

## **Addendum No. 2**

This Addendum forms a part of the Request For Bid Documents and modifies the original Bid Documents dated this same day, April 4, 2014. Acknowledge receipt of this Addendum in the space provided on the Bid Form and attach a signed copy to the bid submittal. All other provisions of the Bid Documents shall remain unchanged unless expressly noted below.

### **Addendum to the RFB:**

**Specifications:** Specifications sections 02 20 00 through 26 05 33, attached, are to be added to all electronic file copies of the RFB/Project Manual (56 pages)

### **General Clarifications:**

The archaeologist involved in this construction will be attending the pre-construction meeting, to be held prior to the Notice To Proceed, to answer questions about the required contractor/archaeologist coordination during trenching activities. Any delays greater than a total of 8 hours of work time during trenching/excavation due directly to archaeology will be evaluated for an extension of contract time. Any delays totaling up to 8 hours due to archaeology observation and sampling should be included in the base bid.

### **Addendum to the Project Manual:**

1. Page 16, State Wage Rates, section 7.1: add "Contractor will be required to submit Certified Payrolls to the City regularly throughout construction."
2. Page 22, Contract Time, section 5.A: Change 60 calendar days to 90 calendar days.  
boilerplate Agreement, page 2, section 3.3: Change "sixty (60) calendar days" to "ninety (90) calendar days".
3. Page 127, Use of Site, section 4.13.1: Add "Contractor's use of the alley off Sheridan shall not at any time block access/egress for the cars who park along the south side of the alley. Those cars may be expected to back into or back out thru the single lane width left clear for their use. Parking Division has agreed to cap off two meters on Sheridan for the Contractor's use during construction.

### **Addendum to the Plan Set:**

Sheet A-102, General Notes: Add note "E. Paint message panel enclosure white. Recommend a paint manufacturer and submit paint specification and color samples for white paint shades to the Architect for approval.

**PART 1 – GENERAL**

**1.1 RELATED WORK SPECIFIED ELSEWHERE**

- A. Submittals: SECTION 01 30 00.
- B. Quality Control SECTION 01 40 00.
- C. Cast-in-Place Concrete: SECTION 03 30 00.

**1.2 CODES AND STANDARDS**

- A. Comply with the following codes and standards including current editions, revisions and supplements.
  - 1. International Code Council – International Building Code.
  - 2. ASTM D 1556, Test for Density of Soil in Place by the Sand-Cone Method.
  - 3. ASTM D 1557, Test Method for Laboratory Compaction Characteristics Modified Effort (56,000 ft-lbs/ft<sup>3</sup> (2,700KN-m/m<sup>3</sup>)).
  - 4. ASTM D 2922, Methods for Determining the Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow-Depth).
  - 5. ASTM D 3017, Test for Moisture Content of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow-Depth).
  - 6. ASTM D 4318, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- B. Field Quality Control: Testing of soils and submitting of test reports in accordance with paragraph 3.6.

**1.3 SUBMITTALS**

- A. Submit copies of each prescribed test as specified in paragraph 3.6 below.

**1.4 PROTECTION**

- A. Protect and guard against damage to life and property of every description at all times throughout life of contract.
- B. Keep excavations free from water from any source at all times. Provide and operate pumps if necessary. Remove water from site in manner to avoid damage to adjoining property.

- C. Contractor shall take every precaution to protect adjoining property from damage during earthwork and excavation operations and shall be responsible for protection of same.
- D. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit amount of dust and dirt rising and scattering in the air to lowest practical level.
  - 1. Comply with governing regulations pertaining to environmental protection.
  - 2. Clean adjacent structures and improvements of dust, dirt, and debris caused by earthwork operations, as directed by the Architect or governing authorities. Return adjacent areas to condition existing prior to the start of the Work.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Structural Fill Quality Requirements: Structural fill and backfill shall be free of vegetation, debris and other deleterious material and shall be approved by the Geotechnical Engineer.
  - 1. Structural Fill Beneath Slabs, Foundations and Footings and Roadways:
    - a. Gradation: See General Foundation Notes on the Contract Drawings.
    - b. Plasticity Index: See General Foundation Notes on the Contract Drawings; test in accordance with ASTM D 4318.
- B. Rocks larger than three (3) inches in diameter shall not be used in the upper two (2) feet of structural fill.

## **PART 3 – EXECUTION**

### **3.1 GROUND SURFACE PREPARATION**

- A. Vegetation, asphalt paving, concrete, gravel, debris, existing fill and soft or disturbed soil shall be stripped and removed throughout the site where new construction is planned or indicated. Included in Clearing shall be any structures or other appurtenances indicated on the Drawings to be removed. Cleared areas shall be inspected by the Geotechnical Engineer prior to placing and compacting engineered fill. Debris shall be cleared and removed from site to a legal dump.

### 3.2 EXCAVATION

#### A. General:

1. Excavated areas shall be scarified, wetted and compacted as specified in paragraph 3.3 (areas to receive structural fill) after excavating as specified above.
2. Excavations which are greater than required by Drawings or Specifications and which is within bearing area of footings, shall be filled with concrete or structural fill.
3. If utility lines are encountered that are not indicated on Drawings, Contractor shall contact the Architect immediately.

#### B. Stockpiling Excavated Materials:

1. The majority of soils removed from excavation are suitable for use as engineered fill and backfill meeting the requirements of paragraph 2.1.A above provided that the soils are thoroughly blended with non-plastic soils and processed and are approved by the Geotechnical Engineer.

### 3.3 STRUCTURAL FILL AND BACKFILL

#### A. Preparation of Substrate: See General Foundation Notes on the Drawings.

#### B. Required Degree of Compaction:

1. Exposed Ground Surface: See General Foundation Notes on the Drawings
2. Fill Materials:
  - a. Fill materials: See General Foundation Notes on the Drawings
  - b. Fill beneath asphaltic concrete paving: Upper one (1) foot 95 percent of ASTM D 1557 maximum density, fill below upper one (1) foot 90 percent ASTM D 1557 maximum density.
  - c. A minimum of six (6) inches of compacted fill shall be placed under all exterior concrete slabs unless noted otherwise on the Drawings.
3. Backfill Materials:
  - a. Backfill beyond 2 feet of the perimeter footing edge of the building pad or paved areas: 90 percent ASTM D 1557 maximum density.

- b. All backfill under platforms, ramps and walks: 95 percent ASTM D 1557 maximum density.
  4. For purposes of acceptance, the in-place density of the fill and backfill shall be defined as that determined by nuclear methods ASTM D 2922 and D 3017, or by sand cone method ASTM D 1556.
  5. Structural fill compaction requirements shall apply to all utility trench, footing, retaining wall, and other backfill in various areas of the project designated for site grading.
  6. Compaction Methods and Equipment: Compaction of structural fill after original ground preparation shall be by whatever method the Contractor chooses. Where vibratory compaction equipment is used, it shall be the Contractor's responsibility to insure that vibrations do not damage nearby buildings or other adjacent property.
- C. Thickness of Lifts:
1. For structural fill and backfill, lifts shall have a thickness, of no more than eight (8) inches maximum loose depth unless otherwise authorized by the Geotechnical Engineer. Where the Contractor demonstrates the equipment being used effectively compacts lifts thicker than eight (8) inches, thicker lifts may be authorized by the Geotechnical Engineer with approval of the Architect.
  2. In areas not accessible to heavy equipment, place material in four (4) inch thick loose layers and compact with approved hand-held equipment or equivalent.
- D. Compaction Observation:
1. Observations of compacting processes shall be performed by the Geotechnical Engineer as required to provide a basis for an opinion on the degree of compaction being obtained. Where compaction of less than specified is indicated, additional efforts shall be made with adjustment of moisture content as necessary until specified compaction is obtained.

### 3.4 UTILITY TRENCHING

A. General:

1. Perform all trenching required for installation of items where trenching is not specifically described in other Sections of these specifications.
2. Make all trench construction with sufficient width to provide free working space at both sides of trench and around installed item as required for proper execution of the work, slope sides as required.
3. Mechanical and Electrical Contractors shall perform their respective excavations to requirements specified herein.

- B. Depth:
1. Trench as required to elevations as indicated or required by the Drawings.
  2. Where elevations are not shown on the Drawings, trench to sufficient depth to give a minimum of 24" of fill above top of pipe, conduit, etc., as measured from adjacent finished grade, except as required otherwise.
  3. Trench bottoms shall have smooth, firm, and stable foundation, free of rock points, etc., throughout length of trench.
  4. Backfill soils in utility trenches to minimum of 90% of modified proctor density, unless a higher degree of compaction is required due to location within building footprint or roadways.
- C. Correction of Faulty Grades: Where trench excavation is inadvertently carried below proper elevations, backfill with material approved by Soils Engineer and then compact as specified in paragraph 3.3 above providing firm and unyielding substrate. Correction of faulty grades shall be at Contractor's expense.
- D. Backfilling: Backfill soils shall be placed and compacted as specified in paragraph 3.3 above.

### 3.5 SITE GRADING

- A. Grade site within limits shown on the Drawings, to conform to finished grades indicated and to accomplish drainage away from building and paved areas.
- B. Grade areas under asphaltic concrete paving to proper level to receive asphalt concrete pavement.

### 3.6 FIELD QUALITY CONTROLS

- A. General:
1. Contractor shall employ the services of a registered, licensed Geotechnical Engineer in the State of New Mexico, approved by Architect, who shall provide continuous on-site inspection by experienced personnel during the execution of all earthwork operations which includes Structural Fill and backfill work. Where critical elements are to be supported on structural fill or densified native soils, continuous observations and tests of grading operations shall be made by the Geotechnical Engineer. Contractor shall notify Geotechnical Engineer at least two (2) working days in advance of any field operations on the earthwork, or of any resumption of operations after stoppages due to thawing of frozen substrates, or during unfavorable weather conditions. Tests of the fill materials and embankments will be made at the following approximate rates or as deemed necessary by the Geotechnical Engineer

- a. One field density test for each 300 square yards of subgrade prior to placing fill.
  - b. One field density test for each 100 cubic yards of fill placed, or each layer of fill for each work area, whichever is greater.
  - c. One moisture-density curve for each type material used, as indicated by sieve analysis and plasticity index.
  - d. Field density and moisture tests may be determined by current ASTM sand cone or nuclear methods.
  - e. One field density test for each 100 lineal feet of utility trench backfill.
  - f. Not less than 30 density tests shall be taken.
- B. Test Reports: Submit three (3) copies of density test reports. Deliver two (2) copies directly to Architect and one (1) copy to the Owner for each prescribed test in accordance with paragraph 1.3 above.
- C. Costs of Testing and Inspection: Costs of all tests and inspections by Geotechnical Engineer specified herein, or required, shall be paid by Contractor, including retests and reinspections.

**END OF SECTION 02 20 00**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Excavating trenches for utilities.
- B. Compacted fill from top of utility bedding to required elevations.
- C. Backfilling and compaction.

**1.2 RELATED SECTIONS**

- A. Geotechnical report; bore hole locations and findings of subsurface materials available from architect/engineer.
- B. Section 01 40 00 - Quality Control: Testing fill compaction.
- C. Section 02 20 00 - Earthwork
- D. Section 03 30 00 - Cast-in-Place Concrete: Concrete materials.

**1.3 REFERENCES**

- A. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- B. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- C. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

**1.4 DEFINITIONS**

- A. Utility: Any buried pipe, duct, conduit, or cable.

**1.5 FIELD MEASUREMENTS**

- A. Verify that survey bench mark, control point, and intended elevations for the Work are as shown on drawings.

## 1.6 COORDINATION

- A. Verify work associated with lower elevation utilities is complete before placing higher elevation utilities.

## **PART 2 - PRODUCTS**

### 2.1 FILL MATERIALS

- A. Fill Type: As indicated in geotechnical report.

## **PART 3 - EXECUTION**

### 3.1 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Protect plant life, lawns, and other features remaining as a portion of final landscaping.
- C. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- D. Maintain and protect above and below grade utilities which are to remain.

### 3.2 EXCAVATING

- A. Excavate subsoil required for utilities to municipal utilities.
- B. Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Hand trim excavation. Remove loose matter.
- E. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd (0.25 cu m), measured by volume.
- F. Correct areas over excavated in accordance with Section 02 20 00.
- G. Stockpile excavated material in area designated on site and remove excess material not being used, from site.

### 3.3 BACKFILLING

- A. Backfill trenches to contours and elevations with unfrozen fill materials.

- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.
- D. Employ a placement method that does not disturb or damage foundation perimeter drainage, utilities in trench, and existing structures.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Remove surplus fill materials from site.
- G. Leave fill material stockpile areas completely free of excess fill materials.

#### 3.4 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1 inch (25 mm) from required elevations.

#### 3.5 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Assurance: Field inspection and testing.
- B. Compaction testing will be performed in accordance with ASTM D1557, ASTM D2922 or ASTM D3017.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.
- D. Frequency of Tests: One per 750 sy or fraction thereof.

#### 3.6 PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Section 01 50 00.
- B. Reshape and re-compact fills subjected to vehicular traffic during construction.

**END OF SECTION 02 22 50**

**PART 1 - GENERAL**

**1.1 RELATED WORK SPECIFIED ELSEWHERE**

- A. Submittals: SECTION 01 30 00.
- B. Quality Control: SECTION 01 40 00.
- C. Earthwork: SECTION 02 20 00.
- D. Concrete Reinforcement: SECTION 03 20 00.
- E. Cast-in-Place Concrete: SECTION 03 30 00.

**1.2 QUALITY ASSURANCE**

- A. Codes and Standards: Comply with the following codes and standards including current editions, revisions, and supplements.
  - 1. International Code Council – International Building Code.
  - 2. ACI 347, Recommended Practices for Concrete Formwork.
  - 3. PS 1 Construction and Industrial Plywood.
  - 4. PS 20 American Softwood Lumber Standard.
  - 5. ACI 301, Specifications for Structural Concrete for Buildings.
- B. Inspection: Forms and Formwork are subject to inspection by Architect. Notify Architect prior to placing concrete. Damaged or improperly installed formwork will be rejected.
- C. Coordination: Coordinate with other trades, installing all inserts, conduits, sleeves, anchors, etc., properly prior to placement of concrete.

**PART 2 – PRODUCTS**

**2.1 FORM MATERIALS**

- A. Forms for Exposed Finish Concrete:
  - 1. General: Construct all formwork for cast-in-place concrete with plywood, metal, metal-framed plywood-faced or other acceptable

panel-type materials to provide continuous, straight, smooth, exposed surfaces. Provide form material in the largest practicable sizes to minimized number of joints.

2. Plywood: Use B-B plyform, sanded, Class 1, EXTDFPA grade trademarked of the American Plywood Association, PS 1-66.
  3. Lumber: For forming studs and whalers, use 2" nominal thickness, construction grade Douglas Fir South or Hem-Fir. For concealed concrete surfaces, use construction grade Douglas Fir South or Hem Fir, shiplap or tongue and groove, nominal 1" thickness.
  4. Concrete Column Forms: Sonotube Finish Free Concrete Forms with Duraglas Coating.
- B. Forms for Architectural Finish Cast-in-Place Concrete: Forms for architectural finish shall produce the finish and texture indicated on the Drawings and approved by the Architect.
- C. Forms for Unexposed Finish Concrete: Use plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- D. Form Coatings: Form coating compounds shall be first quality of their respective kinds and shall be non-staining, non-grain raising, free of mineral oils and other non-drying ingredients, and leaving no bond-inhibiting residues on concrete. The following products are acceptable form coatings and require no further approval.
- E. Chamfer Strips:  $\frac{3}{4}$ " by  $\frac{3}{4}$ " wood, PVC, or rubber.
- F. Expansion Joint Material: Asphalt saturated fiberboard,  $\frac{1}{2}$ " thick, meeting the requirements of ASTM D 1751.
- G. Felt: Asphalt-saturated organic felt, weighing 30 pounds per 100 square feet, meeting the requirements of ASTM D 226.

## 2.2 TIES AND SPREADERS

- A. Form ties and spreaders shall be prefabricated, rod, architectural snap types, flat band or threaded internal disconnecting type, of sufficient strength to resist all imposed loads of fresh concrete and with external holding devices of adequate bearing area. Ties shall permit tightening and spreading of forms and leave no metal closer than one (1) inch from surfaces. All form ties shall be a type which does not leave an open hole through the concrete and which permits neat and solid patching at every hole.
- B. Wire ties and wood spreaders shall not be used.

## 2.3 ROUGH HARDWARE

- A. Accessories: Furnish and install all bolts, anchors, expansion joints and bolts, strap anchors, etc., required for all embedded work.

## **PART 3 - EXECUTION**

### 3.1 FORM TYPES

- A. Concealed Surfaces: For footings, foundation walls, grade beams and surfaces indicated to be covered by other materials, use boards, plywood, reinforced plastic, sonotubes or metal forms as specified in paragraph 2.1 above.
- B. Exposed Surfaces: Use plywood or metal forms as specified in paragraph 2.1 above.

### 3.2 INSTALLATION

- A. General:
  - 1. Install in accordance with ACI 301, Chapter 4.
  - 2. Construct forms to exact shapes, sizes, lines and dimensions as required to obtain accurate alignment, location and grades, and level and plumb work in finished structure. Provide for openings, offsets, recesses, moldings, blocking, bulkheads, anchorages and other required features. Make forms easily removable without hammering or prying against concrete. Use metal spreaders to provide accurate spreading of forms. Construct forms so that no sagging, leakage or displacement occurs during and after pouring of concrete.
  - 3. Install form liner at retaining wall in full conformance with manufacturer's recommendations and established procedures. If form liner becomes displaced during concrete placement, resulting in poor aesthetic quality of retaining wall surface, retaining wall shall be removed and reinstalled at Contractor's expense.

### 3.3 EMBEDDED ITEMS AND ROUGH HARDWARE:

- A. Conduits, electrical under floor ducts or Pipes shall be located to avoid reducing the strength of the construction, and in no case shall pipes other than conduits be placed in a slab 4-1/2" or less in thickness. Conduit buried in concrete slabs shall not have an outside diameter greater than 1/3 of the thickness of the slab nor be placed below bottom reinforcing steel or over top reinforcing steel.
- B. Pipe Sleeves may pass through slabs or walls, provided that they are not exposed to rusting or other deterioration and are of uncoated or galvanized

iron or steel. Sleeves shall be large enough to pass any hub or coupling on the pipe line. Coordinate with DIVISION 15 – MECHANICAL, for special sleeves.

- C. Conduits may be embedded in walls provided they are not larger in outside diameter than 1/3 the thickness of the wall, are not spaced closer than three diameters on center, and do not impair the strength of the structure.

**END OF SECTION 03 10 00**

**CONCRETE REINFORCEMENT**

**PART 1- GENERAL**

**1.1 RELATED WORK SPECIFIED ELSEWHERE**

- A. Submittals: SECTION 01 30 00.
- B. Quality Control: SECTION 01 40 00.
- C. Concrete Formwork: SECTION 03 10 00.
- D. Cast-in-Place Concrete: SECTION 03 30 00.

**1.2 QUALITY ASSURANCE**

- A. Codes and Standards: Comply with the following codes and standards including current editions, revisions and supplements.
  - 1. ACI 315, Manual of Standard Practice for Detailing Reinforced Concrete.
  - 2. ACI 318, Building Code Requirements for Reinforced Concrete.
  - 3. Concrete Reinforcing Steel Institute, Manual of Standard Practice.

**1.3 SUBMITTALS**

- A. Reinforcement: In advance of fabrication, complete Shop Drawings necessary for the fabrication of each component part of the concrete reinforcing including, but not necessarily limited to, the following:
  - 1. Bar schedules.
  - 2. Stirrup spacing.
  - 3. Diagrams of bent bars.
  - 4. Arrangements and assemblies required for the fabrications and placement of concrete reinforcement and embedded rough hardware.
  - 5. Special reinforcement at openings through concrete structures.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Reinforcement:

1. Deformed Steel Reinforcing Bars: ASTM A 615, Grade 60. Ties and stirrups may be Grade 40. The surface of reinforcement and accessories shall be clean and free of any oil, grease, grit, dust or other surface contaminants at time of coating.
2. Supports for Reinforcing Bars and Welded Wire Fabric: CRSI MSP-1, hot-dipped galvanized. Supports shall include bolsters, chairs, spacers and all other devices necessary for proper spacing, supporting, and fastening reinforcing bars and wire fabric in place. Precast blocks with integral tie wire may be used for supporting reinforcing in bottom of mat of footings.
3. Tie Wires: ASTM A 82, annealed steel, 16 gage steel minimum.

**PART 3 - EXECUTION**

**3.1 FABRICATION**

- A. General: Shop fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with ACI 315. In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material.
- B. Unacceptable Materials: Reinforcement with the following defects will not be permitted in the Work:
  1. Bar lengths, depths and bends exceeding specified fabrication tolerances, unless approved by Architect.
  2. Bends or kinks not indicated on Drawings or final Shop Drawings.
  3. Bars with reduced cross-section due to excessive rusting or other cause.

**3.2 CONCRETE COVER** Install reinforcement to achieve the following minimum coverages of concrete, unless noted otherwise on the Drawings:

	Minimum Cover, Inches
A. Concrete cast against and permanently exposed to earth:	3
B. Concrete exposed to earth or weather:	
1. No. 6 through No. 18 bar:	2
2. No. 5 bar, W31 or D31 wire, and smaller:	1-1/2
C. Concrete not exposed to weather or in contact with ground:	
1. Slabs, walls, joists:	
a. No. 11 bar and smaller	3/4

2. Beams, columns:
  - a. Primary reinforcement, ties, stirrups, spirals: 1-1/2

### 3.3 INSTALLATION

#### A. General:

1. Comply with the specified codes and standards and Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
2. Clean reinforcement to remove loose rust and mill scale, earth, ice and other materials which reduce or destroy bond with concrete.

#### B. Reinforcement:

1. Position, support and secure reinforcement against displacement by formwork, construction or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.
  - a. Hold reinforcement steel in slabs above substrate using metal chair spacers of quality required to hold steel at proper height and alignment.
  - b. Hold welded wire fabric in slabs using plastic or metal chairs with sand plates designed for use with welded wire fabric to hold at proper height and alignment. Pulling in place welded wire fabric with a hooked-bar shall not be used and is not an acceptable means of properly setting fabric in place, and shall be reason for rejection.
  - c. Dowels shall be installed and secured prior to pour. Wet setting of dowels is unacceptable and reason for rejection.
2. Place reinforcement to obtain the minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports together with 16 gage wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that ends are directed away from exposed concrete surfaces.
3. Provide sufficient numbers of supports and of strength to carry reinforcement. Do not place reinforcing bars more than two (2) inches beyond last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

4. Splices: Provide standard reinforcement splices by lapping ends, placing bars in contact and tightly wire tying lap splices 40 bar diameters, unless a greater splice length is shown on Drawings. Comply with requirements of ACI 318 for minimum lap of spliced bars.

**END OF SECTION 03 20 00**

**CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.1 RELATED WORK SPECIFIED ELSEWHERE**

- A. Submittals: SECTION 01 30 00.
- B. Quality Control: SECTION 01 40 00.
- C. Concrete Formwork: SECTION 03 10 00.
- D. Concrete Reinforcement: SECTION 03 20 00.

**1.2 QUALITY ASSURANCE**

- A. Qualification of Manufacturer: Manufacturer of ready mix concrete shall show experience of producing concrete for similar size projects for a minimum of 5 years and shall conform to ASTM C 94.
- B. Codes and Standards: Comply with the following codes and standards including current editions, revisions and supplements.
  - 1. ACI 301, Specifications for Structural Concrete for Buildings.
  - 2. ACI 306.1, Standard Specification for Cold Weather Concreting.
  - 3. ACI 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.
  - 4. ACI 318, Building Code Requirements for Reinforced Concrete.
  - 5. International Code Council – International Building Code.
- C. Quality Control: Testing Laboratory, test costs, and test reports in accordance with SECTION 01 40 00 QUALITY CONTROL and Paragraph 3.1 below.

**1.3 SUBMITTALS**

- A. Manufacturer's Literature: Description and recommended installation/application instructions for admixtures, curing compounds, sealers/hardeners, coatings, patching compounds, grouts, filler strips, leveling compounds, etc.
- B. Test Reports: Reports of concrete compression, yield, air content, and slump tests. Testing Laboratory shall submit two copies of the report to Architect and one copy to the Contractor.

- C. Design Mix: Mix design shall conform to the requirements of ACI 301, Section 4. Submit design mix prior to placing any concrete, with the following information:
1. Material content per cubic yard of each class of concrete furnished.
  2. Results of laboratory tests performed within past six months indicating that aggregate from the proposed source meet requirements of ASTM C 33.
  3. Dry weights of cement, saturated surface-dried weights of fine and coarse aggregate, quantities, type and name of admixtures, weight of water, ready-mix delivery tickets, ASTM C 94, design mix certification that mix designs conform to specification by Testing Laboratory.
  4. All flyash shall conform to Class F.
- D. Exterior Concrete: All exterior concrete shall contain between six (6) and eight (8) percent entrained air.
- E. Shop Drawings: Submit shop drawings indicating dimensions drawn to a minimum scale of 1/8" = 1'-0" with reinforcing requirements shown. Contractor shall be responsible for verifying dimensions. Photocopy of structural plan will not be acceptable.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Portland Cement: ASTM C 150, Types I or II, low alkali. Use only one brand and supplier throughout the Project. Do not change brand without prior approval.
- B. Aggregates: ASTM C 33. Furnish clean, crushed rock or washed gravel coarse aggregate.
- C. Water Reducing Admixtures: ASTM C 494, Type A.
- D. Air-Entraining Admixtures: ASTM C 260, CRD C 13, AASHTO M 154.
- E. Water Reducing and Retarding Admixture: ASTM C 494, Type D.
- F. High Range Water Reducing Admixture: ASTM C 494, Type F.
- G. Water: Potable.
- H. Concrete Patching Compound:

1. Description: Fast setting, non-shrink patching material used for repairing/patching honeycomb, spalls, cracks, holes left by tie wires or spreaders and construction faults in concrete.
- I. Non-Shrink Grout: Corps of Engineers CRD-C 588.
- J. Curing Sheet: ASTM C 171, polyethylene, non-staining white types.
- K. Floor Filling/Leveling Materials: Cement based, self leveling.
- L. Filler Strips: Provide widths and depths as indicated on the Drawings.
  1. Bituminous Type: ASTM D 1751, non-extruding, resilient type, for exterior use as required.
  2. Non-Bituminous Type: ASTM D 1752, Type I or II, non-extruding, resilient type, for interior use where expansion material is required.
- M. Curing-Sealing-Hardener Compound: ASTM C 309, FS TT-C-00800A.
- N. Curing Compound: ASTM C 309 and ASTM C 156, clear, non-staining and non-discoloring, non-residual cure for concrete to receive toppings or adhered-type floor covering.

## 2.2 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for each type on concrete. Admixtures shall not be used for cement replacement to reduce minimum cement content.
- B. Concrete:
  1. See General Structural Notes on the Contract Drawings for 28 day compressive strength requirements.
- C. Basis of Mix Designs:
  1. Control concrete mixes in accordance with Section 4, Specification for Reinforced Concrete for Buildings (ACI-301).
- D. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
  1. Ramps, Slabs, and Sloping Surfaces: Not more than three (4) inches.
  2. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than nine (9) inches after adding admixture to site-verified 3-to-4 inch slump.
  3. Other Concrete: Not more than four (4) inches.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION FOR CONCRETE PLACEMENT**

- A. Formwork: Comply with requirements of ACI 301, Section 2, and the completed cast-in-place shall conform to the tolerances specified in that referenced standard specification.
- B. General: Before placing concrete, inspect and verify that formwork, reinforcing steel and items to be embedded or cast-in-place have been installed. Notify other trades to complete the installation of embedded items, coordinate trades in setting such work, as required. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen substructure or substructure containing frozen materials. Remove excess water from forms before concrete is deposited. Remove hard concrete, debris, and foreign materials and ice from interior of forms and from inner surfaces of mixing and conveying equipment. Do not add water at job site without permission and approval by Architect or Contractor's superintendent. Report on batch ticket the amount of water added at the job site.
- C. Wetting: Wet wood forms sufficiently to tighten up cracks. Wet other materials sufficiently to reduce suction and maintain concrete workability.
- D. Earth Subgrade: Lightly dampen 24 hours in advance of concrete placing, but do not muddy. Re-roll where necessary for smoothness and remove loose material.
- E. Removing Forms:
  - 1. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.
  - 2. Formwork Supporting Weight of Concrete: Such as beam soffits, joists, slabs, and other structural elements may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete locations or members.
  - 3. Form-Facing Materials: May be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing materials without loosening or disturbing shores and supports.

## 3.2 HOT AND COLD WEATHER OPERATIONS

### A. Hot Weather Concreting Operations:

1. When concrete is placed under conditions of hot weather concreting, provide extra protection of concrete, as specified within ACI 305. Hot weather is defined as air temperatures which exceed 80 degrees F.
2. During curing operation cover concrete with wet burlap or cotton mats. Keep mats constantly wet for seven (7) days minimum. Keep mats covered with sheet polyethylene. Leave mats in place for three (3) days after discontinuing wetting process.

### B. Cold Weather Concreting Operations:

1. When concrete is placed under conditions of cold weather concreting (defined as a period when the mean daily temperature drops below 40 degrees F. for more than three (3) successive days), take additional precautions as specified herein and in "Specifications for Cold Weather Concreting" by American Concrete Institute (ACI 306) when placing, curing, monitoring and protecting fresh concrete.
2. During the curing operation, maintain the temperature of the placed concrete as constant as possible, and protect from rapid atmospheric temperature changes.
3. Maintain the concrete in a continually moist condition during the curing process by leaving the forms in place as long as possible and by use of steam and/or moisture retaining covers on unformed surfaces.
4. Following the curing operation, avoid rapid changes in concrete temperature. Do not allow the internal temperature of the concrete to change at a rate which exceeds 50 degrees F. in any 24-hour period or 5 degrees F. in any one hour.

## 3.3 CONCRETE PLACING

### A. Joints in Concrete:

1. Locate joints in concrete where indicated on the Drawings or at points of low stress.
2. Keep hardened concrete wet for at least 24 hours before placing new concrete.

### B. Conveying and Placing:

1. Do not place concrete until reinforcing steel and forms have been approved by Architect and other authorities having jurisdiction.

2. Do not drop concrete from its point of release at mixer, hoppers, tremies, or conveyances more than six (6) feet for concealed concrete and three (3) feet for exposed concrete and otherwise prevent segregation of aggregate.
  3. Deposit concrete so that the surface is kept level throughout, a minimum being permitted to flow from one portion to another.
  4. Place concrete into forms immediately after mixing in a manner that will prevent separation of ingredients and in horizontal layers not over 18 inches thick.
- C. Consolidating: Consolidate each layer of concrete with mechanical vibrating equipment. Transmit vibration directly to concrete, in no case through forms. Supplement vibration by forking or spading by hand adjacent to forms. Consolidate concrete into corners and angles of forms and around reinforcement and embedded fixtures.
- D. Operation of Vibrators: Employ skilled and experienced workmen to operate vibrators. Do not transport concrete in forms with vibrators nor allow vibrator to contact forms or reinforcing. In vibrating freshly placed concrete, push the vibrator down vertically into preceding layers that are still completely plastic and slowly withdraw, producing maximum obtainable density in concrete without creating voids or segregation. Under no circumstance disturb concrete that has stiffened or partially set. Vibrate at intervals not exceeding 2/3 the effective visible vibration diameter of the submerged vibrator. Avoid excessive vibration that causes concrete segregation.
- E. Correction of Segregation: Before placing next lift, and at top of last placement for vertical elements, remove concrete containing excess water or fine aggregate, or showing deficiency of coarse aggregate and fill the space with compacted concrete of correct proportions.
- F. Slabs: Compact and tamp interior concrete slabs to bring 1/8" to 1/4" of mortar so surface, and wood float to straightedges and screeds. Do not use tampers on exterior slabs. Do not use steel or plastic floats of any kind for initial floating operations. Do not apply finish until surface water disappears and surface is sufficiently hardened. Remove bleed water and laitance as it appears.
1. Slab-on-Grade Areas: Slabs shall be placed in long panels as indicated on the Drawings. There shall be a minimum of one (1) day elapsed time between the placement of adjoining slabs.
  2. Expansion Joints: Install in sidewalk joints and curbs and at perimeter of exterior slabs. Install expansion joint material at 20'-0" intervals and dummy joints at 5'-0" intervals.

3. Isolation Joints:
  - a. Joints shall be provided at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.
  - b. Expansion joints shall be filled with premolded joint filler strips 1/2 inch thick, extending full slab depth unless otherwise indicated. Filler strips shall be installed at proper level below finish floor elevation with slightly tapered, dress-and-oiled wood strip temporarily secured to top of filler strip to form groove not less than 3/4 inch in depth. Where joint will be sealed with sealing compound and not less than 1/4 inch in depth joint sealing is not required. Wood strip shall be removed after concrete has set. Clean groove of foreign matter and loose particles after surface has dried.
  - c. Joints where indicated on the Drawings shall be isolated with the use of 30 pounds per square roofing felt complying with F.S. HH-R-590, Type II, Class A.
4. Construction and Shrinkage Control Joints: Joints shall be provided to form panels as indicated on the Drawings.
5. Sealing of Joints: Isolation and construction joints which will not be covered with finish flooring material shall be sealed with joint sealing compound after concrete curing period. Groove shall be slightly underfilled with joint sealing compound to prevent extrusion of compound. Excess material shall be removed as soon after sealing as possible.

### 3.4 CURING FORMED CONCRETE

- A. Maintain forms containing concrete in a thoroughly wet condition until forms are removed. Maintain concrete continuously moist for not less than seven (7) consecutive days after pouring. Keep concrete moist with fine fog spray until protected by curing materials. Use curing sheet material, or liquid membrane-forming curing compound.

### 3.5 RUBBED CONCRETE FINISH

- A. Preparation: Remove form marks, offsets, high spots and other defects and in uniform planes, in good condition to receive concrete coating. Fill honeycombed areas 3/8" or more in depth with concrete patching compound specified above. Surface of concrete to be coated shall be clean, free of laitance, dirt, dust, grease, form oil, efflorescence, paint and foreign materials which may be detrimental to adhesion of concrete coating.
- B. Application: Mix concrete coating materials with clean water and bonding agent following manufacturer's recommendations. Apply a light trowel coat of

concrete coating compound over entire surface to be treated, making sure the material is firmly pressed into voids and leveled. Allow this coat to cure thoroughly before applying the final trowel application. When surface is set to point where the coating will not roll or lift, float uniformly using a sponge to achieve desired texture.

### 3.6 SLAB FINISHING

- A. Finish surfaces level or sloped as indicated with maximum deviation of 1/8 inch from a ten (10) foot straightedge on trowelled surfaces. Keep surface moist with fine fog spray of water as necessary. Dusting with cement or sand during finishing operation is not permitted. Finish exposed edge of slabs and slab joints with edging tool.
1. Steel Float Finish:
    - a. Location: Exposed interior concrete and where floor coverings are indicated to be installed.
    - b. Finish: After surface water disappears and floated surface in sufficiently hardened, steel trowel and retrowel to smooth surface. After concrete has set enough to ring trowel, retrowel to smooth uniform finish free of trowel marks or other blemishes. Avoid excessive troweling that may produce burnished areas.
  2. Broom Finish:
    - a. Location: Exposed exterior concrete walks, curbs, drive pad curb and where indicated on the Drawings (non-exposed aggregate).
    - b. Finish: Prepare same as steel float finish, then apply uniform approved coarse texture by sliding broom in one direction along straightedge guide placed at right angles to direction of vehicular traffic.
  3. Non-Slip Broom Finish:
    - a. Apply heavy non-slip broom finish to exterior concrete handicapped ramps where indicated on Drawings. Immediately after trowel finishing, roughen concrete surface by heavy brooming with fiber bristle broom perpendicular to main pedestrian traffic route. Coordinate required final finish with Architect before application.

### 3.7 SLAB CURING AND SEALING

- A. Apply curing after finishing operations and in any case on same day. Apply liquid compounds in accordance with manufacturer's recommendations at an application rate to achieve ASTM C 309.

1. Freshly placed concrete shall be protected from premature drying and cold or hot temperature, shall be maintained without drying at relatively constant temperature for period of time necessary for hydration of cement and proper hardening of concrete.
  2. Initial curing shall start as soon as free water has disappeared from surface of concrete after placing and finishing. Concrete shall be kept moist for minimum 72 hours.
  3. Final curing shall immediately follow initial curing and before concrete has dried. Final curing shall continue until cumulative number of hours or fraction thereof (not necessarily consecutive) during which temperature of air in contact with concrete is above 50 degrees F. has totaled 168 hours. Rapid drying at end of final curing period shall be prevented.
- B. Curing Materials: Apply curing after finishing operations and in any case on same day.
1. Curing Sheet: Cover concrete surfaces with moisture-retaining cover, place material in widest practical width with sides and ends lapped at least three (3) inches and sealed with waterproof adhesive tape compatible with curing sheet membrane. Immediately repair any holes or tears during curing sheet membrane. Immediately repair any holes or tears during curing period using additional layer(s) of curing sheet and waterproof adhesive tape.
  2. Restriction: Do not use liquid membrane-forming curing compound on concrete to receive subsequent concrete or mortar, or on surfaces to receive subsequent applied materials unless such use and compound used are approved by manufacturer of materials to be applied; verify with related trades.
  3. Curing-Sealer-Hardener: Apply at a rate to achieve ASTM C 309. Where dustproof finish is required for either exposed concrete finish or where additional floor finish material such as resilient flooring, carpeting, etc. is specified to be installed, apply two (2) coats of specified curing-sealer-hardener in accordance with the manufacturer's recommendations; first coat applied immediately after finishing; second coat applied after clean-up prior to completion of concrete work.

### 3.8 EQUIPMENT PADS

- A. Cast-in-place equipment pads for mechanical and electrical apparatus as indicated and/or as detailed on the Drawings. Verify exact sizes and location prior to forming concrete.

### 3.9 GROUTING

- A. Mixing: Mix approved non-shrink grout with sufficient water to cause it to flow under its own weight for grout. Mortar Mix shall conform to ASTM C 270 and be proportioned by volume as follows:
1. One (1) part Portland cement.
  2. 1/2 parts Type "S" hydrated lime or lime putty.
  3. 4-1/2 parts sand.
- B. Placing and Curing: Place fluid grout from one side and puddle for complete filling of voids; do not remove dams or forms until grout attains initial set. Finish exposed surfaces smooth and cure with damp burlap at least three (3) days.

### 3.10 INSPECTION AND TESTING OF CONCRETE

- A. General:
1. The Contractor shall engage at his expense, an independent testing laboratory approved by Architect, to conduct and interpret tests and reports and retests and reports. Testing Laboratory will perform tests as specified herein and as directed by Architect. Retesting due to non-compliance shall be at Contractor's expense.
  2. Concrete will be sampled and tested for quality control during the placement of the concrete as follows:
    - a. Sampling fresh concrete ASTM C 172 except modified for slump
      - 1) As required for each test.
    - b. Slump test per ASTM C 94 ASTM C 143
      - 1) One (1) for each concrete sample at point of discharge and one (1) for each set of compressive strength tests.
    - c. Air content by ASTM C 138, C 173, or C 231
      - 1) One (1) for each set of method compressive strength tests.
    - d. Compression test specimens per ASTM C 31
      - 1) One (1) set of four (4) standard specimen cylinders for each compressive strength test.

- 2) Quantity of testing:
  - i. One (1) set for each 25 cubic yards or fraction thereof of each concrete class placed in any one day nor less than one set for each 5000 SF of surface area for slabs-on-grade placed in any one day.
  - ii. Concrete temperature hourly when air temperature is 40 degrees F. or below and 80 degrees F. or above; each time a set of compression test specimens is made.
- e. Compression testing per ASTM C 39
  - 1) Specimens shall be tested at following rates and intervals:
    - i. One (1) specimen at seven (7) days. Two (2) specimens at twenty-eight (28) days. One (1) specimen held for fifty-six (56) days.
- B. Batch Plant Tickets: Submit certification of ready mixed concrete. If concrete is altered by addition of water, admixtures, etc. on site, these alterations must be recorded on the batch ticket and a copy sent directly to the Architect. Other batch plant tickets shall be retained on site for review by Architect.
- C. Defective Work: Acceptance or rejection of concrete shall be based on ACI 318-05 Building Code Requirements for Reinforced Concrete.
  1. Concrete proven to be defective for any reason may be ordered to be removed and replaced at discretion of Architect. If drilled core tests are required by Architect to determine exact strength of concrete in question, costs of drilling and testing will be at Contractor's expense. Indications of strength below requirements shall make it mandatory that cement or water ratio be changed immediately to improve strength at Contractor's expense.
  2. When there is evidence that strength of concrete structure in place does not meet Specification requirements, cores drilled from hardened concrete for compressive strength determination shall be made in accordance with ASTM C 42, and as follows:
    - a. At least three (3) representative cores shall be taken from each member or area of concrete-in-place that is considered potentially deficient. Location of cores will be determined by Architect.

- b. Cores shall be tested after moisture conditioning in accordance with ASTM C 42 if concrete they represent will be more than superficially wet under service.

### 3.11 PATCHING

- A. Honeycombed Areas and Aggregate Pockets: Remove concrete down to sound concrete. Edges shall be perpendicular to surface and at least 3/8" deep. Sandblast surfaces to receive repair. Cast sandblasted surface with epoxy bonding compound. Place mortar in layers having a compacted thickness of 3/8". Scratch surface of each layer to promote bonding with next layer. Match finish on adjacent concrete and cure as specified.
- B. Spalled and Pitted Areas: Chipped back to sound concrete sufficiently to obtain good mechanical bond, and filled with lean mortar.
- C. Rough Areas and High Spots: Rubbed or ground to match plane of adjacent surface and to an acceptable smoothness, unless otherwise approved by Architect.

**END OF SECTION 03 30 00**

**METAL FABRICATIONS**

**PART 1 - GENERAL**

**1.1 RELATED WORK SPECIFIED ELSEWHERE**

- A. Submittals: SECTION 01 30 00.
- B. Quality Control: SECTION 01 40 00.
- C. Cast-In-Place Concrete: SECTION 03 30 00.

**1.2 QUALITY ASSURANCE**

- A. Codes and Standards: Comply with the following codes and standards including current editions, revisions and supplements.
  - 1. A.I.S.C. "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" and including the "Commentary of the A.I.S.C. Specifications", 13<sup>th</sup> Edition.
  - 2. AWS D1.1, "Structural Welding Code".
  - 3. National Association of Architectural Metal Manufacturers (NAAMM).
- B. Welded Construction:
  - 1. Welding shall be performed in accordance with AWS Structural Welding Code.
  - 2. Welders, welding operators, and tackers, to be employed under this specification, shall have been qualified by test as prescribed in AWS Code, within the last twelve months, except that shop personnel continuously employed as welders may be accepted on basis of satisfactory reports dated not more than two (2) years prior to job.
  - 3. Evidence of welding procedure qualification by Contractor shall be submitted for approval prior to fabrication as requested by Architect.
- C. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of the work. Allow for trimming and fitting wherever the taking of field measurements before fabrication might delay Work.
- D. Coordination: Provide strict coordination between the components and products of this Section and that of other trades and Sections of these Specifications. The components and products, when erected and installed, shall act as a complete integral unit.

- E. Shop Assembly: Preassemble items in the shop to the greatest extent possible, to minimize field splicing and assembly of units at the project site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly, coordinating installation.

### 1.3 SUBMITTALS

- A. Manufacturer's Data: Copies of manufacturer's specifications, load tables, dimensions diagrams, anchor details and installation instructions for products to be used in the fabrication of miscellaneous metal work.
- B. Shop Drawings:
  - 1. For shop fabricated and manufactured items showing details of installation, accessories, fastenings, welding and weld finishing.
  - 2. Furnish/Submit minor connections and fastenings not indicated or specified to meet required conditions.
- C. Welding Procedure: Written description if requested by Architect to illustrate each welding procedure to be performed. Contractor shall submit descriptive data for field welding equipment, including type, voltage and amperage.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: For the fabrication of miscellaneous embedded metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, and roughness. Remove such blemishes by grinding, or by welding and grinding.
- B. Types:
  - 1. Steel Shapes:
    - Wide Flange Beams           ASTM A992, Fy = 50 ksi
    - Channels and Angles        ASTM A36, Fy = 36 ksi
  - 2. Steel Plates:                    ASTM A283, A 570, or A 611, Fy = 36 ksi
  - 3. Steel Tubing:                    ASTM A501, Fy = 46 ksi
  - 4. Steel Pipe:                        ASTM A53, Fy = 35 ksi
  - 5. Steel Bars:                        ASTM A108, Fy = 36 ksi
  - 6. Anchor Bolts:                    ASTM A36, A307, F1554
- C. Anchoring and Fastening Hardware:

1. Wedge anchors, drop-in sleeve anchors, expansion shields, capsule anchors, spring toggle bolts, hollow wall fasteners, etc.
- D. Miscellaneous Hardware:
  1. Beam Clamps, Flange Clamps, Conduit Hangers, Strut Clips, Trapeze, Bar Hangers, etc.
- E. Steel Pipe Railings: ASTM A53, with smooth, flush fittings and connector sleeves, mechanically fastened, included embedded sleeves.

## 2.2 SHOP PAINT

- A. Shop paint miscellaneous metal work, except those members or portions of members to be embedded in concrete or masonry or coated with sprayed fireproofing material and galvanized surfaces, surfaces and edges to be field welded unless otherwise indicated.
- B. Remove scale, rust and other deleterious materials before the shop coat of paint is applied. Clean off heavy rust and loose mill scale in accordance with SSPC SP-2 "Hand Tool Cleaning", or SSPC SP-3 "Power Tool Cleaning", or SP-7 "Brush-Off Blast Cleaning". Remove oil, grease and similar contaminants in accordance with SSPC SP-1 "Solvent Cleaning".
- C. Apply one shop coat of red oxide metal primer paint to fabricated metal items, except apply two coats of paint to surfaces which are inaccessible after assembly or erection. Change color of second coat to a grey prime to distinguish it from the first.
- D. Immediately after surface preparation, brush or spray on metal primer paint, applied in accordance with manufacturer's instructions and at a rate to provide a uniform dry film thickness (DFT) of 2.0 mils for each coat. Use painting methods which will result in full coverage of joints, corner, edges and exposed surfaces with no sags or runs.

## 2.3 FABRICATION

- A. Use material of the size and thickness shown or, if not shown, of the required size and thickness to produce adequate strength and durability in the finished product for the intended use. Work to the dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use the type of materials shown or specified for the various components of work.
- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise shown. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

- C. Weld corners and seams continuously and in accordance with the recommendations of AWS. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.
- D. Form exposed connections with hairline joints which are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type shown or, if not shown, use Phillips flathead (countersunk) screws or bolts. Steel railings may be plug welded.
- E. Provide for anchorage of the type shown, coordinated with the supporting structure and the progress schedule. Fabricate and space anchoring devices as shown and as required to provide adequate support for the intended use of the work.
- F. Cut, reinforce, drill and tap miscellaneous metal work as may be required to receive hardware and similar items or work.
- G. Use hot-rolled steel bars for work fabricated from bar stock, unless work is indicated to be fabricated from cold-finished or cold-rolled stock.

## 2.4 MISCELLANEOUS METAL ITEMS

- A. Fabricate miscellaneous units to the sizes, shapes and profiles shown. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of all welded construction using mitered corners welded brackets and splice plates and a minimum number of joints for field connection. Cut, drill, and tap units to receive hardware and similar items to be anchored to the work.
- B. Provide miscellaneous steel trim shapes and sizes as required for the profiles shown. Except as otherwise noted, fabricate units from structural steel shapes and plates and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction, including threaded fasteners for concrete and masonry inserts (provided by others), and other connectors as required.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling and fitting required for the installation of the miscellaneous metal items. Set the work accurately in location, alignment and elevation, plumb, level, true and free from rack, measured from established lines and levels. Provide temporary bracing or

anchors for items which are to be built into concrete, masonry or similar construction.

- C. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Grind joints smooth and shop paint with two (2) coats of primer as specified.

### 3.2 WELDING

- A. Welded construction shall be performed in accordance with AWS Structural Welding Code. Only welded joints deemed as being Pre-Qualified in accordance with AWS Code will be approved for use. Pre-Qualified joint welding procedures to be used shall be prepared by the Contractor as written procedures specifications and shall be made available to Architect.
- B. Welding Process: Welding process shall be limited to one of the following: Shielded metal arc welding, flux-cored metal arc welding, or submerged-arc welding.
- C. Preparation: Clean surfaces to be welded of paint, grease, scale, and foreign matter. Clean welds each time electrodes are changed. Chip entire area of handguided and controlled flame cut edges before welds are deposited thereon. In general, surfaces made by automatic or mechanically guided controlled equipment need not be ground or chipped before welded thereto.
  - 1. Joint surface shall be free from fins and tears caused by shearing.
  - 2. Welding equipment shall be in good working condition, capable of adjustment in full range of current setting; welding cables shall be of adequate size for currents involved, grounding methods shall be such as to assure proper machine performance. Sequence of joint welding shall be outlined and submitted to Architect for approval to control shrinkage and member alignment; this outline shall be rigidly adhered to.
- D. Procedures: Do not weld in wind until adequate protective screening has been set up. Cut out defective welds or parts of welds with a chisel or air arc and replace.
  - 1. Cover bead or finish pass on all welds shall show a smooth and uniform surface with reinforcement of 1/16" to 1/8". (Drawings indicate areas that require weld reinforcement to be ground flush.)
  - 2. To insure soundness, ends of butt welds that carry stress approaching maximum allowable working stress shall be extended past edges of parts joined by means of short extension bars providing a similar joint preparation and having a width of not less than the thickness of thicker part joined. Where material is not more than 3/4" thick, extension bars may be omitted and side welds applied to fill out ends of same reinforcement as faces of welds. If extension bars are required to be

removed due to fireproofing or some other matter, ends of welds shall be left smooth and flush with edges of abutting parts.

3. No welding shall begin until joint elements are clamped on or bolted in intimate contact and adjusted to dimensions shown on Drawings. Heavy sections and those having a high degree of restraint shall be welded with low hydrogen type electrodes as directed by Architect. Do not splice members without prior approval of Architect.
  4. Align and plumb columns before welding on field connections begin.
  5. No welding shall be done when temperature of base metal is below 32° F. At temperatures between 32° F. and 40° F. surface of all areas within three (3) inches of point where weld is to be started shall be heated to temperature at least warm to the hand before welding is started. When welds are made in parts thicker than 1-1/2" temperature of base material adjacent to weld shall be at least 80° F.
  6. Ensure that workmanship and techniques conform to the AWS Code, including preheat and interpass temperatures, in accordance with process being used.
  7. No combination of bolts and welds shall be used for stress transmission in the same faying surface of any connection.
  8. Groove welds made in shop fabrication shall be terminated at the ends of a joint by the use of extension bars or run-off plates. These extensions shall be removed flush with base material edge.
  9. Full penetration groove welds shall be made with the use of steel backing bars. The backing bar shall be continuous for full length of weld. These bars shall be removed by grinding after completion of welding.
  10. Fillet welds terminating at ends or sides shall be returned continuously for a distance at least twice the normal size of weld (end returns).
  11. Welds not specified shall be continuous fillet welds, using minimum fillets as specified.
- E. Characteristics of Welds: After being deposited, welds shall be brushed with wire brushes and shall exhibit uniform section, smoothness of welded metal, feather edges without undercuts or overlays, and freedom from porosity and clinkers. Visual inspection at edges and ends of fillet welds shall indicate good fusion and penetration into base metal.

#### **END OF SECTION 05 50 00**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. This Section covers all interior and exterior job site painting. See Drawings and Schedules for type and location of various surfaces to be painted.
- B. The term "paint", as used herein includes enamels, paints, sealers, fillers, emulsions and other coatings whether used as prime, intermediate, or finish coats.

**1.2 RELATED SECTIONS**

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 05 50 00 – Metal Fabrications

**1.3 REFERENCES**

- A. ANSI/ASTM D16 - Definitions of terms used in this Section.

**1.4 QUALITY ASSURANCE**

- A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with five years experience.
- B. Applicator: Company specializing in commercial painting and finishing with three years documented experience.

**1.5 SUBMITTALS**

- A. Submit product data, samples and application instructions.
- B. Provide product data on all finishing products.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptance.
- B. Container labelling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing.

- C. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F in well ventilated area, unless required otherwise by manufacturer's instructions.
- D. Take precautionary measures to prevent fire hazards and spontaneous combustion.

## 1.7 ENVIRONMENTAL REQUIREMENTS

- A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent, unless required otherwise by manufacturer's instructions.
- C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

## 1.8 EXTRA STOCK

- A. Provide a one gallon container of each color.
- B. Label each container with color, room and wall locations, in addition to the manufacturer's label.

## **PART 2 - PRODUCTS**

### 2.1 ACCEPTABLE MANUFACTURERS - PAINT

- A. PPG Industries, Inc.
- B. Sherwin Williams Company.
- C. Or Approved Equal.

### 2.2 MATERIALS

- A. Coatings: Ready mixed. Pigments capable of being readily and uniformly dispersed to a homogeneous coating.
- B. Coatings: Good flow and brushing properties; capable of drying or curing free of streaks or sags.

- C. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

## 2.3 FINISHES

- A. Refer to schedule at end of Section for surface finish schedule.
- B. Refer to finish plans in Drawings for color selections and location for application.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of Work. Report any condition that may potentially affect proper application.
- C. Beginning of installation means installer accepts existing conditions.

### 3.2 PREPARATION

- A. Remove electrical plates, hardware, light fixture trim, and fittings not to be painted prior to preparing surfaces or finishing.
- B. Correct minor defects and clean surfaces which affect Work of this Section.
- C. Shellac and seal marks which may bleed through surface finishes.
- D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- E. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- F. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

### 3.3 PROTECTION

- A. Protect elements surrounding the Work of this Section from damage or disfiguration.

- B. Repair damage to other surfaces caused by Work of this Section.
- C. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.
- D. Remove empty paint containers from site.

### 3.4 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry.
- C. Apply each coat to uniform finish.
- D. Apply each prime coat of paint slightly lighter than succeeding coats. Finish coat shall be the color specified.
- E. Sand lightly between coats to achieve required finish.
- F. Allow applied coat to dry before next coat is applied.

### 3.5 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Refer to Section 26 00 10 for identification of equipment, ductwork, piping, and conduit.
- B. Paint shop primed equipment as scheduled.
- C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- D. Prime and paint insulated and exposed pipes, conduit, conduit bodies and fittings, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, to match adjoining painted surface, except where items are prefinished.
- E. Replace identification markings on mechanical or electrical equipment when painted accidentally.

### 3.6 CLEANING

- A. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.
- B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.

- C. Collect cotton waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

### 3.7 SCHEDULE - EXTERIOR SURFACES

#### A. Steel - Unprimed

- 1. One coat TT-P-645 zinc chromate primer.
- 2. Two coats acrylic, semi-gloss, "Preferred Stock".

#### B. Steel - Shop Primed

- 1. Touch-up with zinc chromate primer.
- 2. Two coats acrylic semi-gloss, "Preferred Stock".

#### C. Steel - Galvanized

- 1. One coat zinc chromate primer.
- 2. Two coats gloss alkyd enamel.

**END OF SECTION 09 90 00**

**GENERAL PROVISIONS**

**PART 1 - GENERAL**

**1.1 SCOPE OF WORK**

- A. Conform with applicable provisions of the General Provisions.

**1.2 REQUIREMENTS**

- A. Furnish all labor, materials, service, equipment and appliances required to complete the installation of the complete electrical system in accordance with the specifications and contract drawings.

**1.3 REQUIREMENTS OF REGULATORY AGENCIES AND STANDARDS**

- A. Regulatory Agencies: Installation, materials, equipment and workmanship shall conform to the applicable provisions of the 2008 National Electrical Code (NEC), New Mexico State 2008 Edition, the National Electrical Safety Code (NESC), and the terms and the conditions of the authorities having lawful jurisdiction pertaining to the work required. All modifications required by these codes, rules, regulations and authorities shall be made by the Contractor without additional charge to the Owner.
- B. Underwriter's Laboratories (UL): All materials, appliances, equipment or devices shall conform to the applicable standards of Underwriter's Laboratories, Inc. The label of, or listing by, UL is required.

**1.4 SUBMITTALS**

- A. Materials List: Within 15 days after award of contract, the Contractor shall submit to the Architect a minimum of 7 (seven) copies of all equipment to be furnished. Where such equipment will be furnished "as specified", a statement to that effect is sufficient. Where substitutions are proposed, the Contractor shall submit for prior approval. Written approval of the Architect must be obtained.
- B. Samples: If required by the Architect, the Contractor shall submit for inspection samples of both specified and proposed substitute items.
- C. Shop Drawings: Submit for approval a minimum of seven (7) copies of all shop drawings after the materials list has been approved and prior to ordering. Show complete outlines, dimensions, electrical services, control diagrams, electrical characteristics of special nature or critical to the installation and pertinent data required for installation. Indicate in the transmittal that submittal has been reviewed and accepted and all contract deviations identified.

## **PART 2 – PRODUCTS**

### **2.1 EQUIPMENT REQUIREMENTS**

- A. The electrical requirements for equipment specified or indicated on the drawings are based on information available at the time of design. If equipment furnished for installation has electrical requirements other than indicated on the electrical drawings, the Contractor shall make all adjustments to wire and conduit size, controls, over current protection and installation as required to accommodate the equipment supplied, without additional charge to the Owner. The complete responsibility and costs for such adjustments shall be assigned to the respective section of this specification under which the equipment is furnished.

### **2.2 MATERIALS**

- A. All similar materials and equipment shall be the product of the same manufacturer.
- B. Where no specific material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be used, providing it conforms to the contract requirements and meets the approval of the Architect.
- C. Material and equipment shall be the standard products of manufacturers regularly engaged in the productions of such material and shall be the manufacturer's current and standard design.
- D. Altitude: Equipment affected by altitude shall perform satisfactorily for the function intended at an altitude of the project site.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Fabrication, erection and installation of the complete electrical system shall be done in a first class workmanlike manner by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to hold up progress of the project. The Electrical Contractor shall check all areas and surfaces where electrical equipment material is to be installed, removed or relocated and report any unsatisfactory conditions before starting work. Commencement of work signifies this Contractor's acceptance of existing conditions. In the acceptance or rejection of the finished installation, no allowance will be made for lack of skill on the part of workmen.

### **3.2 TEMPORARY POWER AND LIGHTING**

- A. Furnish and install all temporary electrical facilities required for construction and safety operations.

### 3.3 PERFORMANCE TESTS

- A. Thoroughly test all fixtures, services and all circuits for proper operating condition and freedom from grounds and short circuits before acceptance is requested. All equipment, appliances, and devices shall be operated under load conditions.

### 3.4 AS-BUILT DRAWINGS

- A. During progress of the work, maintain an accurate record of the installation of the system, locating each circuit precisely by dimension. Upon completion of the installation, transfer all record data to blue line prints of the original drawings.

### 3.5 OPERATING INSTRUCTIONS AND MANUALS

- A. Instructions: Without additional charge to the Owner, furnish competent instruction to the Owner in the care, adjustment and operation of all parts of the electrical equipment and systems.
- B. Manuals: Upon completion of the work, prepare and deliver to the Owner three (3) sets of complete operating and maintenance manuals for the systems and major equipment installed. Include catalog data, shop drawings, wiring diagrams, performance curves and rating data, spare parts lists and manufacturer's operating and maintenance data.
- C. Other: The above requirements are in addition to specific instructions and manuals specified for individual systems or equipment.

### 3.6 DRAWINGS

- A. General: The electrical drawings show the general arrangement of all conduit, equipment, etc. and shall be followed as closely as actual building construction and the work of other trades will permit. Because of the small scale of the electrical drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings, elbow, pullboxes, and accessories as may be required to meet such conditions.
- B. Field Measurements: The Contractor shall verify the dimensions governing the electrical work at the building. No extra compensation shall be claimed or allowed on account of differences between actual dimensions and those indicated on the drawings.

### 3.7 LOCATION OF EQUIPMENT AND OUTLETS

- A. The approximate locations of cabinets, panelboards, wiring, power outlets, etc., are indicated on the drawings; however, they are not intended to give complete and accurate information. Determine the exact location after thoroughly

examining the general building plans and by actual measurements during construction, subject to the approval of the Architect.

### 3.8 ELECTRICAL INSTALLATIONS

- A. Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
1. Coordinate electrical systems, equipment, and materials installation with other building components.
  2. Verify all dimensions by field measurements.
  3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
  4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
  5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
  6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
  7. Coordinate connection of electrical systems with existing utilities and services. Comply with other governing regulations.
  8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
  9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
  10. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
  11. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in other sections of these specifications.

12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

### 3.9 WARRANTY

- A. Deliver originals of all guarantees and warranties on this portion of the work to the Owner. Warrant all equipment, materials and workmanship for one year in accordance with the terms of this Contract.

**END OF SECTION 26 00 10**

**LOW VOLTAGE CONDUCTORS**

**PART 1 - GENERAL**

1.1 CONFORMANCE

- A. Conform with applicable provisions of the General Conditions, Special Provisions, and General Requirements.

1.2 RELATED WORK IN OTHER SECTIONS

- A. Section 26 00 10, General Provisions; Section 26 05 26, Grounding.

**PART 2 - PRODUCTS**

2.1 WIRES AND CABLES (600 VOLTS)

- A. Type: Conform to the applicable UL and IPCEA Standards for the use intended. Copper conductors with 600 volts insulation unless otherwise specified or noted on the drawings. Stranded conductors for No. 8 or larger where elsewhere specified or noted on the drawings.
- B. Use of aluminum conductors will not be permitted.
- C. Insulation: Type THHN insulation, 75 degrees C, for all conductors otherwise specified or noted on the drawings. 90 degrees C minimum insulation within fixture wireways of fluorescent fixtures. All control conductors shall be THHN stranded or MTW.
- D. Size: No. 14 minimum for controls and No. 12 minimum for lighting and convenience outlets, etc. unless otherwise specified or noted on the drawings. Not less than NEC requirements for the system to be installed. If the equipment to be installed required larger conductor and conduit sizes than indicated on the drawings, the required changes shall be made without additional charge to the Owner.
- E. Color Coding: Phase, neutral, and ground conductors color-coded in accordance with NEC. Connect all conductors of the same color to the same phase conductor. Color coding shall be A-black, B-red, C-blue, N-white, for 120/208 volts and A-brown, B-orange, C-yellow, N-off white for 277/480 volts, with green for all ground conductors. Conductors No. 14, 12 and 10 shall be solid color compounded for entire length.

## 2.2 CONNECTORS AND LUGS

- A. For Copper Conductors No. 6 and Smaller: 3M Scotch-Lok or T & B Sta-Kon compression or indent type connectors with integral or separate insulating caps.
- B. For Copper Conductors Larger than No. 6: Solderless, indent, hex screw or bolt type pressure conductors, properly taped or insulated.

## 2.3 TAPE

- A. Plastic tape: 8.5 mils minimum thickness, 1,000,000 megohms minimum insulation resistance, oil resistant vinyl backing, oil resistant acrylic adhesive, incapable of supporting combustion per ASTM D-568 Test Method B.

## **PART 3 - EXECUTION**

### 3.1 SPLICES

- A. (480 Volts and Under): Conductor lengths shall be continuous from termination to termination without splices unless approved by the Owner.

### 3.2 PULL WIRES

- A. In each empty conduit, except underground conduits, install a No. 14 galvanized steel pull wire or a plastic line having a tensile strength of not less than 200 pounds. In each empty underground conduit install a No. 10 AWG bare, hard drawn copper or copper clad pull wire or a plastic line having a tensile strength of no less than 200 pounds.

### 3.3 IN RACEWAYS

- A. Install conductors in rigid conduit. EMT or flexible metallic conduit, unless otherwise specified or noted on the drawings.

### 3.4 CABLE BENDS

- A. Radius of ends not less than 10 times the outer diameter of the cable.

### 3.5 BUNDLING

- A. Conductors No. 10 and smaller shall be neatly and securely bundled and conductors larger than No. 10 shall be neatly and securely cabled in individual circuits, utilizing marlin twine, two ply lacing or nylon straps.

### 3.6 CONDUCTOR PULL

- A. Conductors shall not be pulled into conduits until after all plastering or concrete work is completed and all conduits in which moisture has collected have been swabbed out.

3.7 CONNECTORS AND LUGS

- A. Install with manufacturer's recommended tools and with the type and quantity of deformations recommended by manufacturer.

3.8 LABELING

- A. All conductors and neutrals shall be tagged in every junction box and cabinet with wrap around, stick-on labels or pre-marked nylon clip sleeves identifying panel and circuit number.

**END OF SECTION 26 05 19**

**PART 1 - GENERAL**

1.1 RELATED WORK IN OTHER SECTIONS

- A. Section 26 00 10, General Provisions; Section 26 05 33, Raceways, Boxes and Fittings; and Section 26 05 19, Conductors

**PART 2 - PRODUCTS**

2.1 GROUNDING SYSTEM

- A. Materials, equipment and devices related to the grounding system are specified under other sections of these specifications.

**PART 3 - EXECUTION**

3.1 EQUIPMENT GROUNDING SYSTEM

- A. General: Provide a complete equipment grounding system in accordance with the minimum code requirements and as further indicated on the drawings or specified. The equipment ground (green conductor) consists of metallic conditions to ground of non-current carrying metal parts of the wiring system or apparatus connected to the system. The primary purpose of equipment grounding is to provide greater safety by limiting the electrical potential between non-current carrying parts of the system to provide a low impedance path to ground for possible ground fault currents.
- B. Ground Bar: Provide an uninsulated equipment ground bar, separate from any insulated neutral bar, in all switchboards, panelboards, transformers, motor control centers, starters, disconnect switches, cabinets, etc., for grounding the enclosure and for connecting other equipment ground conductors. The ground bar shall be an integrally mounted and braced bus bar in switchboards or a separately mounted bar adequately braced or bolted at the enclosure of other types of equipment. The ground bar shall be adequately braced or bolted to the enclosure after thoroughly cleaning both surfaces to assure good contact. Provide solderless pressure connectors for all conductor terminations. Number and size of pressure connectors on equipment grounding bars as required for the termination of equipment grounding conductors. In addition to the active circuits, provide pressure connectors for all three-phase spares and spaces.

- C. Conduits: Where metallic conduits terminate without mechanical connection to a metallic housing of electrical equipment by means of lock nut and bushings, provide ground bushing connected with a bare copper conductor to the ground bar in the electrical equipment. Metallic conduits containing ground wiring shall be bonded to the ground wire at both conduit entrance and exit. Install grounding conductor in each non metallic conduit or duct except those used for telephone, sound, or low-voltage signals and in all flexible conduit that does not have a built-in ground conductor. Bond the conductor at both ends to the equipment grounding system.
- D. Feeders and Branch Circuits: Provide a separate green insulated equipment grounding conductor for each single or three-phase feeder and each branch circuit with a three-phase protective device. Provide a separate green insulated equipment grounding conductor for single phase branch circuits where indicated on the drawings. Install the required grounding conductor in the common conduit or raceway with the related phase and/or neutral conductors and connect to the box or cabinet grounding terminal. Where there are parallel feeders installed in more than one raceway, each raceway shall have a green insulated equipment ground conductor.
- E. Devices: Install a minimum No. 12 green insulated equipment bonding conductor from a grounding terminal in the respective outlet or junction box to the green ground terminal of all receptacles and through flexible conduit to all light fixture housings.
- F. Motors: Install a separate green insulated equipment bonding conductor from the equipment ground bar in the motor control center of separate starter through the conduit and flexible conduit to the ground terminal in the connection box mounted on the motor. Install the grounding conductor in the common conduit or raceway with the related motor circuit conductors.

### 3.2 SEPARATELY DERIVED SYSTEMS

- A. Transformers creating separately derived distribution systems, such as dry-type transformers, shall utilize the equipment ground bars in the transformer enclosure for both secondary equipment ground and secondary neutral ground with separate grounding conductor extended to an approved ground electrode.

### 3.3 GROUND CONNECTIONS

- A. Clean surfaces thoroughly before applying ground lugs or clamps. If surface is coated the coating must be removed down to the bare metal. After the coating has been removed, apply a non-corrosive approved compound to cleaned surface and install lugs or clamps. Where galvanizing is removed from metal, it shall be painted or touched up with "Galvanox", or equal.

**END OF SECTION 26 05 26**

**RACEWAYS, BOXES, AND FITTINGS**

**PART 1 - GENERAL**

1.1 CONFORMANCE

- A. Conform with applicable provisions of the General Conditions, Special Provisions and General Requirements.

1.2 RELATED WORK IN OTHER SECTIONS

- A. Section 26 00 10, General Provisions; Section 26 05 26, Grounding.

**PART 2 - PRODUCTS**

2.1 CONDUITS

- A. Steel Conduit: Rigid, threaded, thick wall, zinc coated on the outside and either zinc coated or coated with an approved corrosion resistant coating on the inside.
- B. Electrical Metallic Tubing (EMT): Mild steel, zinc coated on the outside and either zinc coated or coated with an approved corrosion resistant coating on the inside. Maximum, size 2 inch electrical trade size unless noted on the drawings or specifically approved.
- C. Intermediate Metal Conduit (IMC): Rigid, threaded, lightweight steel, zinc-coated on the outside and either zinc-coated or coated with an approved corrosion resistant coating on the inside.
- D. Flexible Conduit: Commercial greenfield, galvanized steel, with a separate grounding bond wire installed in the conduit in addition to other wires.
- E. Liquid Tight Flexible Conduit: Flexible galvanized steel tubing with extruded liquid tight PVC outer jacket and a continuous copper bonding conductor wound spirally between the convolutions. Where a separate grounding conductor is installed in the conduit, bonding conductor in the convolutions may be omitted.
- F. Plastic coated rigid steel conduit shall be hot galvanized steel conduit with a coating of polyvinyl chloride, minimum 15 mills (0.015), on the exterior surfaces, shall have an approved corrosion resistant coat inside and shall be Pittsburgh, J & L, Republic or approved equal.
- G. Rigid Non-Metallic Conduit: Schedule 40, high impact PVC with 7,000 psi tensile strength at 73.4 F., 11,000 psi flexural strength, 8,600 psi compression strength, approved for 90 C. conductors. Carlon, Triangle, or approved equal.

- H. Aluminum Conduit: Rigid, threaded, thick wall type, approved for the application.
- I. Conduit Size: Minimum conduit size 1/2 inch except where specifically approved for equipment connections. Sizes not noted on drawings shall be as required by the NEC. All home runs to panel shall be 3/4 inch minimum. Conduits for #12 THHN wire shall be sized the same as for #12 TW wire.

## 2.2 CONDUIT FITTINGS

- A. Connectors and Couplings: Compression type threadless fittings for rigid steel conduit or IMC not permitted. Set screw type fittings for rigid aluminum conduit not permitted. EMT couplings and connectors either steel or malleable iron only. "Concrete Tight" or "Rain Tight" and either the gland and ring compression type or the stainless steel multiple point locking type. Connectors to have insulated throats. EMT fittings using set screws or indentations as a means of attachment are not permitted.
- B. Bushings: Insulated type, designed to prevent abrasion of wires without impairing the continuity of the conduit grounding system, for rigid steel conduit, IMC and rigid aluminum conduit larger than 1/2 inch size and connectors for EMT.
- C. Rigid Steel Conduit, IMC and EMT Fittings: Iron or steel only.
- D. Liquid Tight Flexible Conduit Fittings: With threaded grounding cone, a steel, nylon or equal plastic compression ring and a gland for tightening. Either steel or malleable iron only with insulated throats and male thread and locknut or male bushing with or without "O" ring seat. Each connector shall provide a low resistance ground connection between the flexible conduit and the outlet box, conduit or other equipment to which it is connected.
- E. Rigid Aluminum Conduit Fittings: Malleable iron, steel or aluminum alloy. Ferrous fittings zinc coated or cadmium plated. Aluminum alloy fittings shall conform with the characteristics defined by UL for aluminum rigid metallic conduit and shall not contain more than 0.04 percent copper.
- F. Flexible Conduit Fittings (Commercial Greenfield): Either steel or malleable iron only, with insulated throats.
- G. Fittings for PVC Coated Rigid Steel Conduit: Ells and couplings used with PVC coated rigid steel conduit shall have a factory applied coating of polyvinyl chloride, minimum 15 mills (0.015) on exterior surfaces and shall have a PVC sleeve extruded a minimum of 2" from one end of the fitting.

## 2.3 OUTLET BOXES

- A. Construction: Zinc coated or cadmium plated steel boxes of a class to satisfy the condition at each outlet except where unilet on conduit bodies are required. Knockout type with knockouts removed only where necessary to accommodate the conduit entering. Square cornered, straight sided gang

boxes, 4 inch octagon concrete rings and 4 inch octagon hung ceiling boxes with bars may be folded type, one piece deep drawn type for all other boxes.

- B. Size: To accommodate the required number and sizes of conduits, wires and splices in accordance with NEC requirements, but not smaller than size shown or specified. Standard concrete type boxes not to exceed 6 inches deep except where necessary to permit entrance of conduits into side of boxes without interference with reinforcing bars. Special purpose boxes shall be sized for the device or application indicated.

## 2.4 PULLBOXES

- A. Minimum NEC requirements unless larger box is noted. As specified for outlet boxes with blank cover for pullboxes with internal volume not more than 150 cubic inches. As specified for cabinets for pullboxes with internal volume over 150 cubic inches, except covers to have same thickness as box with corrosion resistant screw or bolt attachment.

## PART 3 - EXECUTION

### 3.1 CONDUIT INSTALLATIONS

- A. Conduit Systems: Rigid Steel conduit, IMC, EMT, or Rigid Non-Metallic conduit unless noted. Install steel conduits for underground runs, runs in concrete feeder circuits and where required by the NEC for mechanical protection, etc. Use flexible conduit only for motor or equipment connections and then only to the extent of minimum lengths required for connections. Install flexible conduit connections at all resilient mounted equipment. Provide liquid tight flexible conduit in exterior, wet or damp locations and for connections to the pipe mechanical system. Aluminum conduit may be used only in dry locations above ground in sizes two inch or larger for power and communications systems. Conduit and tubing shall be kept at least 6 inches from paralleled runs or hot water or steam pipes.
- B. Conduit Installation: Install concealed conduit and EMT in as direct lines as possible. Install exposed conduits and EMT parallel to or at right angles to the lines of the building. Right angle bends in exposed conduit and EMT runs shall be made with standard elbows, screw jointed conduit fittings or conduit bent to radius no less than those of standard elbows.
- C. Concealed Conduits: Install conduit systems concealed where possible unless otherwise noted. Conduit systems may be exposed in unfinished utility areas, ceiling cavities and where specifically approved by the Architect.

- D. Conduit in Concrete: Conduits shall not be installed in floor slabs poured on grade. Rigid steel conduit may be embedded in above grade concrete providing the outside diameter does not exceed 1/3 thickness of concrete slab, wall or beam, is located entirely within the center third of the member and lateral spacing of conduits is not less than 3 diameters. Aluminum conduit shall not be embedded in concrete or masonry.
- E. Conduit in Ground: PVC plastic coated rigid steel conduit shall be installed for all underground feeders and in all locations where conduit is in contact with dirt, soil, fill or earth. All fittings, couplings, ells, etc., used with conduit shall have same factory applied PC coating.
1. At his option, Contractor may substitute Schedule 40 rigid non-metallic conduit for PVC plastic coated rigid steel conduit, where allowed by the Code enforcing Authority. Installations and use of rigid non-metallic conduit shall comply with the NEC. An equipment grounding conductor, in accordance with NEC, shall be installed in all non-metallic conduits. All conduit sizes, shown on the plans, shall be increased to accommodate the installation of the equipment grounding conductor. All joints shall be made with solvent cement per manufacturer's recommendations and shall be watertight. Plastic conduit runs stubbing up to above grade junction boxes or conduit by installing a female adapter, 90 degree PVC coated rigid steel elbow and a PVC coated rigid steel nipple of length as required to stub conduit up. No plastic conduit shall be installed above grade. Plastic conduit shall be used for straight runs only. PVC coated rigid steel conduit shall be used for all bends, ells and offsets.
- F. Conduit Bends: In any conduit or EMT run, the number of quarter bends or equivalent between terminations at cabinets or boxes shall not exceed four bends for conduits up to 1 1/4 inch, three bends for 1 1/2 to 2 1/2 inch conduits and two bends for 3 to 4 inch conduits. Conduit runs between cabinets or boxes shall not exceed 200 feet for straight runs nor 100 feet for runs with maximum number of bends. Bends in telephone feeder conduits shall be long radius.
- G. Conduit Openings: Protect all vertical runs of conduits or EMT terminating in the bottoms of boxes or cabinets, etc., from the entrance of foreign material prior to installation of conductors.
- H. Sleeves for Conduit: Install sleeves for conduit where shown or as required. Conduit sleeves not used shall be plugged with recessed type plugs. Sleeve all conduit passing through walls. Sleeves that are used shall be caulked tight with lead yarn.

### 3.2 CONDUIT SUPPORTS

- A. Supports: Provide supports for horizontal conduits and EMT not more than 8 feet apart with not less than two supports for each 10 foot straight length and one support near each elbow or bend including runs above suspended ceilings and within 3 feet of all junction boxes, switches, fittings, etc.
- B. Strap: Install one hole pipe straps on conduits 1 1/2 inch or smaller. Install individual pipe hangers for conduits larger than 1 1/2 inch. Spring steel fasteners with hanger rods may be used in dry locations in lieu of pipe straps.
- C. Trapezes: Install multiple (trapeze) pipe hangers where two or more horizontal conduits or EMT run parallel and at the same elevation. Secure each conduit or EMT to the horizontal hanger member by a U-bolt, one hole strap or other specially designed and approved fastener.
- D. Hanger Rods: Install 1/4 inch diameter or larger galvanized steel rods for trapezes, spring steel fasteners, clips or clamps. Wire or perforated strapping shall not be used for the support of any conduit or EMT.
- E. Fastening: Fasten pipe straps and hanger rods to concrete by means of inserts or expansion bolts to brickwork by means of expansion bolts and to hollow masonry by means of toggle bolts. Wooden plugs and shields shall not be used. Power driven fasteners may be used to attach pipe straps and hanger rods to concrete only where approved by the Architect.
- F. All conduits not embedded in concrete shall be firmly secured by means of pipe clamps, hangers, etc., equal to Caddy fasteners of ERICO Products, Inc. Wire wrapped around conduits and supporting members will not be accepted.

### 3.3 CONDUIT STUB-UPS

- A. All conduits run under floor shall be stubbed up to a coupling set flush with floor. This includes conduits stubbed up in walls and feeder conduits. Install flush plug until after floor is finished, then complete connections to boxes or equipment.

### 3.4 OUTLET BOXES

- A. Outlet boxes, covers and fittings, according to the particular use for which they are required, shall be provided in the locations marked on the drawings by symbols, and/or for use to facilitate the installation of the electrical systems. When necessary, outlets shall be relocated so that where fixtures of other fittings are installed they will be symmetrically located according to the room layout and will not interfere with other work or equipment required by the drawings and these specifications.

- B. Installation: Unless otherwise specified or shown on the drawings, outlet boxes shall be flush mounted and the front edges of the boxes or plaster covers shall be flush with the finished wall or ceiling line or if installed in walls and ceilings of incombustible construction, not more than 1/4 inch back of same. Mount boxes with the long axes of devices vertical, unless otherwise specified. Boxes in plastered walls and ceilings shall be provided with plastic covers. A multiple of box extensions and/or covers will not be permitted. Install in a rigid and satisfactory manner with suitable metal bar hangers, box cleats, adjustable box hangers, etc. Use wood screws on wood, expansion shields on masonry and machine screws on steel work.

### 3.5 PULLBOXES

- A. Provide additional pullboxes wherever necessary to meet requirements for maximum length of conduit runs and maximum numbers of bends as specified under "Conduit and Fittings".

### 3.6 FLOOR BOXES

- A. Install level with top covers adjusted flush with finished floor or floor tile.

### 3.7 FIXTURE CONNECTIONS

- A. Recessed or surface light fixtures in lay-in or accessible ceilings shall be connected with minimum 1/2 inch flexible metallic conduit, 4 to 6 feet long with grounding provisions.

### 3.8 CLOSING OF OPENINGS

- A. Wherever slots, sleeves, or other openings are provided in floors or walls for the passage of conduits or other forms of raceway, such openings, if unused, or the spaces left in such openings, shall be filled or closed in a manner approved by the Architect.

### 3.9 IDENTIFICATION

- A. Refer to Section 26 05 53 for identification requirements for raceways and boxes.

**END OF SECTION 26 05 33**