

SECTION 230501 - BASIC MECHANICAL MATERIALS AND METHODS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Requirements specified in Division 23 Section "Common Work Results for HVAC" apply to this section.
- C. Requirements of Division 03 specification sections apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Extent of mechanical related work required by this section is indicated on drawings and/or specified in other Division 23 sections.
- B. This Contractor shall perform all painting incidental to this work.
- C. Furnish and install all miscellaneous steel required for supports, hangers, anchors, guides, etc., required for installation of equipment and materials furnished and installed under this Division. Steel used in a moist environment shall be hot dipped galvanized unless otherwise noted.
- D. This Contractor shall furnish and install concrete foundations or bases under all equipment that rests on floors in Mechanical Equipment Rooms. Follow drawings and/or manufacturer's literature with regard to design and construction of same.

1.3 QUALITY ASSURANCE

- A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.
- B. Concrete Work Codes and Standards: Comply with governing regulations and, where not otherwise indicated, comply with industry standard, in its application to work in each instance.
- C. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including the recommended installation method, all in accordance with Division 01 and Section 230500 requirements.

PART 2 - PRODUCTS

2.1 MATERIALS OF DIVISION 23 CONCRETE WORK

A. Reinforcing Materials:

1. Reinforcing Bars: Except as otherwise indicated, provide ASTM A 615, deformed, Grade 40 for size numbers 3 through 18; ASTM A 675, plain, Grade 60, for size number 2; sizes as indicated or required.

B. Reinforcement Supports: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Provide wire bar type supports complying with CRSI recommendations, unless otherwise indicated.

C. Concrete Materials:

1. Portland Cement: ASTM C 150, Type I, except as otherwise indicated.
2. Aggregates: ASTM C 33, except as otherwise indicated.
 - a. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used.
 - b. For rough grouting, provide aggregate which is well graded and 100 percent passing through 3/8" sieve.
3. Water: Clean and free of substances harmful to concrete.

2.2 DESIGN AND PROPORTIONING OF CONCRETE MIXES

A. General: Design mechanical work concrete as follows, for each 28-day compressive strength class:

1. 4000 psi Class: 565 lbs. of cement per cu. yd. (6.0 sacks), and 0.35 water/cement ratio.
2. 3000 psi Class: 500 lbs of cement per cu. yd. (5.25 sacks), and 0.46 water/cement ratio.
3. 2500 psi Class: 450 lbs. of cement per cu. yd. (4.75 sacks), and 0.54 water/cement ratio.
4. Backfill Class (Lean Concrete): 375 lbs of cement per cu. yd., (4.0 sacks), and 0.60 water/cement ratio.
5. Rough Grouting Class: 565 lbs. of cement per cu. yd. (6.0 sacks), and 0.60 water/cement ratio.

B. Mix for Patching: Where mechanical work requires patching of exposed concrete work which has been cut to accommodate mechanical work, provide concrete patching mix which is identical with mix of work being patched (same cement, aggregates, admixtures and proportioning).

2.3 GENERAL DIVISION 23 PAINTING PRODUCT REQUIREMENTS:

- A. All exposed insulation in occupied areas (and elsewhere, as indicated) shall be painted at the time of installation with one coat of water base paint. At the completion of the work all such insulation shall be given an additional coat of alkyd resin paint of a color to match existing building structure, or as selected by the Architect/Engineer.
- B. All uncovered ferrous pipe, fittings, exposed threads of galvanized pipe, non-factory painted portions of valves, hangers, structural steel, expansion tanks, cooling tower sumps, return air fans, and all other ferrous work shall be thoroughly cleaned and given two coats of alkyd resin paint of a color as selected by the Architect/Engineer.
- C. All uncovered exposed sheet metal in occupied areas (and elsewhere, as indicated) shall be thoroughly cleaned and neutralized and given two (2) coats of alkyd resin paint of a color as selected by the Architect/Engineer.
- D. All general equipment and materials so indicated on the drawings as work to be painted by this contractor shall be thoroughly cleaned and given two (2) coats of a color as selected by the Architect/Engineer.
- E. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

Devoe and Reynolds Co. (Devoe).
Glidden Coatings and Resins, Div. of SCM Corporation (Glidden).
Benjamin Moore and Co. (Moore).
PPG Industries, Pittsburgh Paints (Pittsburgh).
Pratt and Lambert (P & L).
The Sherwin-Williams Company (S-W).

PART 3 - EXECUTION

3.1 INSTALLATION OF CONCRETE WORK

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions.
- B. Formwork:
 - 1. General: Design, construct and maintain formwork to support vertical and lateral loads including pressure of cast-in-place concrete. Construct formwork so that formed concrete will be required size and shape and in required location. Construct with joints which will not leak cement paste. Form sides and bottoms of concrete work, except where clearly indicated to be cast directly in excavation or against other construction, or on grade or prepared subgrade. Design and construct forms for easy removal without damage to concrete and other work.
 - a. Install chamfer strips at external corners of exposed concrete work.

- b. Construct forms to retain equipment anchor bolts in accurate locations during placement of reinforcing steel and concrete. Use templates furnished by equipment manufacturers to locate anchor bolts or, where not furnished, locate by accurate measure from certified setting diagrams.

C. Placing Reinforcement:

1. General: Comply with requirements and recommendations of specified standards, including "Placing Reinforcing Bars" by CRSI. Place bars where indicated and support to prevent displacement during concrete placement, using appropriate reinforcement supports, properly spaced and wire tied to reinforcing bars.
 - a. Place reinforcement to obtain at least minimum recommended coverages for concrete protection. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
2. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which would reduce bond with concrete.

D. Placing Concrete:

1. Wet wooden forms which have been coated with compound, immediately before concrete, and remove excess water from forms.
2. Strength-Class Application: Comply with the following general application requirements.
 - a. Backfill: Provide backfill class (lean concrete).
 - b. Miscellaneous Supported Work: Provide 3000 PSI class for curbs, pads, and similar supported work.
 - c. Concrete Fill: Provide 2500 PSI class for filling structural steel foundation frames and for filling similar large-volume units.
 - d. Concrete Grout: Provide rough grouting class for filling voids to be grouted which are too small to be filled effectively with 2500 PSI class concrete.
 - e. Patching General Concrete Work: Match concrete being patched.
3. Deposit concrete continuously or in layers of thickness which will result in no concrete being placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within section. If section cannot be placed continuously, provide construction joints. Deposit concrete as nearly as practicable in its final location, so as to avoid segregation due to rehandling or flowing.
4. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures complying with recommended practices of ACI 309; eliminate voids in work.
5. Cold Weather Placement: Comply with ACI 306. Do not use frozen materials or materials containing ice and snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. When air temperature has fallen or is expected to fall below 40 deg F (4.4 deg C), heat water and aggregates uniformly before mixing, as required to obtain concrete mixture temperature of not less than 50 deg F (10 deg C), and not more than 80 deg F (26.7 deg C), at time of placement. Protect concrete work from

physical damage and reduced strength resulting from frost, freezing actions, or low temperatures.

6. Finishing Horizontal Surfaces: Float and trowel horizontal (top) surfaces to level, smooth, uniform textured, dense finish, where surface is to remain exposed or receive coating, membrane or other thin-set finish. Otherwise, leave struck-off surface undisturbed; except scratch surfaces which are to receive concrete or mortar topping or setting bed, by raking with a stiff broom.
7. Depress top of concrete backfill sufficiently so that supported work can be set in bed of mortar or sand as indicated.
8. Curbs: Provide monolithic finish on interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to hard, dense finish with corners, intersections and terminations slightly rounded and coved.
9. Surface Repairs:
 - a. Unexposed Surfaces: Repair significantly damaged and honeycombed areas, and remove major projections and fins where forms have been removed.
 - b. Exposed Surfaces: On formed surfaces which are to be exposed, including those to be coated or covered with membrane or other thin-set applied finish, repair and patch form-tie holes and damaged and honeycombed areas, filling voids with grout and completely removing fins and other projections.

E. Concrete Curing and Protection;

1. General: Protect freshly placed concrete from drying and excessively cold and hot temperatures and maintain in moist condition at relatively constant temperature for period of time necessary for hydration of cement, proper hardening, and achievement of strength requirements as specified.

F. Miscellaneous Concrete Work:

1. Concrete Grouting:
 - a. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
 - b. Clean surfaces that will come into contact with grout.
 - c. Provide forms as required for placement of grout.
 - d. Avoid air entrapment during placement of grout.
 - e. Space approximately 1" thick between bottom of equipment and top of concrete foundation or base which remains after shimming, shall be filled completely with grouting. Grout shall be made up with sand and cement designed for the purpose which does not shrink on setting up.
 - f. Grout openings and recesses as indicated, in and around plumbing work and other work which penetrates or adjoins plumbing concrete work, using rough grouting class of concrete mix.
 - g. Provide formwork where required, and tamp, screed and trowel surfaces.
 - h. Place grout on concrete bases and provide smooth bearing surface for equipment.
 - i. Place grout around anchors.
 - j. Exposed surface of grouting shall be finished to make a neat appearance.
 - k. Cure grout as specified for concrete work.

2. Concrete Bases: In the absence of more specific information, either on drawings, or manufacturer's literature, the bases shall be level, shall have a minimum height above finished floor of 4" and extend 3" beyond the skids, feet or bed plate of the item of equipment.
 3. Concrete pads, beams, pedestals, or saddles placed in existing structures shall be mounted securely to the original substrate with anchor bolts.
- G. General Concrete Clean-Up: Upon completion of concrete work, clean excess concrete from adjacent areas and surfaces. Remove excess concrete by proper methods of washing or scraping, using care not to scratch or otherwise damage finished surfaces.

3.2 SURFACE PREPARATION FOR PAINTING:

- A. General: Clean surfaces before applying paint products. Remove oil and grease prior to mechanical cleaning. Comply with paint products manufacturer's instructions for surface cleaning and preparation. Remove surface-applied accessories which are not to be painted, and reinstall after completion of painting. Protect non-removable items not to be painted, by covering with paper or plastic film.
- B. Ferrous Metal Surfaces: Clean and remove mill scale and loose rust on surfaces which are not zinc-coated or shop/factory prime coated.
- C. Zinc-Coated Surfaces: Clean with non-petroleum based solvent. Wash with copper sulfate solution and flush with water, unless surface has been pretreated, or unless treatment is not recommended by manufacturer of prime coat.

3.3 PAINT SYSTEM APPLICATION:

- A. Environmental Conditions, Painting Work: Comply with governing regulations concerning use of and conditions for application of paint. Comply with manufacturer's recommendations and instructions. Do not apply paint in unfavorable conditions of temperature, moisture (including humidity) or ambient contamination (dust and other pollutants).
- B. Mixing: Comply with manufacturer's recommendations for mixing or stirring paint products immediately before application.
- C. Application Limitations: Except as otherwise indicated, paint every accessible surface of each unit of work indicated to be painted, regardless of whether in location recognized as "concealed" or "exposed".
 1. Omit painting on surfaces located in service shafts and above non-removable ceilings and in similar places where in the opinion of the Engineer, space is too limited or services are too congested to allow access for painting.
 2. Omit painting on machined sliding surfaces and rotating shafts of equipment, and on nonferrous finished metals including chrome plate, stainless steel, special anodized aluminum, brass/bronze and copper, and on plastics and similar finished materials, except where specifically indicated to be color-coded by painting.

3. Omit painting on required name plates, labels, identification tags, signs, markers, printed instructions, performance ratings, flow diagrams and similar text and graphics, located within the scope of work indicated to receive paint application.
 4. Omit specified prime coat of paint system for metal surfaces where surface has shop-applied prime coat of equivalent quality. Apply prime coat on other surfaces to be painted; comply with paint manufacturer's instructions for prime coating where not otherwise indicated. Apply additional prime coats where suction spots or unsealed areas appear.
- D. General Application Requirements: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate, for type of material being applied, and for ambient conditions. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Apply paint at edges, corners, joints, welds and exposed fasteners in manner which will ensure dry-film thickness equal to that of flat surfaces. Allow sufficient time between successive coats for proper drying (comply with manufacturer's drying instructions).
1. Number of Coats: Number indicated is minimum number; apply as many coats as are necessary to comply with dry-film thickness requirements.
 2. Coating Thickness: Apply uniform coats to produce dry-film thickness indicated or, if not otherwise indicated, apply paint without thinning in application thickness recommended by manufacturer for each coat.
 3. Smooth Finishes: Except as otherwise indicated, apply paint in smooth finish without noticeable texture, cloudiness, spotting, holidays, laps, brush marks, runs, sags, ripples, ropiness and other surface imperfections.
 4. Textured Finishes: Where indicated, roll and redistribute paint of final coat to even texture. Match adjoining texture paint finishes if any, and roll to eliminate evidence of roller or lap marks and other unevenness and imperfections.

3.4 PAINTING CLEAN-UP AND PROTECTION:

- A. General Painting Clean-Up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day. When directed by Architect/Engineer, retain paint containers from application of coatings on particular unit or area of work, until average dry-film thickness has been calculated.
1. Spattered Surfaces: Upon completion of painting work, clean paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
 2. Protection: Protect work of other trades, whether to be painted or not, against damage by painting work. Correct damage by cleaning, repairing or replacing and repainting as directed. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings installed for protection of work not to be painted, after completion of painting operations. At completion of work by other trades, touch-up and restore damaged or defaced painted surfaces.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

PART 4 - SUPPLEMENTAL REQUIREMENTS

4.1 KENT STATE UNIVERSITY SUPPLEMENTAL REQUIREMENTS:

- A. The requirements listed below are specific to Kent State University (KSU). Specifications listed in the following notes shall take precedence in case of conflicting information listed elsewhere in document.
- B. Miscellaneous Metals: All outdoor miscellaneous metal equipment supports shall be galvanized steel. Spray-on galvanizing shall be applied to all disturbed areas. All indoor miscellaneous metal equipment supports shall be black iron, primed and painted or galvanized.
- C. All materials shall be non-asbestos containing.
- D. All firestop material shall be painted to match adjacent wall surfaces in visible public spaces.
- E. Obtain welding permit from KSU OUA.

END OF SECTION 230501