to withstand loads from gravity, winds and seismic forces and to resist in-service use conditions that the stacks will experience without failure or loss of serviceability.

B. Material Options: Contractor has the option to furnish stacks constructed from either of the following materials:

1. Structural steel plates and shapes.

2. Stainless steel plates and shapes.

C. Design Criteria

1. Design stacks in accordance with IBC 2000 and design criteria referenced in IBC 2000.

2. Design structural steel stacks in accordance with AISC LRFD or ASD Manual.

3. Design stainless steel stacks in accordance with ASCE 8.

D. Design Loads

1. Dead Loads: Actual weight of components. Include tributary weight of ducts attached to stack.

2. Wind Loads: In accordance with ASCE 7-98. Basic wind speed = 96 mph. Importance factor I =1.0 for wind. Exposure C.

3. Seismic Loads: In accordance with IBC 2000. Site specific response accelerations: Ss = .607, S1 = .18. Site Class definition D, Stiff Soil profile. Seismic Use Group III (three), Seismic Imporance Factor Ie = 1.5. Seismic Design Category D. R = 3.

E. Configuration

1. Configuration shown on drawings is for seven free-standing stacks (reference drawings for stack heights). Contractor may submit alternate configuration that conforms to specified design criteria.

F. Anchorage

1. Design anchorage of stacks to foundation to conform to IBC 2000, including number, size and configuration of anchor bolts and development of anchor bolts in concrete foundation.

1.04 SUBMITTALS

A. General: Submit the following in accordance with conditions of Contract and Division 1, Section "Descriptive Submittal".

B. Product Data: Submit product data of manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

1. Structural steel and stainless steel (each type), including certified copies of mill reports covering chemical and physical properties.

2. Anchor bolts.

3. Unfinished threaded fasteners.

4. High-strength bolts (each type), including nuts and washers; including direct tension indicators if used.

4. Paint and coatings.

5. Interior lining system.

6. Nonmetallic shrinkage-resistant grout.

C. Material Safety Data Sheets (MSDS): Submit MSDS for steel (each type), anchor bolts, unfinished threaded fasteners, high-strength bolts (each type) including nuts and washers, paint, lining and nonmetallic shrinkage-resistant grout.

D. Shop Drawings: Submit shop drawings sealed by a Registered Professional Engineer, including complete details and schedules for fabrication and assembly of structural members.

1. Include details of cuts, connections, holes and other pertinent data. Indicate welds by standard AWS symbols and show size, length, and type of each weld.

2. Provide setting drawings, templates, and directions for installaton of anchor bolts and other anchorages to be installed.

E. Welder Certifications: Provide certification that welders to be employed in work have satisfactorily passed qualification test in accordance with AWS D1.1.

If recertification of welders is required, retesting will be Contractor's responsibility.

F. Test Reports: Submit test reports conducted on shop-and field-bolted and welded connections. Include data on type(s) of test conducted and test results.

G. Calculations: Submit complete design calculations stamped by a Registered Professional Engineer.

H. Qualifications: Submit manufacturer's qualifications.

I. Quality Control Manual: Submit Manufacturer's and Installer's quality control manual for installation and testing of interior lining.

J. Color Samples: Submit color samples of paint.

1.05 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following, except as otherwise indicated.

1. For structural steel stacks, AISC "Code of Standard Practice for Steel Buildings and Bridges" and AISC "Specifications for Structural Steel Buildings" including the "Commentary".

2. For stainless steel stacks, ASCE 8.

3. For welding, AWS D1.1.

B. Qualifications for Welding Work: Qualify welding procedures and welding operators in accordance with the requirements of AWS D1.1.

C. Designer Qualifications: A Registered Professional Engineer who shall perform complete design and review and stamp all calculations and shop drawings.

D. Manufacturer Qualifications: Firm regularly engaged in construction of steel plate structures of similar size for at least 5 years.

E. Manufacturer Qualifications: Firm regularly engaged in design and installation of chemical resistant linings of similar projects for at least 5 years. Installer shall be experts trained and approved by the manufacturer for the installation of the type of product to be used.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time so that work will not be delayed.

B. Storage materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packed materials from corrosion and deterioration. If bolts and nuts become dry or rusty, clean and lubricate before use.

C. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Metal Surfaces, General: For fabrication of work that will be exposed to view, use only materials that are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and applying surface finishes.

B. Structural Steel Shapes, Plates, and Bars: ASTM A36

C. Stainless Steel Plates and Shapes: ASTM A240, Type 304 stainless steel. Contractor may submit alternate alloy for approval.

D. Anchor Bolts: ASTM A307 or A36.

E. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular low-carbon steel bolts and nuts; provide hexagonal heads and nuts for all connections.

F. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:

1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A325.

2. Where indicated as galvanized, provide units that are zinc-coated, either mechanically deposited complying with ASTM B695, Class 50, or hot-dip galvanized complying with ASTM A153.

G. Electrodes for Welding: Comply with AWS Code.

H. Nonmetallic Shrinkage- Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107.

I. Exterior Paint for all Stacks and Interior Paint for Solvent and General Exhaust Stacks

1. Structural Steel Stacks

a. Prime coat and finish coat: Water borne acrylic, International Protective Coatings “Intercryl 520” or approved equal.

b. Provide different colors for prime and finish coats.

2. Stainless Steel Stacks

a. Provide factory mill finish with no exterior paint.

J. Interior Coating for Acid Exhaust Stacks: Self-vulcanizing, butyl rubber lining chemically bonded to steel substrate. Rubber lining shall be homogeneous material free from layer interfaces.

1. Structural Steel Stacks

a. Product: Vulcoferran 2206 as manufactured by SGL Carbon Groups's Corrosion Protection Business Unit, or approved equal.

b. Properties:

Thickness:	4 mm
Shore hardness A:	65±5
Tear Strength:	>725psi (5N/mm)
Elongation at break:	>300%
Peel Test:	>580psi (4N/mm)

2. Stainless Steel Stacks

a. Provide factory Teflon ETFE or Halar ECTFE coating on interior of stacks as directed by mechanical specification; Coated Stainless Steel Ductwork 15890-S. Interior stack coating shall be the same type as, awarded by contract, for acid exhaust ductwork.

2.02 FABRICATION

A. Shop fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items in accordance with criteria and as indicted on final shop drawings.

1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.

2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burns, and other defects.

B. Connections: Weld or bolt shop connections, as indicated.

1. Bolt field connections, except where welded connections or other connections are indicated. Do not use field welded connections where field welding would damage shop applied coatings.

C. High-Strength Bolted Connections: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A325 or A490 Bolts".

D. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.

E Tolerances:

1. Horizontal Joints in Stack Shell: Upper plate shall not project beyond the face of lower plate by more than 20 percent of lower plate thickness.

2. Vertical Joints in Stack Shell: Misalignment in completed vertical joints shall not exceed 1/16 inch.

3. Warping or bulging of plate shell to adjust for misalignment is forbidden.

2.03 SHOP PAINTING

A. General: Shop-paint components, except those members or portions of members not to be painted or to be embedded in concrete or mortar. Paint embedded steel that is partially exposed on exposed portions and intitial 2 inches of embedded areas only.

1. Do not paint surfaces to be welded or high-strength bolted with friction-type connections.

2. Apply 2 coats of paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish from first.

B. Surface Preparation: After inspection and before shipping, clean components to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Clean steel in accordance with SSPC as follows:

1. Structural Steel

SP-1 "Solvent Cleaning"
SP-2 "Hand-Tool Cleaning"
SP-6 "Commercial Blast Cleaning"

C. Exterior Paint on Structural Steel: Immediately after surface preparation, apply prime coat in accordance with manufacturer's instructions and at a rate to provide

dry film thickness of not less than 4.0 mils. Use painting methods that result in full coverage of joints, corners, edges and exposed surfaces.

D. Interior Coating: Surface shall be prepared and coating shall be installed in full compliance with Manufacturer's technical recommendations.

2.04 SOURCE QUALITY CONTROL

A. Materials and fabrication procedures are subject to inspection and test in mill, shop and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements. Promptly remove and replace materials or fabricated components that do not comply.

PART 3 - EXECUTION

3.01 ERECTION

A. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

B. Anchor Bolts: Furnish anchor bolts and other connectors required for securing stack to foundations.

1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.

C. Setting Bases and Bearing Plates: Clean concrete bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base plates.

1. Set base plates on wedges or other adjusting devices.

2. Tighten anchor bolts after stacks have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

3. Pack grout solidly between bearing surfaces and bases or plates to insure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

4. For proprietary grout materials, comply with manufacturer's instructions.

D. Field Assembly: Set stacks accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structures to within 2 inches of plumb.

2. Splice members only where indicated and accepted on shop drawings.

3. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

E. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in components. Cutting will be permitted only on secondary members that are not under stress, as acceptable to the SDR. Finish gas-cut sections equal to a sheared appearance when permitted. Comply with NFPA 51B for cutting processes.

F. Field Painting of Structural Steel:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

   Apply by brush or spray to provide minimum dry film thickness of 4.0 mils.

2. Apply finish coat to all exposed surfaces to provide minimum dry firm thickness of 4.0 mils.

3.02 QUALITY CONTROL

A. Sandia National Laboratories (SNL) may engage an independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.

1. Testing agency shall conduct and interpret tests, state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.

2. Provide access for testing agency to places where stack work is being fabricated or produced so required inspection and testing can be accomplished.

3. Testing agency may inspect stack at plant before shipment. SNL reserves the right, at any time before final acceptance, to reject materials not complying with specified requirements.

B. Correct Deficiencies in work that inspections and laboratory test reports have indicated are not in compliance with requirements. Perform additional tests, at Contractor's expense, as necessary to reconfirm any noncompliance of original work and to show compliance of corrected work.

C. Shop-Bolted and Field-Bolted Connections: Inspect or test in accordance with AISC Specifications.

D. Shop Welding and Field Welding: Inspect and test during fabrication for shop welding and during erection for field welding, of all components as follows:

1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.

2. Perform visual inspection of all welds.

3. Perform tests up to and including 100 percent of welds at SNL's option. Inspection procedures may include the following:

a. Liquid Penetration Inspection: ASTM E165.

b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not acceptable.

c. Radiographic Inspection: ASTM E94 and ASTM E142; minimum quality level "2-2T.

d. Ultrasonic Inspection: ASTM E164.

E. Acceptance criteria shall be as specified in AWS D1.1.

1. Final Inspection by lining manufacturer's representative shall include:

2. Test for imperviousness by the high-voltage testing method.

3. Visual examination for irregularities.

4. Acoustic testing to detect lack of bonding

5. Testing for Thickness of rubber lining.

F. Testing for Shore hardness.

END OF SECTION