SECTION 05500 - MISCELLANEOUS METALWORK

City of San Diego, CWP Guidelines

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing miscellaneous metalwork and appurtenances including the following:

1. Anchor Bolts
2. Power Driven Pins
3. Bolts
4. Seat Angles, Supports and Brackets
5. Iron Castings
6. Gratings
7. Floor and Cover Plates
8. Steel Stairs
9. Safety Stair Treads
10. Floor Hatches
11. Pipe Columns
12. Fall Prevention System
13. Manhole Frames and Covers

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 03300 Cast-in-Place Structural Concrete
2. Section 03315 Grout
3. Section 05120 Structural Steel
4. Section 09800 Protective Coating

1.3 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. Uniform Building Code

1.4 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090 - REFERENCE STANDARDS.

1.5 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1. **Federal Specifications:**

QQ-F-461 C (1)	Floor Plate, Steel, Rolled
MIL-6-18015	(Ships) Aluminum Planks, (6063-T6)

2. **Commercial Standards:**

AISC MO11	Manual of Steel Constructions
AASHTO HS-20	Truck Loading
ASTM A36	Specification for Structural Steel
ASTM A 48	Specification for Gray Iron Castings
ASTM A 53	Specification for Pipe, Steel, Black and Hot- Dipped, Zinc-Coated Welded and Seamless
ASTM A 123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 125	Specification for Steel Springs, Helical, Heat Treated
ASTM A 153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A283	Specification for Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars
ASTM A 307	Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile
ASTM A320	Specification for Alloy-Steel Bolting Materials for Low-Temperature Service
ASTM A489	Carbon Steel Eyebolts
ASTM A 569	Specification for Steel, Carbon, (0.15 Maximum Percent) Hot Rolled, Sheet and Strip, Commercial Quality
ASTM A 575	Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM B 98	Specification for Copper-Silicon Alloy Rod, Bar, and Shapes
ASTM B 210	Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes

ASTM B 221	Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
ASTM B 438	Specification for Sintered Bronze Bearings (Oil-Impregnated)
ANSI/AWS D1.1	Structural Welding Code - Steel
NFPA 101	Life Safety Code
NAAMM	Metal Stairs Manual

1.6 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. Shop drawings showing connection details and locations proposed for power driven pins.

2. Shop drawings of miscellaneous metalwork including seat angles, supports and guides.

3. Shop drawings showing proposed use of adhesive anchors.

4. Data indicating load capacities, chemical resistance and temperature limitations of power driven pins.

5. Manufacturer's catalog data for manhole frame, covers, and each type of anchor.

6. Welding procedures and welder qualifications.

1.7 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL in compliance with Section 01300:

1. Manufacturer's installation instructions.

PART 2 -- PRODUCTS

2.1 MISCELLANEOUS METALWORK

A. **Materials:** Except as otherwise indicated, products fabricated of structural steel shapes, plates and bars shall comply with the requirements of ASTM A 36 [or] [ASTM A283].

B. **Corrosion Protection:** Miscellaneous metalwork of fabricated steel, which will be used in a corrosive environment or will be submerged shall be stainless steel. Other miscellaneous steel metalwork shall be hot-dip galvanized after fabrication except as otherwise indicated.

C. **Stainless Steel:** Stainless steel metalwork shall be of Type 316 L stainless steel. Stainless steel shall not be torch heated for welding. The CONTRACTOR shall submit welding methods and procedures. All welded stainless steel shall be passivated after welding by immersing in a pickling solution of 6 percent nitric acid and 3 percent hydrofluoric acid. Temperature and detention time for passivation shall be sufficient for

removal of oxidation and ferrous contamination without etching of surface. The passivated steel shall undergo a complete neutralization by immersion in a detergent rinse followed by clean water wash, or shall be buffed with Scotch Brite EXL (or equal) for removal of weld discoloration and heat tint.

D. **Welding:** Welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" and supplemented by other standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards.

In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall comply with the AWS Code. Upon completion of welding, weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. Sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

E. **Galvanizing:** Where galvanizing is indicated, structural steel plates shapes, bars and fabricated assemblies shall be thoroughly cleaned of rust and scale and shall be galvanized in accordance with the requirements of ASTM A 123. Any galvanized part that becomes warped during the galvanizing operation shall be straightened. Bolts (except ASTM A325), anchor bolts, nuts and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A 153.

2.2 ANCHOR BOLTS

A **General:** Anchor bolts shall comply with the following:

1. Anchor bolts shall be fabricated of materials complying with SSPWC Subsections 206-1.4.1 and 209-2.2 and as follows:

Steel bolts	ASTM A325
Fabricated steel bolts	ASTM A36
Stainless steel bolts, nuts, washers	ASTM A320, Type 316

2. Anchor bolt holes in equipment support frames shall not exceed the bolt diameters by more than 25 percent, up to a maximum oversizing of 1/4 inch. Unless otherwise indicated, minimum anchor bolt diameter shall be 1/2 inch. Anchor bolts for equipment shall be 316 stainless steel and shall be provided with leveling nuts which shall be tightened against flat surfaces to not less than 10 percent of the bolt's safe tensile stress.

3. Tapered washers shall be provided where mating surface is not square with the nut.

4. Expansion, wedge, or adhesive anchors set in holes drilled in the concrete after the concrete is placed is not permitted as substitution for anchor bolts except where otherwise indicated. Upset threads shall not be acceptable.

5. ASTM A307 anchor bolts are prohibited.

B. **Adhesive Anchors:** Unless otherwise indicated, drilled concrete or masonry anchors shall be adhesive anchors. Substitutions will not be considered unless accompanied with ICBO report verifying strength and material equivalency. Except as otherwise indicated, adhesive anchors shall comply with the following:

1 .Epoxy adhesive anchors may be provided for drilled anchors where exposed to weather, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring handrails and reinforcing bars. Threaded rod shall be stainless steel Type 316.

2 Glass capsule, polyester resin adhesive anchors may be permitted in other locations.

C. **Expanding-Type Anchors:** Expanding-type anchors, where indicated, shall be Type 316 stainless steel. Size shall be as shown. Expanding-type anchors are prohibited from use in corrosive areas and in deteriorating concrete

2.3 POWER DRIVEN PINS

A. **Materials:** Power-driven pins for installation in concrete or steel in interior locations of nonprocess areas shall be heat-treated steel alloy complying with AISI 1062 or 4063 and shall be zinc-plated. Pins shall have capped or threaded heads capable of transmitting the shank loads. Pins that are connected to steel shall have longitudinal serrations around the circumference of the shank.

2.4 BOLTS

A. **Bolt Requirements:** Bolts shall comply with the following:

1. The nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. Bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.

2.. The length of all bolts shall be such that after joints are made up, each bolt shall extend through the entire nut, but in no case more than 1/2-inch beyond the nut.

B. **Standard Service Bolts (Not Buried or Inside Tanks or Channels)**: Except where otherwise indicated, bolts and nuts shall be steel and shall be galvanized after fabrication. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing. Except as otherwise indicated herein, steel for bolts, anchor bolts and cap screws shall be in accordance with the requirements of ASTM A 325, or threaded parts of ASTM A 36. ASTM A 325 bolts and nuts shall not be galvanized.

C. **Bolts Buried or Inside Tanks or Channels:** Unless otherwise indicated, bolts, anchor bolts, nuts and washers which are buried, submerged, or below the top of the wall inside any hydraulic structure shall be of Type 316 stainless steel.

D. Unless otherwise indicated, eyebolts shall conform to ASTM A 489.

2.5 SEAT ANGLES, SUPPORTS AND BRACKETS

A. Seat angles over slide gate guides shall be welded to the guides. Seat angles for supports for floor plates, clips for precast panels and brackets for piping shall be steel, hot-dip

galvanized after fabrication unless otherwise indicated. Over tanks and channels seat angles and brackets shall be Type 316 L stainless steel.

B. Seat angles for grating shall be aluminum or steel as indicated, except that Type 316 L stainless steel shall be used over tanks and channels. Guides for slide gates shall be Type 316 L stainless steel.

2.6 IRON CASTINGS

A. Castings shall conform to the requirements of ASTM A 48 unless otherwise indicated. Castings weighing less than 100 pounds shall be hot-dip galvanized after machining. Castings weighing greater than 100 pounds shall be galvanized where indicated.

2.7 GRATINGS

A. **General:** Both bearing bars and cross bars shall be continuous. Openings shall be banded with bars having the same dimensions as the bearing bars. Perimeter edges shall be banded with bars flush at the top surface of the grating and 1/4 inch clear of the bottom surface. Bars terminating against edge bars shall be welded to the edge bars when welded construction is used. When crimped or swaged construction is used, bars at edges shall protrude a maximum of 1/16 inch and shall be peened or ground to a smooth surface. No single piece of grating shall weigh more than 80 pounds unless otherwise indicated.

Rough weld beads and sharp metal edges on gratings and plates shall be ground smooth. Welds exposed to view shall be uniform and neat. Welds to be galvanized shall be sandblasted prior to galvanizing.

Holes shall be punched 1/16 inch larger than the nominal size of the bolts, unless otherwise indicated. Whenever needed, because of the thickness of the metal, holes shall be subpunched and reamed or shall be drilled. Cutting, drilling, punching, threading and tapping shall be performed prior to hot-dip galvanizing.

1. Aluminum: Aluminum grating bearing bars and aluminum floor plates and cover plates shall be of alloy 6061-T6 conforming to ASTM B221. Aluminum grating cross bars shall be of an alloy conforming to either ASTM B221 (extrusions) or B210 (drawn).

   Unless otherwise indicated, grating shall be fabricated of aluminum. Bearing bars shall be punched to receive the cross bars. After insertion in the bearing bars, cross bars shall be deformed by a hydraulic press or similar means to permanently lock the bars into the bearing bar openings. Fabrication methods employing bending or notching of bearing or cross bars will not be permitted.

2. Steel: Steel grating bearing bars and cross bars shall be of welding quality mild carbon steel conforming to ASTM A569. Steel floor plates and cover plates shall be of structural quality steel conforming to ASTM A36.

   Steel grating shall be used only where indicated. Steel grating shall be hot-dip galvanized. Notching, slotting, or cutting the top or bottom edges of bearing bars to receive cross bars will not be permitted unless each intersection of bars is fully welded to restore each bearing bar to its full cross-sectional strength.

2.8 FLOOR AND COVER PLATES:

A. Plates shall be set flush with surrounding floor. No single piece of floor and cover plate shall weigh more than 80 pounds unless specifically detailed otherwise. Floor and cover plates over tanks and channels shall be Type 316 stainless steel.

2.9 STAIRS

A. Unless otherwise indicated, stairs shall be steel and shall be fabricated in accordance with standard practice of the National Association of Ornamental Metal Manufacturers, and as indicated. Steel stairs shall be hot-dip galvanized after fabrication.

2.10 SAFETY STAIR TREADS

A. Safety stair treads shall be provided on stairs or where indicated and shall be 4 inches wide aluminum. Aluminum stair treads shall have isolation coating to prevent direct contact with concrete surfaces per Section 09800.

2.11 FLOOR HATCHES

A. **General:** Floor hatches shall be of the design, sizes and types indicated.

B. **Construction:** Hatches shall be double-swing, and shall be furnished with 2 stay bars designed to hold the cover in an open position and provide a railing around the opening, 4 flush handles, joint gutter, and a moat-type edge drain complete with drain connection. Steel hatches shall be hot-dip galvanized after fabrication.

C. **Material:** Hatches shall be of aluminum or stainless steel as indicated. No single piece of grating shall weigh more than 80 lb unless otherwise indicated. Aluminum shall be 6061T6 Alloy Bearing Bars and 6063T5 Alloy Cross Bars. Stainless steel shall be Type 316. All grating shall be completely banded.

D, **Finish:** Aluminum in contact with other metal or concrete shall be shop-painted with one coat of zinc chromate and 2 coats of approved aluminum metal-and-masonry paint.

2.12 PIPE COLUMNS

A. Pipe column steel shall conform to the requirements of ASTM A 53, Grade B.

2.13 FALL PREVENTION SYSTEM

A. The fall prevention system shall include safety belt and other components for a complete and fully operational fall prevention system.

2.14 MANHOLE FRAMES AND COVERS

A. Except as otherwise indicated, manhole frames and covers shall comply with SSPWC Subsection 206-3.3 and shall be fabricated of cast iron complying with ASTM A48, Class 30 and shall be the heavy-duty type designed for H-20 highway loading, shall have a 24-inch clear frame opening and a minimum frame height of 4 1/2 inches and shall be equipped with a continuous-ring type gasket designed to minimize surface water inflow. Cover pattern shall be checkered pattern design and shall have concealed or closed pick holes with sufficient dimensions to allow for removal without special equipment. Bearing and wedging surfaces shall be machined to ensure a tight fit and to prevent rocking. Frames shall be provided with four 1-inch diameter holes for anchor bolts. The use of salvaged or scrap materials will not be permitted.

B. Covers shall be provided with a continuous, machined groove on either the underside bearing lip or the outer wedging edge of the cover. A groove on the bearing lip shall be fitted with a glued, continuous, low compression, set gasket; a groove on the outside edge shall be fitted with a neoprene O-ring seal.

C. Locking type, nongasketed frames and covers shall be provided where indicated. Locking covers shall have two locking wedges in the frame. Covers shall have two fingers which engage the locking wedges when the cover is positioned in the frame and turned.

2.15 MANUFACTURERS

A. Products of the type or model (if any) indicated shall be manufactured by one of the following (or equal):

1. Epoxy Adhesive Anchors:

Sika/FI System with Sikadur Injection Gel Epoxy
Masterbuilders Concresive Epoxy Cartridge Dispensing System and Concresive Paste LPL

2. Glass Capsule Polyester Resin Adhesive Anchors:

Hilti HV
Molly Parabond

3. Expanding-Type Anchors:

Phillips Drill Company "Red Head"
McCullock Industries "Kwick-Bolt"

4. Steel Gratings:

Irving Type IWA
Gary Type GW

5. Floor and Cover Plates:

Alcoa C-102 Aluminum Tread Plate
Reynolds Diamond Tread Plate

6. Floor Hatches:

Babcock Davis
Bilco Company
Inryco-Milcor
Milcor

7. Safety Stair Treads:

Wooster Products, Incorporated Alumogrit, Type 101
American Abrasive Metals Company Alumalum, Style A
Safe-T-Metal Company Incorporated Style AX
American Mason Safety Tread Company [ ]

8. Fall Prevention System:

   Research and Trading Corporation, Wilmington, Delaware Everest Lifeline System Model No. 6006
   North Consumer Products, Inc., California Saf-T-Climb

.9 Manhole Frames and Covers:

   Neenah Foundry Company R-1642 with Self-Sealing Cover
   Phoenix Iron Works P-1090 R/G

10. Field Repairs to Galvanizing:

    "Galvinox"
    "Galvo-Weld"

11. Aluminum Grating:

    Gary Galok
    Seidelhuber

PART 3 -- EXECUTION

3.1 GENERAL

A. **Fabrication and Erection:** Except as otherwise indicated, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction."

B. **General:** Fieldwork, including cutting and threading, shall not be permitted on galvanized items. Dissimilar metals shall be protected from galvanic corrosion by means of pressure tapes, coatings or isolators. Grouting of anchor bolts with nonshrink or epoxy grouts, where indicated, shall be in accordance with Section 03315.

1. Drilling of bolts or enlargement of holes to correct misalignment will not be allowed.

2. Metalwork to be embedded in concrete shall be placed accurately and held in correct position while the concrete is placed or, if indicated, recesses or blockouts shall be formed in the concrete. The surfaces of metalwork in contact with or embedded in concrete shall be thoroughly cleaned. Recesses may be neatly cored in the concrete after it has attained its design strength and the metalwork grouted in place. Embedments shall comply with Section 03300.

3. Holes shall be punched 1/16 inch larger than the nominal size of the bolts, unless otherwise indicated. Whenever needed, because of the thickness of the metal, holes shall be subpunched and reamed or shall be drilled.

4. Fabrication including cutting, drilling, punching, threading and tapping required for miscellaneous metal or adjacent work shall be performed prior to hot-dip galvanizing.

3.2 INSTALLATION OF ANCHOR BOLTS

A. After anchor bolts have been embedded, their threads shall be protected by grease and the nuts run on.

B. Installation of adhesive, capsule and expansion anchors shall comply with the following:

1. All installation recommendations by the anchor system manufacturer shall be followed carefully, including maximum hole diameter.

2. Use shall be limited to applications where exposure to fire or exposure to concrete or rod temperature above 120 degrees F is not indicated. Overhead applications (such as pipe supports) shall not be allowed.

3. Use shall be limited to locations where exposure to acid concentrations higher than 10 percent, to chlorine gas, or to machine or diesel oils, is not indicated.

4. Concrete temperature (not air temperature) shall be compatible with curing requirements recommended by adhesive manufacturer. Anchors shall not be placed in concrete below 25 degrees F.

5. Anchor diameter and grade of steel shall comply with equipment supplier specifications. Anchor shall be threaded or deformed full length of embedment and shall be free of rust, scale, grease, and oils.

6. Adhesive capsules of different diameters may be used to obtain proper volume for the embedment, but no more than two capsules per anchor may be used. When installing different diameter capsules in the same hole, the larger diameter capsule shall be installed first. Any extension or protrusion of the capsule from the hole is prohibited.

7. Holes shall have rough surfaces, such as can be achieved using a rotary percussion drill.

8. Holes shall be blown clean with compressed air and be free of dust or standing water prior to installation.

9. Anchor shall be left undisturbed and unloaded for full adhesive curing period.

3.3 INSTALLATION OF SEAT ANGLES, SUPPORTS AND GUIDES

A. Seat angles shall be set flush with the floor.

3.4 INSTALLATION OF POWER DRIVEN PINS:

A. Power-driven pins shall be installed by a craftsman who is certified by the manufacturer as being qualified to install the manufacturer's pins. Pins shall be driven in one initial movement by an instantaneous force that has been carefully selected to attain the required penetration. Driven pins shall conform to the following requirements where "D" = Pin's shank diameter:

Material Penetrated by Pin	Material's Minimum Thickness	Pin's Shank Penetration in Supporting Material	Minimum Space From Pin's CL to Edge of Pene-trated Material	Minimum Pin Spacing
Concrete	16D	6D minimum	14D	20D

Steel	1/4-inch	Steel thickness	4D	7D

3.5 INSTALLATION OF GRATING, FLOOR AND COVER PLATES

A. Grating, floor and cover plates shall be field measured for proper cutouts and proper sizes.

3.6 INSTALLATION OF STAIRS AND LADDERS

A. Stairs and ladders shall be fitted accurately and field measured where necessary.

3.7 INSTALLATION OF SAFETY STAIR TREADS

A. Unless otherwise indicated, safety stair treads shall be installed on all concrete stairs. Treads shall be secured to concrete with suitable anchors at 15 inches on centers and not more than 4 inches from the ends. Rubber tape, 1/8-inch thick, shall be provided at both ends and cut to fit shape of tread prior to concrete placement.

3.8 INSTALLATION OF FLOOR HATCHES

A. Unless otherwise indicated, the WORK of this Section includes a 1/2-inch drain line to the nearest floor drain for all floor hatches.

3.9 INSTALLATION OF DRILLED ANCHORS

A. Drilled anchors shall be installed in strict accordance with the manufacturer's instructions. Holes shall be roughened with a brush on a power drill, cleaned and dry. Drilled anchors shall not be installed until the concrete has reached the indicated 28-day compressive strength. Adhesive anchors shall not be loaded until the adhesive has reached its indicated strength in accordance with the manufacturer's instructions.

3.10 INSTALLATION OF MANHOLE FRAMES AND COVERS

A. The installation of manhole frames and covers shall comply with SSPWC Subsection 301-1.6.

** END OF SECTION **