

SG.8. UNAUTHORIZED EXCAVATION

Wherever, through neglect of the Contractor, the excavation is carried beyond or below the lines and grades as given by the Engineer or as shown on the plans, except as specified above, all such excavated space shall be refilled with such material and in such a manner, as may be directed by the Engineer, so as to insure the stability of the affected structure. Beneath all structures, space excavated without authority shall be refilled by the Contractor, at his own expense, with 2,000 psi concrete and as directed by the Engineer.

SG.9. DISPOSAL OF MATERIAL

Surplus excavated material, in excess of that required for backfilling and site grading as required by the plans, shall be disposed of by the Contractor at an approved landfill or at a site obtained by the Contractor and approved by the Engineer.

SG.10. REMOVAL OF WATER

The Contractor shall, during the excavation period and as long thereafter as the condition of the work may require, provide and maintain, in good operating condition, pumping equipment full adequate in capacity to promptly remove all water entering any excavation or other parts of the work.

All excavations shall be kept dry and water pumped or drained from the work shall be disposed of in such a manner as to prevent damage to adjacent property or to other work under construction. Any and all damage, of whatever nature, caused by dewatering the work shall be promptly repaired or remedied by the Contractor at his own expense. This shall include the cleaning and flushing of existing drainage pipe lines where such are used.

SG.11. MEASUREMENT AND PAYMENT

No separate measurement or payment will be made for this item.

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**SECTION MB**  
**METAL BUILDINGS**

MB.1      **SCOPE OF WORK**

Provide all materials and labor to design and construct the metal buildings, shed structures, and roofs as specified herein. Drawings and general provisions of the Contract, including Special Instructions and General Conditions of Agreement, and General Information Specification Sections, apply to this Section.

All metal roofs shall match the color provided by the Owner.

Building components specified herein include the following:

1. Structural framing.
2. Roof panels.
3. Wall panels.
4. Insulation.
5. Accessories and trim.

Seismic Requirements:

1. The building design/construction shall meet the following seismic requirements:
  - a. Seismic Design Category "A". Site soil Class "C".
  - b. The design spectral response acceleration in the short period range is  $S_s = 4.8\%$ . The design spectral response acceleration at a period of 1.0 second is  $s_1 = 2.1\%$ .

Specific Requirements:

1. Building members shall be designed to support future electrical conduits.
2. All fabricated steel primary structural members (columns, rafters, beams, base plates, etc.) shall be primer coated with an alkyd, corrosion-inhibiting, lead and chromate free primer complying with TT-P-664, latest revision after fabrication.

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MB.2      DEFINITIONS

Bay Spacing: Dimension between main frames measured normal to frame (at centerline of frame) for interior bays, and dimension from centerline of first interior main frame measured perpendicular to end wall (outside face of end-wall girt).

Building Length: Dimension of the building measured perpendicular to main framing from end wall to end wall (outside face of girt to outside face of girt).

Building Width: Dimension of the building measured parallel to main framing from sidewall to sidewall (outside face of girt to outside face of girt).

Clear Span: Distance between supports of beams, girders, or trusses (measured from lowest level of connecting area of a column and a rafter frame, or knee).

Eave Height: Vertical dimension from finished floor to eave (the line along the sidewall formed by intersection of the planes of the roof and wall).

Clear Height Under Structure: Vertical dimension from finished floor to lowest point of any part of primary or secondary structure, not including crane supports, located within clear span.

Terminology Standard: Refer to MBMA's "Low Rise Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

MB.3      SYSTEM PERFORMANCE REQUIREMENTS

General: Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior. Include primary and secondary framing, roof and wall panels, and accessories complying with requirements indicated, including those in this Article.

Metal Building System Design: Of size, spacing, slope, and spans indicated, and as follows:

1. Primary Frame Type: Provide the following:
  - a. Rigid Clear Span: Solid-member structural-framing system without interior columns.
2. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, as follows:
  - a. Provide primary frame, capable of supporting one-half of a bay design load, and end-wall columns.



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3. Secondary Frame Type: Manufacturer's standard purlins and the following girts:
  - a. Exterior-framed (flush) girts.
4. Eave Height: As indicated by nominal height on Drawings.
5. Bay Spacing: Manufacturer's standard.
6. Roof Slope: Manufacturer's standard.
7. Roof System: Manufacturer's standard lap seam roof panels with insulation.
8. Exterior Wall System: Manufacturer's standard field assembled insulated wall panels.

Structural Performance: Provide metal building systems capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Engineer metal building systems according to procedures in MBMA's "Low Rise Building Systems Manual."
2. Live Loads: Include vertical loads induced by the building occupancy. Include loads induced by maintenance workers, materials, and equipment for roof live loads.
  - a. Building Occupancy: As indicated.
3. Wind Loads: Include horizontal loads induced by a basic wind speed corresponding to building code requirements at Project site.
4. Collateral Loads: Include additional dead loads other than the weight of metal building system for permanent items such as mechanical systems, electrical systems, and ceilings.
5. Load Combinations: Design metal building systems to withstand the most critical effects of load factors and load combinations.
6. Deflection Limits: Engineer assemblies to withstand design loads with deflections no greater than the following:
  - a. Purlins and rafters generally require deflection limit of 1/360 of the span.
  - b. Girts: Horizontal deflection of 1/360 of the span.
  - c. Roof Panels: Vertical deflection 1/240 of the span.
  - d. Wall Panels: Horizontal deflection of 1/240 of the span.



7. Design secondary framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.

Thermal Movements: Provide metal building roof and wall panel systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120°F, ambient; 180°F, material surfaces.

Thermal Performance: Provide metal building roof and wall assemblies with the thermal-resistance values (R-value) as indicated.

Wind-Uplift Resistance: Provide roof panel assemblies that meet requirements of UL 580 for the following wind-uplift resistance:

1. Class 90.

#### MB.4 SUBMITTALS

Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of the following metal building system components:

1. Structural-framing system.
2. Roof panels.
3. Wall Panels.
4. Vapor retarders.
5. Trim and closures.
6. Doors.
7. Windows.
8. Accessories.

Shop Drawings: For the following metal building system components. Include plans, elevations, sections, details, and attachments to other Work.

1. For installed components indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

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2. Anchor-Bolt Plans: Include location, diameter, and projection of anchor bolts required to attach metal building to foundation. Indicate column reactions at each location.
3. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
4. Roof and Wall Panel Layout Drawings: Show layouts of panels on support framing, details of edge conditions, joints, panel profiles, corners, custom profiles, supports, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work.
5. Personnel Door Schedule: Provide schedule of doors and frames, using the same reference numbers as indicated on Drawings.
6. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2" per 12":
  - a. Gutters.
  - b. Downspouts.
  - c. Ventilators.

Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of the following products with factory-applied color finishes:

1. Roof panels.
2. Wall panels.
3. Trim and closures.
4. Doors.
5. Windows.
6. Accessories.

Product Certificates: Signed by manufacturers of metal building systems certifying that products furnished comply with requirements.

1. Letter of Design Certification: Signed and sealed by a qualified professional engineer registered in the State of Texas. Include the following:
  - a. Name and location of Project.
  - b. Order number.

- c. Name of manufacturer.
- d. Name of Contractor.
- e. Building dimensions, including width, length, height, and roof slope.
- f. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
- g. Governing building code and year of edition.
- h. Design Loads: Include dead load, roof live load, collateral loads, roof load, deflection, wind loads/speeds and exposure, and seismic zone or effective peak velocity-related acceleration/peak acceleration.
- i. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
- j. Building-Use Category: Indicate category of building use and its effect on load importance factors.
- k. International Accreditation Service (IAS) AC472: Include statement that metal building system and components were designed and produced in an IAS AC472 accredited facility by an IAS AC472 accredited manufacturer.

Manufacturer Certificates: Signed by manufacturers certifying that they comply with requirements. Include evidence of manufacturing experience.

Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, indicating the following current products comply with requirements.

#### MB.5 QUALITY ASSURANCE

Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal building systems that are similar to those indicated for this Project in material, design, and extent.

Manufacturer Qualifications: A firm experienced in manufacturing metal building systems similar to those indicated for this Project and with a record of successful in-service performance.

Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.



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Source Limitations: Obtain each type of metal building system component through one source from a single manufacturer.

Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, or in-service performance.

1. DO NOT modify intended aesthetic effects, as judged solely by Engineer, except with Engineer's approval. If modifications are proposed, submit comprehensive explanatory data to Engineer for review.

Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.3, "Structural Welding Code--Sheet Steel."

Regulatory Requirements: Fabricate and label structural framing to comply with special inspection requirements at point of fabrication for welding and other connections required by authorities having jurisdiction.

Structural Steel: Comply with AISC S335, "Specification for Structural Steel Buildings--Allowable Stress Design, Plastic Design"; or AISC S342, "Load and Resistance Factor Design Specification for Structural Steel Buildings," for design requirements and allowable stresses.

Cold-Formed Steel: Comply with AISI SG-671, "Specification for the Design of Cold-Formed Steel Structural Members," and AISI SG-911, "Load and Resistance Facet Design Specification for Steel Structural Members," for design requirements and allowable stresses.

Pre-Installation Conference: Conduct conference at Project site.

#### MB.6 DELIVERY, STORAGE, AND HANDLING

Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package roof and wall panels for protection during transportation and handling.

Handling: Unload, store, and erect roof and wall panels to prevent bending, warping, twisting, and surface damage.

Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight and ventilated covering. Store roof and wall panels to ensure dryness. DO NOT store panels in contact with other materials that might cause staining, denting, or other surface damage.

Protect plastic insulation as follows:

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1. DO NOT expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. DO NOT deliver plastic insulation materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

MB.7 PROJECT CONDITIONS

Weather Limitations: Proceed with installation only when weather conditions permit roof panel installation to be performed according to manufacturer's written instructions and warranty requirements.

Field Measurements: Verify metal building system by field measurements before metal building fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions for Foundations: Where field measurements cannot be made without delaying the Work, establish foundation dimensions and proceed with fabricating structural framing without field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.
2. Established Dimensions for Panels: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating roof and wall panels without field measurements, or allow for field-trimming panels. Coordinate roof and wall construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

MB.8 COORDINATION

Coordinate size and location of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in SECTION C - CAST-IN-PLACE CONCRETE.

MB.9 WARRANTY

General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

MB.10 MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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1. Varco Pruden
2. Behlen Mfg. Company
3. Butler Manufacturing Company
4. Ceco Building Systems
5. Crown Metal Buildings, Inc.
6. Mesco Metal Buildings
7. Star Building Systems
8. NUCOR
9. Tyler
10. Standard Structures
11. or Equal

MB.11 STRUCTURAL-FRAMING MATERIALS

Structural-Steel Shapes: ASTM A 36/A 36M or ASTM A 529/A 529M, primer coating with an alkyd, corrosion-inhibiting, lead and chromate free primer complying with TT-P-664, latest revision.

Steel Plate, Bar, or Strip: ASTMA529/A529M, ASTMA570/A570M, or ASTM A 572/A 572M; 50,000-psi minimum yield strength, primer coating with an alkyd, corrosion-inhibiting, lead and chromate free primer complying with TT-P-664, latest revision.

Steel Tubing or Pipe: ASTM A 500, Grade B; ASTM A 501; or ASTM A 53, Grade B.

Structural-Steel Sheet: Hot-rolled, ASTM A 570/A 570M, Grade 50 or Grade 55; hot-rolled, ASTM 568/A 568M; or cold-rolled, ASTM A 611, structural-quality, matte (dull) finish.

Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 50, with G60 coating designation; mill phosphatized.

Metallic-Coated Steel Sheet Pre-painted with Coil Coating: Steel sheet metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A 755/A 755M and the following requirements:

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.

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Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A; carbon-steel, hex-head bolts; carbon-steel nuts; and flat, unhardened steel washers:

1. Finish: Zinc plating, ASTM B 633.

High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers:

1. Finish: Zinc plating, ASTM B 633.
2. Direct-Tension Indicators: ASTM F 959, Type 325 or Type 490.
  - a. Finish: Zinc plating, ASTM B 633.

Anchor Rods, Bolts, Nuts, and Washers: As follows:

1. Unheaded Rods: ASTM A 36/A 36M.
2. Headed Bolts: ASTM A 307, Grade A; carbon-steel, hex-head bolts; and carbon-steel nuts.
3. Headed Bolts: ASTM A 325, Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
4. Washers: ASTM A 36/A 36M.

Primers: As selected by manufacturer for resistance to normal atmospheric corrosion, compatibility with finish paint systems, capability to provide a sound foundation for field-applied topcoats despite prolonged exposure, and as follows:

1. Primer: Manufacturer's standard, lead- and chromate-free, non-asphaltic, rust-inhibiting primer meeting FS TT-P-664. Color shall be red-brown.

MB.12      PANEL MATERIALS

Metallic-Coated Steel Sheet Pre-painted with Coil Coating: Steel sheet metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A 755/A 755M and the following requirements:

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
2. Surface: Manufacturer's standard stucco-embossed finish.

Panel Sealants: Provide the following:

1. Joint Sealant: ASTM C 920; one-part elastomeric polyurethane, polysulfide, or silicone-rubber sealant; of type, grade, class, and use classifications required to seal joints in panels and remain weathertight; and as recommended by metal building system manufacturer.

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2. Translucent Panel Sealant: Non-staining saturated polymer as recommended by manufacturer for sealing laps.

MB.13      INSULATION MATERIALS

Glass-Fiber-Blanket Insulation: Thermal insulation, complying with ASTM C 991, Type I, of 32 lb./1,000 sf. weight, thickness as required to meet R-value of R-19, with a flame-spread rating of 25 or less, and 2" wide, continuous, vapor-tight edge tabs.

Mineral-Fiber-Blanket Insulation: Thermal insulation combining glass or slag/rock-wool fibers with thermosetting resins, complying with ASTM C 665 and as follows:

1. Type I: Unfaced.
2. Type II: Faced on side with non-reflective vapor-retarder membrane.
  - a. Class A: Membrane-faced surface with a flame-spread rating of 25 or less.

Vapor-Retarder Facing: Complying with ASTM C 1136, with permeance not greater than the following when tested according to ASTM E 96, Desiccant Method:

1. Composition: Vinyl-faced, scrim-reinforced polyester, with permeance not greater than 0.02 perm.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. CGI Silvercote, Inc.
  - b. Lamtec Corporation
  - c. Mizell Bros. Company
  - d. Owens-Corning Fiberglas Corporation

Internal face of all roof and wall panels shall be insulated.

MB.14      MISCELLANEOUS MATERIALS

Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, non-corrosive, non-staining grout containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application, and with a thirty (30) minute working time.

Shop Primer for Unpainted Metal Surfaces: High Solidus Alkyd primer selected by manufacturer for compatibility with substrate. Comply with FS TT-P-664.

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MB.15      FABRICATION. GENERAL

General: Design components and field connections required for erection to permit easy assembly and disassembly.

1. Fabricate components in a manner that once assembled in the shop, they may be disassembled, repackaged, and reassembled in the field.
2. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
3. Fabricate framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Cold-formed members shall be free of cracks, tears, and ruptures.

Primary Framing: Shop-fabricate framing components to indicated size and section with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

1. Make shop connections by welding or by using high-strength bolts.
2. Join flanges to webs of built-up members by a continuous submerged arc-welding process.
3. Brace compression flange of primary framing by angles connected between frame web and purlin or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
4. Weld clips to frames for attaching secondary framing members.
5. All primary structural framing members shall be primer coated with an alkyd, corrosion-inhibiting, lead and chromate free primer complying with TT-P-664, latest revision after fabrication.

Secondary Framing: Shop-fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

1. Make shop connections by welding or by using non-high-strength bolts.

Tolerances: Comply with MBMA's "Low-Rise Building Systems Manual": Chapter IV, Section 9, "Fabrication and Erection Tolerances."

MB.16      STRUCTURAL FRAMING

Primary Framing: Manufacturer's standard structural primary framing system, designed to withstand required loads and specified requirements. Primary framing includes



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transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.

1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
  - a. Slight variations in span and spacing may be acceptable if necessary to meet manufacturer's standard, as approved by Engineer.
2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
3. Frame Configuration: Single gable.
4. Exterior Column Type: Tapered or uniform.
5. Rafter Type: Uniform depth for lean to, tapered or uniform depth at gable.

End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:

1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet; with minimum thickness of 0.0747".
2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; with minimum thickness of 0.0598".

Secondary Framing: Manufacturer's standard secondary framing members, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Fabricate framing from cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet pre-painted with coil coating, unless otherwise indicated, to comply with the following:

1. Purlins: C- or Z-shaped sections; fabricated from minimum 0.0598" thick steel sheet, built-up steel plates, or structural-steel shapes; minimum 2-1/2" wide flanges.
  - a. Depth: Required to meet deflection criteria.
2. Girts: C- or Z-shaped sections; fabricated from minimum 0.0598" thick steel sheet, built-up steel plates, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 45 to 50 degrees to flange and with minimum 2-1/2" wide flanges.
  - a. Depth: Required to meet deflection criteria.

3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from 0.0598" thick steel sheet, built-up steel plates, or structural-steel shapes; to provide adequate backup for both roof and wall panels.
4. Flange and Sag Bracing: Minimum 1-5/8" x 1-5/8" structural-steel angles, with a minimum thickness of 0.0598", to stiffen primary frame flanges.
5. Base or Sill Angles: Minimum 3" x 2" x 0.0747" zinc-coated (galvanized) steel sheet.
6. Purlin and Girt Clips: Minimum 0.0747" thick, zinc-coated (galvanized) steel sheet.
7. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from minimum 0.0747" thick, zinc-coated (galvanized) steel sheet.
8. Framing for Openings: Channel shapes; fabricated from minimum 0.0598" thick, cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings, and head, jamb, and sill of other openings.
9. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates, Alkyd Primed steel sheet; designed to withstand required loads.

Bracing: Provide adjustable wind bracing as follows:

1. Rods: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade D; or ASTM A 529/A 529M, Grade 50; 1/2-inch- diameter steel; threaded full length or threaded a minimum of 12-inches at each end.
2. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.
3. Rigid Portal Frames: Fabricate from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
4. Fixed-Base Columns: Fabricate from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
5. Cables: Wound steel cable of sufficient size required to withstand design wind loads.
6. Bracing: Provide wind bracing using any method specified above, at manufacturer's option.

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Bolts: Provide shop-painted bolts unless structural-framing components are in direct contact with roof and wall panels. Provide zinc-plated bolts when structural-framing components are in direct contact with roof and wall panels.

MB.17      ROOF PANELS

Lap-Seam Roof Panels: Fabricate from metallic-coated steel sheets pre-painted with coil coating, factory formed to provide 36" coverage, with raised trapezoidal major ribs at 12" O.C., and intermediate stiffening ribs symmetrically spaced between major ribs for full length of panel. Design panels for mechanical attachment to structure using exposed fasteners, lapping major ribs at panel edges. Comply with the following:

1. Material: Metallic-Coated Steel Sheet Pre-painted with Coil Coating
2. Yield Strength: 50 ksi.
3. Metal Thickness: 0.0239"
4. Panel Thickness: 1.250"

Roof Panel Accessories: Provide components required for a complete roof panel assembly including trim, copings, fasciae, mullions, sills, corner units, ridge closures, clips, seam covers, battens, flashings, gutters, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of roof panels, unless otherwise indicated.

1. Closures: Provide closures at eave and ridge, fabricated of same metal as roof panels.
2. Clips: Minimum 0.0625" thick, stainless steel panel clips designed to withstand negative-load requirements.
3. Cleats: Mechanically seamed cleats formed from minimum 0.0250" thick, stainless steel or nylon-coated aluminum sheet.

Exterior Finish: Apply the following coil coating to roof panels and accessories:

1. Fluorocarbon Coating: Factory applied Fluoropolymer 3-Coat Coating System: Manufacturer's standard 3-coat, thermo-cured inhibitive primer 0.2 mil dry film thickness, and thermo-cured fluorocarbon coating containing not less than 70% Kynar 500 resin, minimum 0.8 mil dry film thickness.
2. Color: Selected by Owner from full range of manufacturer's standard colors.

Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored backer finish, consisting of prime coat and wash coat with a total minimum dry film thickness of 0.5 mil.



MB.18      WALL PANELS

Uninsulated Wall Panels: Provide manufacturer's standard panels complying with the following:

1. Ribbed Panels: Fabricate from metallic-coated steel sheets pre-painted with coil coating, factory formed to provide 36-inch coverage. Design panels for mechanical attachment to structure using exposed fasteners, lapping major ribs at panel edges. Comply with the following:
  - a. Material: Metallic-Coated Steel Sheet Pre-painted with Coil Coating
  - b. Yield Strength: 50 ksi
  - c. Metal Thickness: 0.0239"
  - d. Panel Thickness: 1.250"

Wall Panel Accessories: Provide components required for a complete wall panel assembly, including trim, copings, mullions, sills, corner units, clips, seam covers, battens, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of panels.

1. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

Exposed Finish for Exterior Panels: Apply the following coil coating:

1. Fluorocarbon Coating: Factory applied Fluoropolymer 3-Coat Coating System: Manufacturer's standard 3-coat, thermo-cured inhibitive primer 0.2 mil dry film thickness, and thermo-cured fluorocarbon coating containing not less than 70 percent Kynar 500 resin, minimum 0.8 mil dry film thickness.
2. Color: Selected by Owner from full range of manufacturer's standard colors.

Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored backer finish, consisting of prime coat and wash coat with a total minimum dry film thickness of 0.5 mil.

MB.19      ACCESSORIES

General: Provide accessories as standard with metal building system manufacturer, and complying with the following:

1. Provide sheet metal accessories of same material and in same finish as roof and wall panels, unless otherwise indicated.

Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners

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with heads matching color of roof or wall sheets by means of plastic caps or factory-applied coating. Comply with the following:

1. Fasteners for Roof and Wall Panels: Self-drilling or self-tapping 410 stainless, aluminum, or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of panels.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

Flashing and Trim: Form from 0.0179" thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet pre-painted with coil coating (G90). Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent roof or wall panels.

1. Opening Trim: Minimum 0.028" thick steel sheet. Trim head and jamb of door openings, and head, jamb, and sill of other openings.
2. Colors, Textures, and Glosses: Metal building trim shall be the color provided by the Owner.

Closures: Closed-cell, laminated polyethylene; minimum 1" thick, flexible closure strips; cut or pre-molded to match roof and wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

Gutters: Form from 0.0179" thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet pre-painted with coil coating (G90). Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96" long sections, sized according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced 36" O.C., fabricated from same metal as gutters. Provide bronze, copper, or aluminum wire ball strainers at outlets. Finish gutters to match roof fascia and rake trim.

Downspouts: Form from 0.0179" thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet pre-painted with coil coating (G90); in 10 ft. long sections, complete with formed elbows and offsets.

#### MB.20 FINISHES, GENERAL

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are



acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

MB.21      SOURCE QUALITY CONTROL

Correct deficiencies in or remove and replace structural framing that inspections indicate DO NOT comply with requirements.

MB.22      EXAMINATION

Examine substrates, with Erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of metal building system.

1. Proceed with erection only after unsatisfactory conditions have been corrected.

Before erection proceeds, survey elevations and locations of concrete and masonry bearing surfaces, baseplates, and anchor bolts to receive structural framing. Verify compliance with requirements and metal building system manufacturer's tolerances.

MB.23      PREPARATION

Clean substrates of substances, including oil, grease, rolling compounds, incompatible primers, and loose mill scale, that impair bond of erection materials.

Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

MB.24      ERECTION

Erect metal building system according to manufacturer's written instructions and erection drawings.

DO NOT field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

Set structural framing in locations and to elevations indicated and according to AISC specifications referenced in this section. Maintain structural stability of frame during erection.

Align and adjust framing members before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Make adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.

Primary Framing and End Walls: Erect framing true to line, level, plumb, rigid, and secure. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist cure grout for not less than seven days after placement.



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1. Make field connections using high-strength bolts. Tighten bolts by turn-of-the-nut method.

Secondary Framing: Erect framing true to line, level, plumb, rigid, and secure. Fasten secondary framing to primary framing using clips with field connections using non-high-strength bolts. Hold rigidly to a straight line by sag rods.

1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
2. Locate and space wall girts to suit door and window arrangements and heights.
3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, exhaust fans, ventilators, and other penetrations of roof and walls.

Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.

1. Tighten rod and cable bracing to avoid sag.
2. Locate interior end bay bracing only where indicated.

Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to building structural frame.

#### MB.25 ROOF PANEL INSTALLATION

General: Provide roof panels of full length from eave to ridge when possible. Install panels perpendicular to purlins.

1. Field cutting by torch is not permitted.
2. Rigidly fasten eave end of roof panels and allow ridge end free movement due to thermal expansion and contraction. Pre-drill panels.
3. Provide weatherseal under ridge cap.
4. Flash and seal roof panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
5. Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
6. Use aluminum or stainless-steel fasteners for exterior applications and galvanized fasteners for interior applications.
7. Locate and space fastenings in true vertical and horizontal alignment.

8. Install ridge caps as roof panel work proceeds.
9. Locate panel splices over, but not attached to, structural supports. Stagger panel splices to avoid a four-panel lap splice condition.

Lap-Seam Roof Panels: Fasten roof panels to purlins with exposed fasteners at each lapped joint at location and spacing determined by manufacturer.

1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
2. Locate and space exposed fasteners in true vertical and horizontal alignment.
3. Provide sealant tape at lapped joints of roof panels and between panels and protruding equipment, vents, and accessories.
4. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps, and on side laps of nesting-type panels.
5. At panel splices, nest panels with minimum 6" end lap, sealed with butyl sealant and fastened together by interlocking clamping plates.

#### MB.26 WALL PANEL INSTALLATION

General: Provide panels full height of building when possible. Install panels perpendicular to girts.

1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Install panels with vertical edges plumb. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
2. Unless otherwise indicated, begin panel installation at corners with center of rib lined up with line of framing.
3. Field cutting by torch is not permitted.
4. Align bottom of wall panels and fasten with blind rivets, bolts, or self-tapping screws.
5. Fasten flashing and trim around openings and similar elements with self-tapping screws.
6. When two rows of panels are required, lap panels 4 in. minimum. Locate panel splices over structural supports.

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7. When building height requires two rows of panels at gable ends, align lap of gable panels over wall panels at eave height.
  8. Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
  9. Provide weather-resistant escutcheons for pipe and conduit penetrating exterior walls.
  10. Flash and seal wall panels with weather closures under eaves and rakes, along lower panel edges, and at perimeter of all openings.
  11. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as necessary for waterproofing. Handle and apply sealant and backup according to sealant manufacturer's written instructions.
  12. Use aluminum or stainless-steel fasteners for exterior applications and galvanized fasteners for interior applications.
  13. Locate and space fastenings in true vertical and horizontal alignment.

#### MB.27 INSULATION INSTALLATION

General: Install insulation concurrently with panel installation, according to manufacturer's written instructions and as follows:

1. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. DO NOT obstruct ventilation spaces, except for firestopping.
2. Tape joints and ruptures in vapor retarder and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

Blanket Insulation: Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation with both sets of facing tabs sealed to provide a complete vapor retarder. Comply with the following installation method:

1. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing members. Hold in place by panels fastened to secondary framing.

Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing members. Install layer of filler insulation over first layer to fill space formed by roof panel standoffs. Hold in-place by panels fastened to standoffs.



MB.28      ACCESSORY INSTALLATION

General: Install gutters, downspouts, ventilators and other accessories according to manufacturer's written instructions, with positive anchorage to building and weathertight mounting. Coordinate installation with flashings and other components.

Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft. with no joints allowed within 24" of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1" deep, filled with mastic sealant (concealed within joints).
3. Separations: Separate metal from incompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.

Pipe Flashing: Form flashing around pipe penetration and roof panels. Fasten and seal to roof panel as recommended by manufacturer.

MB.29      ERECTION AND LOCATION TOLERANCES

Structural-Steel Erection Tolerances: Comply with erection tolerance limits of AISC S303, "Code of Standard Practice for Steel Buildings and Bridges."

Roof Panel Installation Tolerances: Shim and align units within installed tolerance of 1/4" in 20 ft. on slope and location lines as indicated and within 1/8" offset of adjoining faces and of alignment of matching profiles.

Wall Panel Installation Tolerances: Shim and align units within installed tolerance of 1/4-inch in 20 feet on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

Door Installation Tolerances: Fit doors in frames within clearances specified in SDI 100.

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MB.30 CLEANING AND PROTECTION

Touchup Painting: Immediately after erection, clean, prepare, and prime or reprime welds, bolted connections, and abraded surfaces of prime-painted primary and secondary framing, accessories, and bearing plates.

1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
2. Apply compatible primer of same type as shop primer used on adjacent surfaces.

Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded surfaces of shop-painted primary and secondary framing, accessories, and bearing plates are included in SECTION PC - PROTECTIVE COATINGS.

Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

Roof and Wall Panels: Remove temporary protective coverings and strippable films, if any, as soon as each panel is installed. On completion of panel installation, clean finished surfaces as recommended by panel manufacturer and maintain in a clean condition during construction.

1. Replace panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

Doors: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

1. Protection Removal: Immediately before final inspection, remove protective wrapping from doors and frames.

Insulation: Tape all seams and any tears in vapor-retarder facing of insulation with tape of same material, color, and mil thickness as the vapor retarder.

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6. NACE International  
NACE Publication TPC2 Coatings and Linings for Immersion Service: Chapter 1 Safety, Chapter Surface Preparation, Chapter 3 Curing, and Chapter 4 Inspection  
NACE Standard SP0178 Standard Recommended Practice – Fabrication Details, Surface Finish Requirements and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service  
NACE Standard SP0188 Standard Recommended Practice – Discontinuity (Holiday) Testing of Protective Coatings  
NACE Standard RP0287 Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surfaces Using a Replica Tape  
NACE Standard RP0288 Standard Recommended Practice, Inspection of Linings on Steel and Concrete
7. OSHA (Occupational Safety & Health Administration)  
1915.35 Standards – 29 CFR – Painting
8. SSPC (Society for Protective Coatings)  
SSPC-SP2 Hand Tool Cleaning  
SSPC-SP3 Power Tool Cleaning  
SSPC-SP11 Power Tool Cleaning to Bare Metal  
SSPC-SP13 Surface Preparation of Concrete  
SSPC-PA-1 Shop, Field and Maintenance Painting  
SSPC-PA-2 Measurement of Dry Film Thickness with Magnetic Gages  
SSPC-PA-3 Guide to Safety in Paint Application  
SSPC-Guide 12 Guide for Illumination of Industrial Painting Project  
SSPC-VIS 1-89 Pictorial Surface Preparation Standards for Painting Steel Surfaces  
SSPC Paint Spec 36 Two Component Weatherable Aliphatic Polyurethane Topcoat, Performance-Based
9. SSPC/NACE Joint Standards  
SSPC-SP5/NACE 1 White Metal Blast Cleaning  
SSPC-SP6/NACE 3 Commercial Blast Cleaning  
SSPC-SP7/NACE 4 Brush-Off Blast Cleaning  
SSPC-SP10/NACE 2 Near-White Metal Blast Cleaning  
SSPC-SP13/NACE 6 Surface Preparation of Concrete
10. NAPF (National Association of Pipe Fabricators)  
NAPF 500-03-01 Solvent Cleaning  
NAPF 500-03-04 Abrasive Blast Cleaning for Ductile Iron Pipe

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NAPF 500-03-05     Abrasive Blast Cleaning for Cast Ductile Iron  
Fittings

The Engineer's decision shall be final as the interpretation and/or conflict between any of the referenced specifications and standards contained herein.

PC.3.     CONTRACTOR

The Contractor shall have three years practical experience and successful history in the application of specified product to surfaces of steel water tanks. Upon request, he shall substantiate this requirement by furnishing a list of references and job completions.

The Contractor shall submit with his bid a written statement by the coatings manufacturer stating that the Contractor is familiar with the materials specified and has workers capable of performing the work specified herein.

The personnel performing the work shall be knowledgeable and have the required experience and skill to adequately perform the work for this project, in accordance with SSPC-PA1, "Shop, Field and Maintenance Painting".

PC.4.     QUALITY ASSURANCE

General: Quality assurance procedures and practices shall be utilized to monitor all phases of surface preparation, application and inspection throughout the duration of the project. Procedures or practices not specifically defined herein may be utilized provided they meet recognized and accepted professional standards and are approved by the Engineer.

Mock-Up: Contractor shall schedule a meeting at the project site with the Engineer and coating supplier present. At this meeting the Contractor shall perform the required surface preparation on a 5' x 5' area on the tank(s) exterior and interior surfaces. The Engineer may require up to three additional mock-up areas be prepared at no cost to the Owner.

Surface Preparation: Surface preparation will be based upon comparison with: "Pictorial Surface Preparation Standards for Painting Steel Surfaces: SSPC-VIS 1-89", ASTM Designation D2200-95, "Pictorial Surface Preparation Standards for Painting Steel Surfaces", ASTM D 4417-91, Method A and/or Method C "Field Measurement of Surface Profile of Blast Cleaned Steel" or NACE Standard RP0287-87 "Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape". Surface preparation of concrete will be based on comparison with ICRI Technical Guideline 310.2-1997 comparators in conjunction with SSCP-SP13. In all cases the written standard shall take precedence over the visual standard. In addition, NACE Standard SP0178, "Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service", along with the Visual Comparator, shall be used to verify the surface preparation of welds.

Application: No coating or paint shall be applied when: 1) the surrounding air temperature or the temperature of the surface to be coated or painted is below the minimum surface temperature for the products specified herein, 2) rain, snow, fog or mist is present, 3) the surface temperature is less than 5F above the dew point, 4) the air temperature is expected to drop below



the minimum temperature for the products specified within six hours after application of coating. Dewpoint shall be measured by use of an instrument such as a Sling Psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychrometric Tables. If any of the above conditions are prevalent, coating or painting shall be delayed or postponed until conditions are favorable. The day's coating or painting shall be completed in time to permit the film sufficient drying time prior to damage by atmospheric conditions.

Coating Thickness: Thickness of coatings and paint shall be measured checked according to the procedures outlined in SSPC-PA 2 "Measurement of Dry Film Thickness with Magnetic Gages", May 2012 Edition. Dry film thickness shall be a Level 2 as defined in Paragraph 9.2, excepting that no single gage reading shall be less than 80% of the specified dry film thickness. Areas that fail to meet these criteria shall be corrected at no expense to the Owner. Use of an instrument such as a Tooke Gauge, precision groove grinder, etc. is permitted if a destructive test is deemed necessary by the Engineer and the total DFT is less than 50 mils.

Holiday (Pinhole) Testing: The integrity of coated surfaces scheduled for immersion shall be tested for holidays in accordance with NACE Standard SP0188. For dry films less than 20 mils, a non-destructive holiday detector shall not exceed 67.5 volts, nor shall destructive holiday detector exceed the voltage recommended by the manufacturer of the coating system. A solution of 1 ounce non-sudsing type wetting agent, such as Kodak Photo-Flo, and 1 gallon of tap water shall be used to perform the holiday testing. For coating thickness at 20 mils and greater, a high voltage Tinker & Rasor AP/W holiday tester shall be used. Contact coating manufacturer for voltage recommendations and curing parameters. All pinholes and/or holidays shall be marked and repaired in accordance with the manufacturer's printed recommendations and retested. No pinholes or other irregularities will be permitted in the final coating.

Inspection Devices: The contractor shall furnish, until final acceptance of coating and painting is accepted, inspection devices in good working condition for detection of holidays and measurement of dry film thickness of coating and paint. The Contractor shall also furnish U.S. Department of Commerce, National Bureau of Standards certified thickness calibration plates and/or plastic shims, depending upon the thickness gauge used, to test the accuracy of dry film thickness gauges and certified instrumentation to test the accuracy of holiday detectors. Dry film gauges and holiday detectors shall be made available for the Engineer's use at all times until final acceptance of application. Holiday detection devices shall be operated in the presence of the Engineer.

Inspection: Inspection for this project shall consist of 'hold point' inspections. The Engineer or his representative shall inspect the surface prior to abrasive blasting, after abrasive blasting but prior to application of coating materials, and between subsequent coats of material. Final inspection shall take place after all coatings are applied, but prior to placing the tank in service. Contractor will insure that sufficient rigging is in place so that the Engineer or his representative shall be able to conduct the required inspections.

Warranty Inspection: Warranty inspection shall be conducted during the eleventh month following acceptance of all coating and painting work. All defective work shall be repaired in accordance with this specification and to the satisfaction of the Engineer and/or Owner.



PC.5. SAFETY AND HEALTH REQUIREMENTS

General: In accordance with requirements set forth by regulatory agencies applicable to the construction industry and manufacturer's printed instructions and appropriate technical bulletins and manuals, the Contractor shall provide and require use of personal protective lifesaving equipment for persons working on or about the project site.

Head and Face Protection and Respiratory Devices: Equipment shall include protective helmets which shall be worn by all persons while in the vicinity of the work. In addition, workers engaged in or near the work during sandblasting shall wear eye and face protection devices and air purifying halfmask or mouthpiece respirators with appropriate filters. Barrier creams shall be used on any exposed areas of skin.

Ventilation: Where ventilation is used to control hazardous exposure, all equipment shall be explosion-proof. Ventilation shall reduce the concentration of air contaminants to a degree a hazard does not exist. Air circulation and exhausting of solvent vapors shall be continued until coatings have fully cured.

Sound Levels: Whenever the occupational noise exposure exceeds maximum allowable sound levels, the Contractor shall provide and require the use of approved ear protection devices.

Illumination: Adequate illumination shall be provided while work is in progress, including explosion-proof lights and electrical equipment. Whenever required by the Engineer, the Contractor shall provide additional illumination and necessary supports to cover all areas to be inspected. The level of illumination for inspection purposes shall be determined by the inspector.

Temporary Ladders and Scaffolding: All temporary ladders and scaffolding shall conform to applicable safety requirements. They shall be erected where requested by the Engineer to facilitate inspection and be moved by the Contractor to locations requested by the Engineer.

PC.6. PRODUCT DELIVERY, STORAGE & HANDLING

All materials shall be brought to the jobsite in original sealed containers. They shall not be used until the Engineer has inspected the contents and obtained data from information on containers or label. Materials exceeding storage life recommended by the manufacturer shall be rejected.

All coatings and paints shall be stored in enclosed structures to protect them from weather and excessive heat or cold. Flammable coatings and paints must be stored to conform with City, County, State and Federal safety codes for flammable coating or paint materials. At all times coatings and paints shall be protected from freezing.

PC.7. HOT DIP GALVANIZING

This section applies to all equipment items and related appurtenances specified to be hot dip galvanized, as described herein or as shown on the plans.

Galvanizing shall conform to the Standard Specifications of ASTM A-123, A-386-73, and A-120-72A, as applicable latest edition of Zinc (Hot-Galvanized) Coating on Structural Steel Shapes, Plates and Bars and their products. Zinc used for hot dipped galvanizing shall conform to ASTM Designation B-6-70. Galvanizing shall be performed after components are completely fabricated.

Pieces shall be fabricated in maximum sizes suitable for shipping and galvanizing. The equipment shall be designed and fabricated per ASTM A-143, A-384, and A-385 for bolt-together field assembly. No field welding on hot dipped galvanized equipment will be permitted.

Minor defects in the hot dipped galvanizing coating caused by shipping, handling or installation shall be repaired after equipment installation. The defects shall be thoroughly cleaned and wire brushed to remove all foreign substances, wiped clean with a suitable solvent, thoroughly dried, and coated with at least 3 mils of a zinc rich compound specifically formulated for touch-up galvanizing and conforming to USN Specification MIL-P-21035 or USAF Specification MIL-P-26915A.

All galvanized members delivered to the job site shall be stored by the contractor in a position whereby they are raised off the ground and separated with strip spacers to provide free access of air to all parts of the surface. Stored members shall also be inclined in such a manner as to give maximum drainage. Resinous wood may not be used for spacers or packing of hot dip galvanized members.

PC.8. GENERAL REQUIREMENTS

All materials shall be lead-free as defined by the Consumer Product Safety Act, Part 1303.

All zinc dust pigment contained in any zinc-rich material shall meet the requirements of ASTM D520 Type III as regards zinc content and purity.

All materials for the interior wetted portion of raw and treated water tanks and other equipment shall meet the requirements of ANSI/NSF Standard 61 for potable water contact.

No coatings shall contain Methylene Dianiline (MDA). All coatings, including all colors, shall be lead-free.

All catalyzed polyurethane products shall meet the minimum requirements of SSPC Paint Specification Number 36, Level 3 Performance Level.

No coating shall contain MOCHA.

Manufacturer's color charts shall be submitted to the Engineer at least 30 days prior to coating and/or paint application. General Contractor and Painting Contractor shall coordinate work so as to allow sufficient time (normally seven to ten days) for paint to be delivered to the job site.



PC.9. MATERIAL PREPARATION

- A. Mix and thin materials according to manufacturer's latest printed instructions.
- B. Do not use materials beyond manufacturer's recommended shelf life.
- C. Do not use mixed materials beyond manufacturer's recommended pot life.
- D. Do not split kits of multi-component products.

PC.10. SUBMERGED & INTERMITTENTLY SUBMERGED COATING SCHEDULE

The number of coats called for in this schedule shall be considered minimum. If more coats are required for complete coverage and uniform appearance, they shall be applied. Colors will be selected by the Owner from standard manufacturer's color samples.

**Interior of Ferrous Metal Tank:**

- 1. Surface Preparation Prior to Abrasive Blast Cleaning: Weld flux and spatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour. All welds shall be ground to a smooth contour as per NACE Standard SP0178, Designation D.
- 2. Surface Preparation: SSPC-SP10 Near-White Metal Blast Cleaning. Anchor profile shall be angular, 2.0 to 3.0 mils as per ASTM D 4417, Method C or NACE Standard RP0287.
- 3. Coating System:
  - First Coat: Tnemec Series 94-H2O Hydro-Zinc applied at 2.5 to 3.5 dry mils. Thin only with approved thinner, Tnemec 41-2 or 41-3 Thinner.
  - Stripe Coat: Tnemec Series 20-15BL Pota-Pox applied by brush and scrubbed into all weld seams. In addition to weld seams, all edges, corners, bolts, rivets, pits, etc. shall receive a stripe coat.
  - Second Coat: Tnemec Series 141-1255 Beige Epoxoline applied at 10.0 to 12.0 dry mils. Thin only with approved thinner, Tnemec 41-4 Thinner.

Total dry film thickness shall be a minimum of 13.0 mils.

PC.11. NON-SUBMERGED PAINTING SCHEDULE

The number of coats called for in this schedule shall be considered minimum. If more coats are required for complete coverage and uniform appearance, they shall be applied. Colors will be selected by the Owner from standard manufacturer's color samples.



**Exterior Exposed Ferrous Metal (Tank and other items):**

1. Surface Preparation Prior to Abrasive Blast Cleaning: Weld flux and spatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour. All welds shall be ground to a smooth contour as per NACE Standard SP0178, Designation D.
2. Surface Preparation: SSPC-SP6 Commercial Blast Cleaning. Anchor profile shall be 1.5 to 2.0 mils as per ASTM D 4417, Method C or NACE Standard RP0287.
3. Coating System:
  - First Coat: Tnemec Series 90G-1K97 Tneme-Zinc applied at 2.5 to 3.5 dry mils.
  - Stripe Coat: Tnemec Series 66HS Hi-Build Epoxoline applied by brush and scrubbed into all weld seams. In addition to weld seams, all edges, corners, bolts, rivets, pits, etc. shall receive a stripe coat.
  - Second Coat: Tnemec Series 66HS Hi-Build Epoxoline applied at 4.0 to 6.0 dry mils. (Application by brush or roller may require two coats to achieve specified film thickness.)
  - Third Coat: Tnemec Series 740 UVX applied at 3.0 to 5.0 dry mils. (Application by brush or roller may require two coats to achieve specified film thickness.)

Total minimum dry film thickness shall be 10.0 mils.

**Interior Exposed Structural & Miscellaneous Steel, Etc.:**

1. Surface Preparation Prior to Abrasive Blast Cleaning: Weld flux and spatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour. All welds shall be ground to a smooth contour as per NACE Standard SP0178, Designation D for Lap, Butt & Fillet Welds.
2. Surface Preparation: SSPC-SP6 Commercial Blast Cleaning. Anchor profile shall be 1.5 to 2.0 mils as per ASTM D 4417, Method C or NACE Standard RP0287.
3. Coating System:
  - First Coat: Tnemec Series 90G-1K97 Tneme-Zinc applied at 2.5 to 3.5 dry mils.
  - Second Coat: Tnemec Series 66HS Hi-Build Epoxoline applied at 4.0 to 6.0 dry mils.
  - Third Coat: Tnemec Series 66HS Hi-Build Epoxoline applied at 4.0 to 6.0 dry mils.

Total minimum dry film thickness shall be 10.5 mils.

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**Exterior Exposed Ductile Piping, Valves & Fittings:**

1. Surface Preparation:

- a. Clean all surfaces as per NAPF 500-03-01 Solvent Cleaning to remove all oil, grease, factory-applied tars and/or bitumastic coatings and all other soluble contaminants.
- b. Prepare ductile iron pipe as per NAPF 500-03-04 Abrasive Blast Cleaning for Ductile Iron Pipe providing a minimum 1.5 mil angular anchor profile.
- c. Prepare ductile iron valves and fittings as per NAPF 500-03-05 Abrasive Blast Cleaning for Cast Ductile Iron Fittings.
- d. If existing ductile is factory coated with Tnemec Series N140, please follow recoat windows listed on the current product data sheet.

2. Coating System:

First Coat: Tnemec Series 66HS Hi-Build Epoxoline applied at 6.0 to 8.0 dry mils.

Second Coat: Tnemec Series 66HS Hi-Build Epoxoline applied at 6.0 to 8.0 dry mils.

Third Coat: Tnemec Series 740 UVX applied at 3.0 to 5.0 dry mils.

Total minimum dry film thickness shall be 9.0 mils.

Basis of Payment: No direct payment will be made for painting as may be required under the various other items of these specifications, measurement and payment for labor, materials and equipment required to constitute the completed work, or any part thereof as specified, will be included in the price bid for the specific bid item where such labor, materials and equipment are required.

PC.12. GENERAL EXECUTION

All surface preparation, coating and painting shall conform to applicable standards of the Society for Protective Coatings, NACE International and the manufacturer's printed instructions. Materials applied to the surface prior to the approval of the Engineer shall be removed and re-applied to the satisfaction of the Engineer at the expense of the contractor.

All work shall be performed by skilled craftsmen qualified to perform the required work in a manner comparable with the best standards of practice. Continuity of personnel shall be coordinated with the Engineer.

The Contractor shall provide a supervisor at the work site during cleaning and application operations. The supervisor shall have the authority to sign and change orders, coordinate work and make decisions pertaining to the fulfillment of the contract.

Dust, dirt, oil, grease or any foreign matter that will affect the adhesion or durability of the coating or paint must be removed by washing with clean rags dipped in an approved cleaning solvent and wiped dry with clean rags.



Coating and painting systems include surface preparation, prime coating and finish coatings. Unless otherwise approved in writing by the Engineer, prime coating shall be field applied. Where prime coatings are shop applied, the Contractor shall instruct suppliers to provide the prime coat specified herein. Any off-site work which does not conform to this specification, is subjected to damage during transportation, construction or installation, shall be thoroughly cleaned and touched-up in the field as directed by the Engineer. The Contractor shall use repair procedures which insure the complete protection of all adjacent primer. The specified repair method and equipment may include wirebrushing, hand or power tool cleaning, or dry air blast cleaning. In order to prevent injury to surrounding painted surfaces, blast cleaning may require use of lower air pressure, smaller nozzle and/or abrasive blast particles, or shorter blast nozzle distances from surface shielding and masking. If damage is too extensive or uneconomical to touch-up, the entire item shall be blasted and then coated or painted as directed by the Engineer.

The Contractor's coating and painting equipment shall be designed for application of materials specified and shall be maintained in first class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air. Contractor's equipment shall be subject to approval of the Engineer.

Application of the first coat shall follow immediately after surface preparation and cleaning and stripe coat, if applicable, before rust bloom occurs or the same day, whichever is less. Any cleaned areas not receiving first coat within this period shall be recleaned prior to application of first coat. Use of dehumidification equipment shall be first reviewed by the Engineer and coatings manufacturer prior to deviating from this provision.

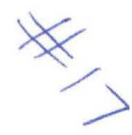
Prior to assembly, all surfaces made inaccessible after assembly shall be prepared as specified herein and shall receive the coating or paint system specified.

PC.13. SURFACE PREPARATION

The latest revision of the following surface preparation specifications of the Society for Protective Coatings (SSPC) shall form a part of this specification. The summaries listed below are for informational purposes; consult the actual SSPC specification for full detail.

1. Solvent Cleaning (SSPC-SP1): Removal of oil, grease, soil and other contaminants by use of solvents, emulsions, cleaning compounds, steam cleaning or similar materials and methods which involve a solvent or cleaning action.
2. Hand Tool Cleaning (SSPC-SP2): Removal of loose rust, loose mil scale and other detrimental foreign matter to degree specified by hand chipping, scraping, sanding and wirebrushing.
3. Power Tool Cleaning (SSPC-SP3): Removal of loose rust, loose mil scale and other detrimental foreign matter to degree specified by hand chipping, scraping, sanding and wirebrushing.



- 
4. White Metal Blast Cleaning (SSPC-SP5/NACE 1): Blast cleaning to a gray-white uniform metallic color until each element of surface area is free of all visible residues.
  5. Commercial Blast Cleaning (SSPC-SP6/NACE 3): The removal of all visible oil, grease, dirt, dust, mil scale, rust, paint, oxides, corrosion products and other foreign matter by compressed air nozzle blasting centrifugal wheels or other specified method. Discoloration caused by certain stains shall be limited to no more than 33% of each square inch of surface.
  6. Brush-Off Blast Cleaning (SSPC-SP7/NACE 4): Blast cleaning to remove loose rust, loose mil scale and other detrimental foreign matter degree specified.
  7. Near White Blast Cleaning (SSPC-SP10/NACE 2): The removal of all visible oil, grease, dirt, dust, mil scale, rust, paint, oxides, corrosion products and other foreign matter by compressed air nozzle blasting, centrifugal wheels or other specified method. Discoloration caused by certain stains shall be limited to no more than 5% of each square inch of surface area.
  8. Power Tool Cleaning to Bare Metal (SSPC-SP11): Power tool cleaning to produce a bare metal surface and to retain or produce a minimum 1.0 mil surface profile. This standard is suitable where a roughened, clean, bare metal surface is required, but where abrasive blasting is not feasible or permissible.
  9. Surface Preparation of Concrete (SSPC-SP13/NACE 6): Surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems.

Slag, weld metal accumulation and spatters not removed by the Fabricator, Erector or Installer shall be removed by chipping and/or grinding. All sharp edges shall be peened, ground or otherwise blunted as required by the Engineer. All grinding and finishing of welds, edges, etc. shall be performed prior to solvent cleaning and abrasive blasting. Welds shall be prepared as per NACE Standard SP0178 for all interior and exterior surfaces as specified in Section 2.0. Minimum acceptable level of finish shall be Designation "D" unless specified otherwise.

Concrete surfaces shall be abrasive blasted to produce a minimum surface profile of equal to 40 grit sandpaper with no loose concrete remaining. This preparation will be followed by vacuum cleaning to remove all dust, dirt or friable substances leaving clean, dust free surfaces for resurfacing. Concrete surfaces rubbed smooth shall not be considered an acceptably prepared surface.

1. Prepare concrete surfaces in accordance with manufacturer's instructions, SSPC-SP 13/NACE 6 and ICRI Technical Guideline 310.2-1997.

2. Allow concrete to cure for a minimum of 28 days.
3. Test concrete for moisture in accordance with ASTM D 4263 and F 1869.
4. Abrasive blast surface to remove laitance and solid contaminants and to provide clean, sound substrate with uniform anchor profile.
5. Fill holes, pits, voids, and cracks with Tnemec Series 218 MortarClad.
6. Ensure surfaces are clean, dry, and free of oil, grease, chalk, form release agents, and other contaminants.

Field blast cleaning for all surfaces shall be by dry method unless otherwise directed. Blast nozzles shall be venturi-type nozzles with a minimum pressure at the nozzle of 90 psi.

Particle size of abrasives used in blast cleaning shall be that which will produce a 1.5 – 3.0 mil (37.5 microns - 65.0 microns) surface profile or in accordance with recommendations of the manufacturer of the specified coating or paint system to be applied.

If the profile of the blasted steel exceeds the profile specified above, the Contractor shall be required to do one or both of the following:

1. Reblast the surface using a finer aggregate in order to produce the required profile.
2. Apply a thicker prime coat, if possible given the limitations of the products being applied, in order to adequately cover the blast profile

Abrasive used in blast cleaning operations shall be new, washed, graded and free of contaminants that would interfere with adhesion of coating or paint and shall not be reused unless specifically approved in writing by the Engineer.

During blast cleaning operations, caution shall be exercised to insure that existing coatings or paint are not exposed to abrasion from blast cleaning.

The Contractor shall keep the area of his work and the surrounding environment in a clean condition. He shall not permit blasting materials to accumulate as to constitute a nuisance or hazard to the accomplishment of the work, the operation of the existing facilities or to the surrounding environment.

Blast cleaned surfaces shall be cleaned prior to application of specified coatings or paint. All surfaces shall be free of dust, dirt, and other residue resulting from the abrasive blasting operation. No coatings or paint shall be applied over damp or moist surfaces.

All welds not scheduled to be abrasive blasted or finished by grinding or sanding with power tools as per SSPC-SP3 or SP11 shall be neutralized with a suitable chemical compatible with the specified coating or paint.



Pitted areas on ferrous metal scheduled for immersion shall be repaired by either filling with Tnemec Series 215 Surfacing Epoxy or Series FC22 Epoxoline (floors) or by welding. Epoxy filler shall be feathered smooth. No protrusions or spatter will be allowed. Pits deeper than 1/8" shall be filled by welding.

Specific Surface Preparation: Surface preparation for the specific system shall be as noted in Sections 2.04 and 2.05.

PC.14. APPLICATION, GENERAL

Coating and paint application shall conform to the requirements of the Steel Structure Painting Council Paint Application Specification SSPC-PA1, latest revision, for "Shop, Field and Maintenance Painting".

Thinning shall be permitted only as recommended by the manufacturer and approved by the Engineer.

Each application of coating or paint shall be applied evenly, free of brush marks, sags, runs, with no evidence of poor workmanship. Care shall be exercised to avoid lapping on glass or hardware. Coatings and paints shall be sharply cut to lines. Finished surfaces shall be free from defects or blemishes.

Protective coverings or drop cloths shall be used to protect floors, fixtures and equipment. Care shall be exercised to prevent coatings or paints from being spattered onto surfaces which are not to be coated or painted. Report to the Engineer surfaces from which materials cannot be satisfactorily removed.

When two coats of coating or paint are specified, where possible, the first coat shall contain sufficient approved color additive to act as an indicator of coverage or the two coats must be of contrasting color.

Film thickness per coat as specified in Sections 2.04 and 2.05 are the minimum required. If roller application is deemed necessary, the Contractor shall apply additional coats as to achieve the specified thickness.

All material shall be as specified.

PC.15. COATING SYSTEMS APPLICATION

After completion of surface preparation as specified for the specific system, materials shall be applied as noted in Sections 2.04 and 2.05.

Care shall be taken so as to eliminate overspray and dry spray. Where such conditions are encountered, the surface shall be cleaned of all over spray and dry spray prior to the application of the succeeding coat.



Areas rendered inaccessible after erection shall receive the full coating system prior to erection and/or assembly.

Structures Within One-Half Mile of Coast: Exterior surfaces that have been coated on a previous day shall be rinsed with clean potable water and allowed to dry before applying subsequent coat(s). Cleaned surfaces, which are not coated the day of cleaning shall be recleaned prior to applying coatings.

PC.16. COLOR SCHEME

The Engineer shall select colors for the project. The Contractor shall submit current charts of the manufacturer's available colors to the Engineer thirty (30) days prior to the start of coating and painting.

PC.17. SOLVENT VAPOR REMOVAL

All solvent vapors shall be completely removed by suction-type exhaust fans and blowers before placing closed structures in operating service.

All solvent vapors will be exhausted both during and after coating application as per AWWA D 102 to allow the proper curing of the coating material.

Ventilation shall be continued until such time as the coating has reached "full cure" as specified by the coating manufacturer.

PC.18. REPAIRS

After the interior coating system has been installed and holiday tested, repair pinholes and voids as follows:

1. Abrasive blasting shall be in accordance with SSPC-SP10/NACE No.2 Near White Blast Cleaning obtaining a minimal surface profile as specified herein.
2. Power tool cleaning shall be in accordance with SSPC-SP11 Power Tool Cleaning to Bare Metal. Surface profile shall be angular and not less than the surface profile as specified herein.
3. All edges of remaining sound, tightly adhering coating shall be feathered back (beveled) to create a smooth transition from the substrate to the coatings surface. The coating may be considered tightly adhering if an edge cannot be lifted with a dull putty knife.
4. Install the coating system as specified herein to provide a complete and monolithic system, free of voids and pinholes.

For exterior surfaces, repair as follows:

1. Hand or Power Tool Sand as per SSPC-SP2 or SP3 to remove the defect. In cases where the defect extends to the substrate, prepare the surface as per SSPC-SP11 Power Tool Cleaning to Bare Metal, obtaining a minimum anchor profile as specified herein.
2. All edges of remaining sound, tightly adhering coating shall be feathered back (beveled) to create a smooth transition from the substrate to the coatings surface. The coating may be considered tightly adhering if an edge cannot be lifted with a dull putty knife.
3. Install the coating system as specified herein to provide a complete and monolithic system, free of voids and pinholes.

PC.19. DISINFECTION

Disinfection to be excluded.

PC.20. CLEAN UP

Upon completion of the work, all staging, scaffolding and containers shall be removed from the site or destroyed in a manner approved by the Engineer. Coating or paint spots or oil stains upon adjacent surfaces shall be removed and the jobsite cleaned. All damage to surfaces resulting from the work of this section shall be cleaned, repaired or refinished to the satisfaction of the Engineer at no cost to the Owner.

SECTION FB  
FLEXIBLE BASE

FB.1.        DESCRIPTION

This section shall govern the placing and furnishing of a base course to be composed of crushed stone aggregate material. All work and material shall be in accordance with Texas Department of Transportation "2004 Standard Specification for Construction of Highways, Streets, and Bridges, Item 247, Flexible Base" except as otherwise stated herein.

FB.2.        TYPE AND GRADE

The flexible base supplied shall be Type A, Grade 1.

FB.3.        SOURCE

The flexible base source shall be approved by the Texas Department of Transportation and the County.

FB.4.        DENSITY

The flexible base shall be installed in 6" lifts maximum and compacted to 100% density by TEX 113E.

FB.5.        MEASUREMENT

No separate payment will be made for work covered under this section of the specifications and all costs in connection therewith shall be included in the contract price for the items to which the work pertains.

The costs of laboratory design tests and testing will not be paid for directly, but shall be considered subsidiary to the item of "Flexible Base".

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SECTION ER  
GENERAL EQUIPMENT REQUIREMENTS

ER.1.      GENERAL

The work included in this section of the specifications is applicable to all equipment specifications and related sections as noted. If this section is not consistent with the individual equipment sections, the individual equipment sections shall govern.

ER.2.      ANCHORAGE AND FASTENERS

1. Carbon steel fasteners shall be of A325 structural grade steel.
2. Stainless steel fasteners shall be AISI Type 304 stainless steel.
3. All installed anchor bolts shall be of the chemical injection type. Drill hole in existing concrete, hole diameter set by anchor bolt manufacturer for each size of bolt, insert stainless steel threaded rod and fill hole with Hilti "HIT" Hy150 injection adhesive.

ER.3.      EQUIPMENT DELIVERY, STORAGE AND HANDLING

All pieces shall be delivered in the largest pieces practical for field assembly by the Contractor. Individual pieces shall be permanently tagged with welded erection marks or stainless steel tags cross referenced with information on the manufacturer's erection and assembly drawings. Gear boxes, mechanical and electrical components shall be protected from the weather and suitably packaged to facilitate handling and storage. Special lubricating and rust preventative oils shall be provided to prevent internal corrosion of gear assemblies. All mechanical equipment shall be kept thoroughly dry at all times and shall be stored indoors.

All equipment stored on the job shall be protected and maintained in accordance with the manufacturer's recommendations. Electrical equipment must be stored in weatherproof, ventilated enclosures. Structural materials may be stored outdoors on pallets or other wooden supports provided there is proper support and drainage. Equipment shall not be allowed to contact the ground directly.

ER.4.      SHIPPING

Fabricated assemblies shall be shipped in the largest section permitted by carrier regulations, properly match-marked for ease of field erection.

ER.5.      SUBMITTAL DATA AND O&M DATA

Submittal Data and Operation and Maintenance Data for the items of equipment as specified herein shall be furnished in accordance with Section B of these specifications.

ER.6. INSTALLATION MANUALS

Installation Manuals containing complete information in connection with the assembly, operation, adjustment, maintenance, and repair of the equipment, and a detailed parts list with drawings or photographs shall be furnished in six (6) copies with each unit or part thereof.

ER.7. PATENT ROYALTIES

All royalties and fees for patents covering materials, articles, apparatus, devices, or equipment (as distinguished from processes) shall be included in prices quoted by equipment suppliers. Attention is directed to the requirements of the General Conditions concerning patents.

ER.8. LUBRICATION

Lubricants of the type recommended by the equipment manufacturer shall be furnished and applied by the Contractor. The Contractor shall certify that the equipment components have received the proper amount of recommended lubricant.

ER.9. EQUIPMENT INSTALLATION

The equipment shall be furnished complete by the manufacturer and shall be assembled, erected and installed by the General Contractor as directed by the manufacturer in his working drawings and written instructions. The installation, alignment, testing, and grouting (if applicable) shall be checked and approved by a factory representative before acceptance (as required in the individual equipment sections):

1. The manufacturer's representative shall inspect the completed installation, and assist the Contractor in aligning, start-up, and testing. The representative shall also instruct plant personnel in operation and maintenance of the equipment.
2. A written report shall be furnished by the equipment manufacturer and shall describe the representative's observations. This report shall describe in detail any deficiencies noted. All such deficiencies, whether by the manufacturer or Contractor, shall be corrected at no expense to the Owner.
3. Prior to final approval, the manufacturer shall submit a letter certifying that the installation meets all requirements of the manufacturer.

APPENDIX A  
GEOTECHNICAL REPORT



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**GEOTECHNICAL ENGINEERING  
REPORT**



**Paisano Drive Booster Station  
FM 2523 & Old Hamilton Road  
Del Rio, Texas  
Val Verde County**

**PSI Project No. 0312-1545**

**PREPARED FOR:**

**TRC  
505 East Huntland Drive, Ste. 250  
Austin, Texas 78752**

**August 31, 2017**

**BY:**

**PROFESSIONAL SERVICE  
INDUSTRIES, INC.  
Three Burwood Lane  
San Antonio, Texas 78216  
Phone: (210) 342-9377  
Fax: (210) 342-9401**



August 31, 2017

TRC  
505 East Huntland Drive, Ste. 250  
Austin, Texas 78752

Attn: Mr. S. Jared Niermann, P.E.

RE: GEOTECHNICAL ENGINEERING REPORT  
PROPOSED PAISANO BOOSTER STATION  
FM 2523 & OLD HAMILTON ROAD  
DEL RIO, TEXAS  
PSI Project No. 0312-1545

Dear Mr. Niermann:

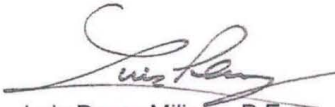
Professional Service Industries, Inc. (PSI) is pleased to submit this Geotechnical Engineering Report for the referenced project. This report includes the results of field and laboratory testing along with recommendations for use in preparation of the appropriate design and construction documents for this project.

PSI appreciates the opportunity to provide this Geotechnical Engineering Report and looks forward to continuing participation during the design and construction phases of this project. If there are any questions pertaining to this report, or if PSI may be of further service, please contact the PSI office.

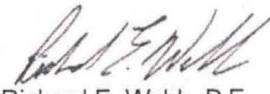
PSI also has great interest in providing materials testing and inspection services during the construction of this project. If you will advise us of the appropriate time to discuss these engineering services, we will be pleased to meet with you at your convenience.

Respectfully submitted,

**PROFESSIONAL SERVICE INDUSTRIES, INC.**  
Texas Board of Professional Engineers Certificate of Registration # F003307

  
Luis Perez-Milicua, P.E.  
Project Engineer



  
Richard E. Webb, P.E.  
Principal Consultant

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## 1.0 PROJECT INFORMATION

### 1.1 PROJECT AUTHORIZATION

Professional Service Industries, Inc., (PSI) has completed a field exploration and geotechnical evaluation for the proposed Paisano Drive Booster Station project to be constructed at the intersection of FM 2523 & Old Hamilton Road in Del Rio, Texas. Mr. Jared Niermann, P.E., representing TRC, authorized PSI's services on August 16, 2017 by issuing Task Order No. 040 per Master Services Agreement No. AUS-PSI-06.

### 1.2 PROJECT DESCRIPTION

Based on information provided to PSI by TRC, a summary of the proposed project is presented in the following table.

TABLE 1.1: GENERAL PROJECT DESCRIPTION

|                                        |                                                             |
|----------------------------------------|-------------------------------------------------------------|
| Structure                              | Ground Storage Tank                                         |
| Preliminary Storage Tank Capacity      | 40,000 gallons                                              |
| Preliminary Storage Tank Diameter      | 15 to 20 feet                                               |
| Existing Grade Change within Tank Area | ± 2 feet estimate<br>(No Topographic Information Available) |
| Finished Grade for Tank                | Within ± 1 feet from existing                               |
| Requested Foundation Type              | Mat Foundation                                              |

The geotechnical recommendations presented in this report are based on the available project information, structure locations, and the subsurface materials described in this report. If any of the noted information or assumptions made are incorrect, please inform PSI so that the recommendations presented in this report can be amended as necessary. IPSI will not be responsible for the implementation of provided recommendations if not notified of changes in the project.

### 1.3 PURPOSE AND SCOPE OF SERVICES

The purpose of this study is to evaluate the subsurface conditions at the site and develop geotechnical engineering recommendations and guidelines for use in preparing the design and other related construction documents for the proposed project. The scope of services included drilling borings, performing laboratory testing, and preparing this geotechnical engineering report.

This report briefly outlines the available project information, describes the site and subsurface conditions, and presents the recommendations regarding the following:

- General site development and subgrade preparation.
- Estimated potential soil movements associated with shrinking and swelling soils and methods to reduce these movements to acceptable levels.
- Recommendations for site excavation, fill compaction, use of on-site and imported fill material in the area of the structure.
- Recommendations for tank pad preparation for ground supported foundations.



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- Recommendations for a mat foundation system for the proposed storage tank.

The scope of services for this geotechnical exploration did not include an environmental, mold nor detailed seismic/fault assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air on or below, or around this site. Any statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes.





2.0 SITE AND SUBSURFACE CONDITIONS

2.1 SITE DESCRIPTION

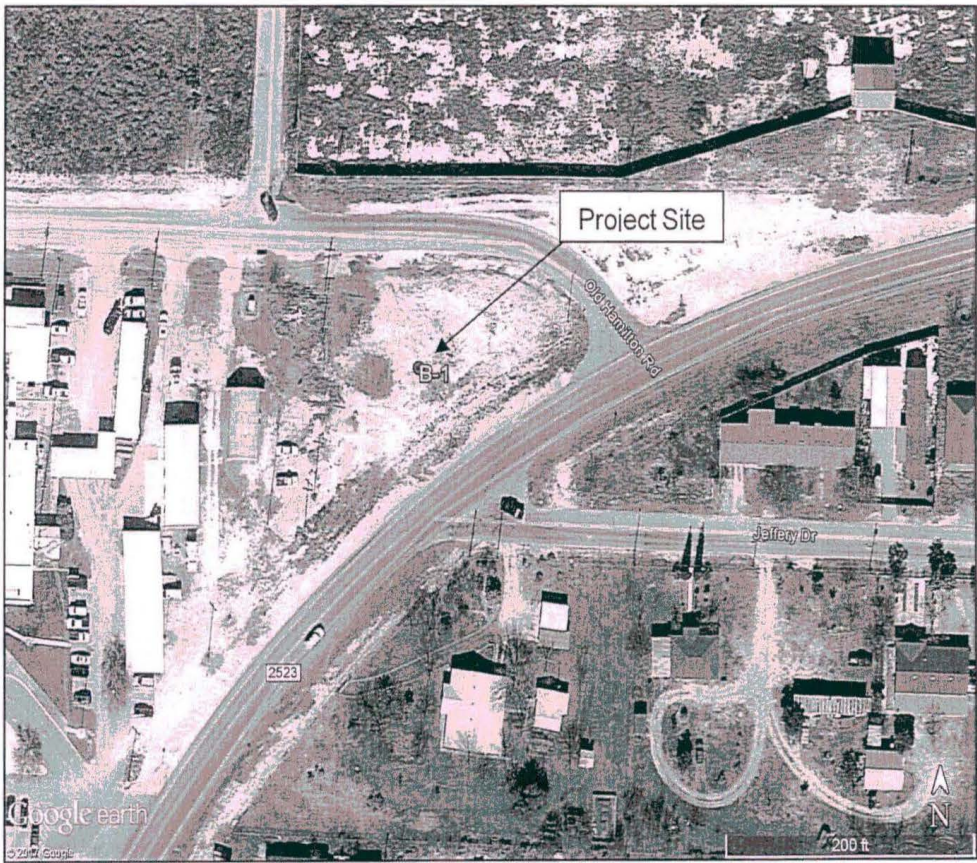
The following table and aerial photography provide generalized descriptions of the existing site conditions based on visual observations during the field activities, as well as other available information.

TABLE 2.1 : SITE DESCRIPTION

|                                        |                                                                                  |
|----------------------------------------|----------------------------------------------------------------------------------|
| Site Location Description              | West side of the intersection of FM 2523 and Old Hamilton Road in Del Rio, Texas |
| Approximate Coordinates                | 29.3743, -100.8454 (WGS 84)                                                      |
| Existing Site Conditions               | Relatively flat                                                                  |
| Existing Site Ground Cover             | Barren ground, undeveloped.                                                      |
| Ground Surface Soil Support Capability | Firm enough for geotechnical equipment                                           |

An aerial view showing the boring performed is displayed in the figure below.

FIGURE 2.1: AERIAL PHOTOGRAPHY





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## 2.2 FIELD EXPLORATION

Field exploration for the project consisted of drilling one (1) boring. The boring design element, boring label, and approximate depth is provided in the following table.

TABLE 2.2: FIELD EXPLORATION SUMMARY

| Design Element | Boring Label | Approx. Depth of Boring |
|----------------|--------------|-------------------------|
| Storage Tank   | B-1          | 35 feet                 |

The boring location was selected by PSI personnel and located in the field using available natural landmarks and GPS coordinates. The references to elevations of various subsurface strata are based on depths below existing grade at the time of drilling. The approximate boring locations are depicted on the Boring Location Plan provided in the Appendix.

TABLE 2.3: FIELD EXPLORATION DESCRIPTION

|                                                  |                                        |
|--------------------------------------------------|----------------------------------------|
| Drilling Equipment                               | Truck-mounted drilling equipment       |
| Drilling Method                                  | Continuous Flight Auger                |
| Drilling Procedure                               | Applicable ASTM and PSI Safety Manual  |
| Sampling Procedure                               | ASTM D1587/1586                        |
| Field Testing Procedures                         | Standard Penetration Test (ASTM D1586) |
| Frequency of Groundwater Level Measurements      | Not encountered during drilling        |
| Boring Backfill Procedures                       | Soil Cuttings                          |
| Sample Preservation and Transportation Procedure | General accordance with ASTM D4220     |

During the field activities, the encountered subsurface conditions were observed, logged, and visually classified (in general accordance with ASTM D2487). Field notes were maintained to summarize soil types and descriptions, water levels, changes in subsurface conditions, and drilling conditions.

## 2.3 LABORATORY TESTING PROGRAM

PSI supplemented the field exploration with a laboratory testing program to determine additional engineering characteristics of the subsurface soils encountered. The laboratory testing program included:

- Visual Classification (ASTM D2488)
- Moisture Content Tests (ASTM D2216)
- Atterberg Limits (ASTM D4318)
- Material Finer than No. 200 (ASTM D1140)

The laboratory testing program was conducted in general accordance with applicable ASTM Test Methods. The results of the laboratory tests are provided in the Appendix on the Logs of Boring. Portions of samples that are not altered or consumed by laboratory testing will be retained for 60 days from the date shown this report and will then be discarded.

