

PROJECT MANUAL
Including Specifications

**WAYNE WESTLAND
FIRE STATION NO. 2**

CITY OF WESTLAND
WESTLAND, MICHIGAN

SIDOCK GROUP, INC. PROJECT NO. 23196

SIDOCK GROUP, INC.
45650 GRAND RIVER AVENUE
NOVI, MICHIGAN 48374
(248) 349-4500

PLANTE MORAN REALPOINT
3000 Town Center – Suite 100
SOUTHFIELD, MICHIGAN 48075
(248) 223-3500

PROJECT MANUAL
Including Specifications for

WESTLAND FIRE STATION NO. 2
City of Westland, Michigan

Architect's Project No. 23196

OWNER:	City of Westland, Michigan 3300 S. Wayne Rd. Westland, Michigan
ARCHITECTS – ENGINEERS:	Sidock Group, Inc. 45650 Grand River Avenue Novi, Michigan 48374 Telephone: (248) 349-4500
PROGRAM MANAGERS:	Plante Moran Realpoint 3000 Town Center – Suite 100 Southfield, Michigan 48075 Telephone: (248) 223-3500

Address all communications to the Program Manager at
the address and telephone number above.

Date: May 10, 2024

DIVISION 11 - EQUIPMENT

- 11 00 00 Equipment
- 11 31 00 Appliances

DIVISION 12 - FURNISHINGS

- 12 00 00 Furnishings
- 12 20 00 Window Treatments
- 12 35 30 Manufactured Casework

FACILITY SERVICES SUBGROUP

DIVISION 21 - FIRE SUPPRESSION

- 21 05 00 Common Work Results for Fire Suppression

DIVISION 22 - PLUMBING

- 22 05 00 Common Work Results for Plumbing
- 22 07 00 Plumbing Insulation
- 22 10 00 Plumbing Piping and Pumps
- 22 15 00 General Service Compressed-Air Systems
- 22 30 00 Plumbing Equipment
- 22 42 00 Commercial Plumbing Fixtures

DIVISION 23 - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

- 23 05 00 Common Work Results for HVAC
- 23 05 93 Testing, Adjusting, and Balancing
- 23 07 00 HVAC Insulation
- 23 11 00 Facility Fuel Piping
- 23 20 00 HVAC Piping
- 23 30 00 HVAC Air Distribution
- 23 54 00 Furnaces
- 23 55 23 Low Intensity Gas-Fired Radiant Heaters
- 23 63 13 Air-Cooled Refrigerant Condensers

DIVISION 24 - NOT USED

DIVISION 25 - INTEGRATED AUTOMATION (NOT USED)

DIVISION 26 - ELECTRICAL

- 26 05 19 Low-Voltage Electrical Power Conductors and Cables
- 26 05 26 Grounding and Bonding for Electrical Systems
- 26 05 29 Hangers and Supports for Electrical Systems
- 26 05 33 Raceways and Boxes for Electrical Systems
- 26 05 44 Sleeves and Sleeve Seals for Electrical Raceways and Cabling

- 06 15 00 Wood Decking
- 06 41 00 Custom Casework
- 06 61 00 Solid Surface Fabrications

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

- 07 21 00 Thermal Insulation
- 07 26 00 Vapor Retarders
- 07 31 13 Asphalt Shingles
- 07 46 00 Fiber Cement Siding
- 07 62 00 Sheet Metal Flashing and Trim
- 07 84 00 Firestopping
- 07 84 00 UL Details
- 07 90 00 Joint Protection

DIVISION 08 - OPENINGS

- 08 11 13 Hollow Metal Doors and Frames
- 08 11 16 Aluminum Thermal Flush Doors
- 08 14 00 Wood Doors
- 08 32 13 Sliding Aluminum-Framed Glass Doors
- 08 35 00 Electric Four Fold Doors
- 08 51 13 Aluminum Windows
- 08 71 00 Door Hardware
- 08 80 00 Glazing
- 08 91 00 Louvers

DIVISION 09 - FINISHES

- 09 21 16 Gypsum Board Assemblies
- 09 30 00 Tiling
- 09 51 13 Acoustical Panel Ceilings
- 09 65 00 Resilient Flooring
- 09 68 00 Carpeting
- 09 90 00 Painting and Coating

DIVISION 10 - SPECIALTIES

- 10 21 13 Toilet Compartments
- 10 28 00 Toilet Accessories
- 10 28 01 Toilet Accessories Product Literature
- 10 44 00 Fire Extinguishers, Cabinets, and Accessories
- 10 51 13 Metal Lockers
- 10 99 90 Miscellaneous Specialties

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- 26 05 44 Sleeves and Sleeve Seals for Electrical Raceways and Cabling
- 26 05 53 Identification for Electrical Systems
- 26 09 23 Lighting Control Devices
- 26 24 16 Panelboards

26 27 26	Wiring Devices
26 28 13	Fuses
26 28 16	Enclosed Switches and Circuit Breakers
26 51 00	Interior Lighting
26 51 19	LED Interior Lighting

DIVISION 27 - COMMUNICATIONS

27 00 00	Communications
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DIVISION 28

28 31 00	Fire Alarm & Sprinkler Alarm Systems
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SITE AND INFRASTRUCTURE SUBGROUP

DIVISION 31 – SEE DRAWINGS

DIVISION 32 – SEE DRAWINGS

DIVISION 33 – SEE DRAWINGS

END OF DOCUMENT

SECTION 01 00 00

GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Summary:
 - 1. Contract description.
 - 2. Work by Owner.
 - 3. Contractor's use of premises.
 - 4. Future work.
 - 5. Specification conventions.

- B. Price and Payment Procedures:
 - 1. Cash allowances.
 - 2. Contingency allowances.
 - 3. Testing and inspection allowances.
 - 4. Schedule of values.
 - 5. Applications for payment.
 - 6. Change procedures.
 - 7. Unit prices.
 - 8. Alternates.

- C. Administrative Requirements:
 - 1. Coordination.
 - 2. Field engineering.
 - 3. Meetings.
 - 4. Progress meetings.
 - 5. Equipment electrical characteristics and components.
 - 6. Cutting and patching.

- D. Submittals:
 - 1. Submittal procedures.
 - 2. Construction progress schedules.
 - 3. Proposed products list.
 - 4. Product data.
 - 5. Shop drawings.
 - 6. Samples.
 - 7. Manufacturer's instructions.
 - 8. Manufacturer's certificates.

- E. Quality Requirements:
 - 1. Quality control.
 - 2. Tolerances.
 - 3. References.
 - 4. Labeling.

5. Mock-ups.
 6. Testing and inspection laboratory services.
 7. Manufacturer's field services and reports.
 8. Examination.
 9. Preparation.
- F. Temporary Facilities and Controls:
1. Temporary electricity.
 2. Temporary lighting for construction purposes.
 3. Temporary heating and cooling.
 4. Temporary ventilation.
 5. Telephone and facsimile service.
 6. Temporary water service.
 7. Temporary sanitary facilities.
 8. Field offices and sheds.
 9. Access roads.
 10. Parking.
 11. Progress cleaning and waste removal.
 12. Project identification.
 13. Fire prevention facilities.
 14. Barriers and fencing.
 15. Enclosures.
 16. Protection of installed work.
 17. Security.
 18. Water control.
 19. Pollution and environmental control.
 20. Removal of utilities, facilities, and controls.
- G. Product Requirements:
1. Products.
 2. Delivery, handling, storage, and protection.
 3. Product options.
 4. Substitutions.
- H. Execution Requirements:
1. Closeout procedures.
 2. Final cleaning.
 3. Starting of systems.
 4. Demonstration and instructions.
 5. Testing, adjusting and balancing.
 6. Protecting installed construction.
 7. Project record documents.
 8. Operation and maintenance data.
 9. Spare parts and maintenance materials.
 10. Warranties.

1.2 CONTRACT DESCRIPTION

- A. Construction of an approximately 12,900 SF, single story Fire Station and Command Center, and related site work, as indicated in these contract documents.
- B. Perform Work of Contract under a stipulated sum contract with General Contractor in accordance with Conditions of Contract.

1.3 WORK BY OWNER

- A. Owner will furnish and install equipment and furnishings, unless indicated otherwise in these contract documents.

1.4 CONTRACTOR'S USE OF PREMISES

- A. Limit use of premises to allow:
 - 1. Work by others and work by Owner.

1.5 FUTURE WORK – NOT USED

1.6 SPECIFICATION CONVENTIONS

- A. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words “shall be” are included by inference where a colon (:) is used within sentences or phrases.

1.7 CASH ALLOWANCES – NOT USED

1.8 CONTINGENCY ALLOWANCES – NOT USED

1.9 TESTING AND INSPECTION ALLOWANCES

- A. Testing and Inspection Allowances: The Owner will pay for the costs through the General Contractor and employ a testing and inspection firm. Testing and inspection firm shall follow these requirements and requirements within individual sections for bidding the work to the Owner.
- B. Included in General Contractor's Allowance: Cost of engaging testing or inspection firm, execution of tests or inspection, and reporting of results.
- C. Testing and inspection shall include all items as required by the 2017 Michigan Building Code as presented in chapter 17, “Structural Tests and Special Inspections”.
- D. Items by Contractor:
 - 1. Incidental labor and facilities required to assist testing or inspection firm.
 - 2. Costs of re-testing upon failure of previous tests as determined by Architect/Engineer.

- E. Reports will be submitted by independent firm to Architect/Engineer, Contractor, Owner, and authority having jurisdiction, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
 - 1. Submit final report indicating correction of Work previously reported as non-compliant.

- F. Agency Reports: After each test, promptly submit copies of report to Architect/Engineer, General Contractor, Owner, and authority having jurisdiction. When requested by Architect/Engineer, provide interpretation of test results. Include the following:
 - 1. Date issued.
 - 2. Project title and number.
 - 3. Name of inspector.
 - 4. Date and time of sampling or inspection.
 - 5. Identification of product and specifications section.
 - 6. Location in Project.
 - 7. Type of inspection or test.
 - 8. Date of test.
 - 9. Results of tests.
 - 10. Conformance with Contract Documents.

1.10 SCHEDULE OF VALUES

- A. Submit schedule on AIA Form G703. Contractor's standard form or electronic media printout will be considered.

- B. Submit Schedule of Values in duplicate within 15 days after date of Contractor Agreement.

1.11 APPLICATIONS FOR PAYMENT

- A. Submit three copies of each application on AIA Form G702 and G703 or approved version of Contractor's standard equivalent form.

- B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

- C. Payment Period: As provided in the General Conditions (Document AIA A201) and Supplementary Conditions.

1.12 CHANGE PROCEDURES

- A. Stipulated Sum/Price Change Order: Based on Proposal Request, and Contractor's fixed price quotation or Contractor's request for Change Order as approved by Architect/Engineer/Owner.

- B. Change Order Forms: AIA G701 or equivalent form.

1.13 UNIT PRICES – NOT USED

1.14 ALTERNATES – NOT USED

1.15 COORDINATION

- A. Coordinate scheduling, submittals, and Work of various sections of specifications to ensure efficient and orderly sequence of installation of interdependent construction elements.
- B. Verify utility requirement characteristics of operating equipment are compatible with building utilities.
- C. Coordinate space requirements and installation of mechanical and electrical work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable.
- D. In finished areas, conceal pipes, ducts, and wiring within construction.

1.16 FIELD ENGINEERING

- A. The General Contractor will employ a land surveyor to locate reference datum, provide layout and construction staking.
- B. Subcontractors are to protect survey control and reference points.
- C. Establish elevations, lines, and levels and certify elevations and locations of the Work conform with Contract Documents.
- D. Verify field measurements are as indicated on shop drawings or as instructed by manufacturer.

1.17 MEETINGS

- A. Contactor shall schedule preconstruction meeting after Notice of Award for affected parties.
- B. When required in individual specification section, convene pre-installation meeting at Project site prior to commencing work of section.

1.18 PROGRESS MEETINGS

- A. Contractor shall schedule and administer meetings throughout progress of the Work at a maximum of 2 week intervals or as agreed upon with Owner.
- B. Contractor shall preside at meetings, record minutes, and distribute copies within five days to those affected by decisions made, Architect, and Owner.

1.19 EQUIPMENT ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Motors: NEMA MG1 Type; specific motor type is specified in individual specification sections.
- B. Wiring Terminations: Terminal lugs to match branch circuit conductor; size terminal lugs to NFPA 70.
- C. Cord and Plug: Minimum 6 foot cord and plug including grounding connector; cord of longer length is specified in individual sections.

1.20 CUTTING AND PATCHING

- A. Employ original installer to perform cutting and patching new Work; restore Work with new Products.
- B. Submit written request in advance of cutting or altering structural or building enclosure elements.
- C. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:
 - 1. Fit several parts together, to integrate with other Work.
 - 2. Uncover Work to install or correct ill-timed Work.
 - 3. Remove and replace defective and non-conforming Work.
 - 4. Remove samples of installed Work for testing.
 - 5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.
- D. Cut masonry and concrete materials using masonry saw or core drill. Restore Work with new Products in accordance with requirements of Contract Documents.
- E. Fit Work tight to adjacent elements. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.
- F. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- G. Refinish surfaces to match adjacent finishes.

1.21 SUBMITTAL PROCEDURES

- A. Submittal form to identify Project, General Contractor, subcontractor or supplier; and pertinent Contract Document references.
- B. Apply Contractor's stamp, signed or initialed, certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.
- C. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of completed Work.

- D. Revise and resubmit submittals as required; identify changes made since previous submittal.
- E. Submittals to be in Electronic PDF format, unless otherwise approved.

1.22 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit initial progress schedule after date of Owner-Contractor Agreement.

1.23 PROPOSED PRODUCTS LIST

- A. Within 15 days after date of the Owner-Contractor Agreement, submit list of major Products proposed for use, with name of manufacturer, trade name, and model number of each product.

1.24 PRODUCT DATA

- A. Product Data:
 - 1. Submitted to General Contractor & Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
 - 2. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes as specified.
- B. Submit number of copies which Contractor requires, plus two copies which will be retained by Architect/Engineer and Owner. Electronic submittals in PDF format are acceptable and preferred over any paper copies.
- C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer's standard data to provide information unique to this project.

1.25 SHOP DRAWINGS

- A. Shop Drawings:
 - 1. Submitted to General Contractor & Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
 - 2. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes as specified.
- B. When required by individual specification sections, provide shop drawings signed and sealed by professional engineer responsible for designing components shown on shop drawings.
 - 1. Include signed and sealed calculations to support design.
 - 2. Submit drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
 - 3. Make revisions and provide additional information when required by authorities having jurisdiction.

1.26 SAMPLES

- A. Samples for Review:
 - 1. Submitted to General Contractor & Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
 - 2. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes as specified.
- B. Samples For Selection:
 - 1. Submitted to Architect/Engineer for aesthetic, color, or finish selection.
 - 2. Submit samples of finishes from full range of manufacturer's standard colors, textures, and patterns for Architect/Engineer selection.
 - 3. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes as specified.
- C. Submit samples to illustrate functional and aesthetic characteristics of Product.
- D. Submit samples of finishes from full range of manufacturer's standard colors, textures, and patterns for Architect/Engineer's selection.

1.27 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification sections, submit manufacturer printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.

1.28 MANUFACTURER'S CERTIFICATES

- A. When specified in individual specification sections, submit certifications by manufacturer to Architect/Engineer, in quantities specified for Product Data.
- B. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

1.29 QUALITY CONTROL

- A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturer's instructions.
- C. Comply with specified standards as minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

1.30 TOLERANCES

- A. Monitor fabrication and installation tolerance control of installed Products over suppliers, manufacturers, Products, site conditions, and workmanship, to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply fully with manufacturer's tolerances.

1.31 REFERENCES

- A. Conform to reference standards by date of issue current as of date of Contract Documents.
- B. When specified reference standard conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

1.32 LABELING

- A. Attach label from agency approved by authority having jurisdiction for products, assemblies, and systems required to be labeled by applicable code.
- B. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label.
 - 1. Model number.
 - 2. Serial number.
 - 3. Performance characteristics.

1.33 MOCK-UPS – NOT USED

1.34 TESTING AND INSPECTION LABORATORY SERVICES

- A. The Owner through the General Contractor will appoint, employ, and pay for specified services of independent firm to perform testing and inspection. See paragraph 1.9 for more information on required services.
- B. Independent firm will perform tests, inspections, and other services as required.
- C. Cooperate with independent firm; furnish samples as requested.
- D. Re-testing required because of non-conformance to specified requirements will be charged to Contractor.

1.35 MANUFACTURER'S FIELD SERVICES AND REPORTS

- A. When specified in individual specification sections, require material or Product suppliers or manufacturers to furnish qualified staff personnel to observe site conditions and to initiate instructions when necessary.

- B. Report observations and site decisions or instructions that are supplemental or contrary to manufacturer's written instructions.

1.36 EXAMINATION

- A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Verify utility services are available, of correct characteristics, and in correct location.

1.37 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

1.38 TEMPORARY ELECTRICITY

- A. Temporary power will be provided by General Contractor from the Electrical Utility.
- B. Provide temporary electricity and power outlets for construction operations, connections, branch wiring, distribution boxes, and flexible power cords as required.

1.39 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain temporary lighting for construction operations.
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- C. Permanent building lighting may be utilized during construction. Repair, clean, and replace lamps at end of construction.

1.40 TEMPORARY HEATING AND COOLING

- A. Provide heating and cooling devices and heat and cool as needed to maintain specified conditions for construction operations.
- B. Until new HVAC equipment is up and running, the Contractor will pay cost of energy as needed. New HVAC equipment shall not be used for temporary heating, cooling, and ventilation, until all dust producing operations are complete, included finishing of drywall surfaces, general clean-up is complete, and approval of Architect/Engineer and Commissioning Agent are received in writing. The cost for cleaning of ductwork will be paid for by the General Contractor if required after the construction is complete.
- C. All openings in ductwork shall be sealed off during dust producing construction activities.

- D. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.
 - E. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.
- 1.41 TEMPORARY VENTILATION
- A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- 1.42 TELEPHONE AND FACSIMILE SERVICE – NOT USED
- 1.43 TEMPORARY WATER SERVICE
- A. Contractor to furnish and pay for temporary water service from water utility company. Maintain access to service for use during construction, until permanent service is installed.
- 1.44 TEMPORARY SANITARY FACILITIES
- A. Provide and maintain required facilities and enclosures. New building facilities may not be used.
 - B. Maintain in clean and sanitary condition.
- 1.45 FIELD OFFICES AND SHEDS
- A. Office: Weather tight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture and drawing display table.
 - B. Provide space for Project meetings, with table and chairs to accommodate 8 people.
- 1.46 ACCESS ROADS
- A. Use existing roads accessing public streets to serve construction area, as designated by Owner.
- 1.47 PARKING
- A. Arrange for temporary parking areas to accommodate construction personnel in areas as designated by Owner.
- 1.48 PROGRESS CLEANING AND WASTE REMOVAL
- A. Collect and maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.

1.49 PROJECT IDENTIFICATION

- A. Provide 8 foot wide x 6 foot high project sign of exterior grade plywood and wood frame construction, painted, to Architect/Engineer's design and colors.
- B. Erect on site at location established by Architect/Engineer and approved by Owner.

1.50 FIRE PREVENTION FACILITIES

- A. This is a smoke-free environment. Prohibit smoking within buildings under construction and on the Owners property.
- B. Establish fire watch for cutting and welding and other hazardous operations capable of starting fires. Maintain fire watch before, during, and after hazardous operations until threat of fire does not exist.
- C. Portable Fire Extinguishers: NFPA 10; 10 pound capacity, 4A-60B: C UL rating.
 - 1. Provide one fire extinguisher on each floor of buildings under construction.
 - 2. Provide minimum one fire extinguisher in every construction trailer and storage shed.
 - 3. Provide minimum one fire extinguisher on roof during roofing operations using heat producing equipment.

1.51 BARRIERS AND FENCING

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage. Maintain access to existing adjacent Multi-Lakes Water & Sewer Authority Building. Coordinate with Owner.
- B. Construction: Contractor's option.

1.52 ENCLOSURES

- A. Provide temporary insulated weather tight closures to exterior openings to permit acceptable working conditions and protection of the Work.

1.53 PROTECTION OF INSTALLED WORK

- A. Protect installed Work and provide special protection where specified in individual specification sections.
- B. Prohibit traffic or storage upon waterproofed or roofed surfaces.

1.54 SECURITY

- A. Provide security and facilities to protect Work from unauthorized entry, vandalism, or theft.

1.55 WATER CONTROL

- A. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Provide erosion control in accordance with authority having jurisdiction.

1.56 POLLUTION AND ENVIRONMENTAL CONTROL

- A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.
- B. Provide dust control, erosion and sediment control, noise control, pest control and rodent control to allow for proper execution of the Work.

1.57 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion review.
- B. Remove underground installations. Grade site as indicated on Drawings.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore permanent facilities used during construction to specified condition.

1.58 PRODUCTS

- A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work.

1.59 DELIVERY, HANDLING, STORAGE, AND PROTECTION

- A. Deliver, handle, store, and protect Products in accordance with manufacturer's instructions.

1.60 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for manufacturers not named.

1.61 SUBSTITUTIONS

- A. Instructions to Bidders specify time for submitting requests for Substitutions during bidding period to requirements specified in this section.
- B. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

1.62 CLOSEOUT PROCEDURES

- A. Submit written certification Contract Documents have been reviewed, Work has been inspected, and Work is complete in accordance with Contract Documents and ready for Architect/Engineer's inspection.
- B. Submit final Application for Payment identifying total adjusted Contract Sum/Price, previous payments, and amount remaining due.

1.63 FINAL CLEANING

- A. Execute final cleaning prior to final inspection.
- B. Clean interior and exterior surfaces exposed to view. Vacuum carpeted and soft surfaces.
- C. Clean debris from site, roofs, gutters, downspouts, and drainage systems.
- D. Replace filters of operating equipment.
- E. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.64 STARTING OF SYSTEMS

- A. Provide seven days notification prior to start-up of each item.
- B. Ensure each piece of equipment or system is ready for operation.
- C. Execute start-up under supervision of responsible persons in accordance with manufacturer's instructions.
- D. Submit written report stating equipment or system has been properly installed and is functioning correctly.

1.65 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

- C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at equipment location.

1.66 TESTING, ADJUSTING, AND BALANCING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Contractor will appoint, employ, and pay for services of independent firm to perform testing, adjusting, and balancing.
- C. Reports will be submitted by independent firm to General Contractor, Architect/Engineer and Owner indicating observations and results of tests and indicating compliance or non-compliance with specified requirements and with requirements of Contract Documents.
- D. Cooperate with independent firm; furnish assistance as requested.
- E. Re-testing required because of non-conformance to specified requirements will be charged to Contractor.

1.67 PROTECTING INSTALLED CONSTRUCTION

- A. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- B. Protect finished floors, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- C. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- D. Prohibit traffic from landscaped areas.

1.68 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of Contract Documents to be utilized for record documents.
- B. Record actual revisions to the Work. Record information concurrent with construction progress.
- C. Specifications: Legibly mark and record at each Product section description of actual Products installed.
- D. Record Documents and Shop Drawings: Legibly mark each item to record actual construction.
- E. Submit documents to Architect/Engineer and Owner with claim for final Application for Payment.

1.69 OPERATION AND MAINTENANCE DATA

- A. Submit two sets prior to final inspection, bound in 8-1/2 x 11 inch text pages, three D side ring binders.
- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS" and title of project.
- C. Internally subdivide binder contents with permanent page dividers, logically organized, with tab titles legibly printed under reinforced laminated plastic tabs.
- D. Contents:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Owner, subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system.
 - 3. Part 3: Project documents and certificates.

1.70 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide Products, spare parts, maintenance and extra materials in quantities specified in individual specification sections.
- B. Deliver to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

1.71 WARRANTIES

- A. Provide duplicate notarized copies.
- B. Execute and assemble transferable warranty documents from subcontractors, suppliers, and manufacturers.
- C. Submit prior to final Application for Payment.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 91 00

COMMISSIONING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Contract documents are included by reference for information purposes only.

1.2 SUMMARY

- A. Section includes requirements that apply to the commissioning process

1.3 DEFINITIONS

- A. CxA: Commissioning Authority.
- B. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources and documentation requirements of the commissioning process.

1.4 GENERAL PROVISIONS

- A. Attention is directed to the Contract, General Conditions, and all sections within Division 1 – General Requirements that are hereby made part of this Section of the Commissioning Specifications.
- B. Examine all Sections of the Specifications for requirements that affect work under this Section.
- C. This Section of the Contract is set aside to incorporate current Commissioning contract requirements and to be the document by which this Section of the Contract will be built into the Final Commissioning Report.
- D. Commissioning: Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the Owner's operational needs. This is achieved by beginning in the design phase and documenting design intent and continuing through construction, acceptance and the warranty period with actual verification of performance. The commissioning process encompasses and coordinates the traditionally separate functions of system documentation, equipment start-up, control system calibration, testing and balancing, performance testing and training.
- E. Commissioning Objective: To have the Contractor complete a comprehensive system readiness process followed by system demonstration to the Commissioning Team with the Commissioning Firm providing the documentation/verification of the building systems that they perform in accordance with the requirements of the contract documents.

1.5 SUBMITTALS

- A. Commissioning Plan
- B. Commissioning Report
- C. Certificates of Readiness
- D. Certificates of Completion

1.6 COMMISSIONING PROCESS (CONSTRUCTION PHASE UP THRU WARRANTY PHASE OF PROJECT)

- A. The Owner shall champion the commissioning process with the Commissioning Firm to commission the building systems to the quality standards and procedures specified herein.
- B. The General Contractor shall work closely with the Commissioning Firm in establishing and maintaining the schedule of commissioning events for the commissioning of systems and activities noted below.
- C. Commissioning of the selected systems shall consist of demonstration and documentation of system readiness prior to demonstration using the PFPT checklists. The PFPT shall be developed and provided to the Contractors by the Commissioning Firm and shall be used in concert with the suggested manufacturer start-up checklists as part of contract start-up.
- D. Commissioning of the selected systems shall consist of demonstration of the interactive system operation through the use of finalized Functional Performance Test (FPT) narratives. The FPT narratives shall be completed with input during the Construction Phase from the Contractor and used to verify operation per design intent through all modes and conditions. Facility staff shall participate and receive on-the-job training during the Functional Performance Testing.
- E. Prior to Project Closeout, the Commissioning Firm shall work with the Contractor to compile the Re-Commissioning Management Manual.
- F. In the Post-Construction Phase, the Commissioning Firm shall facilitate a 10-month Warranty/Project Closeout meeting.

1.7 SYSTEMS TO BE COMMISSIONED

- A. Systems to be commissioned shall be listed below. Systems include all interconnected components and are not limited to the equipment listed within this specification.
 - 1. Heating, Ventilating, and Air Conditioning:
 - a. Central Air Handling Systems:
 - 1) Furnaces: F-1, F-2, F-3, F-4 & F-5.
 - 2) Air Cooled Condensing Units: ACU-1, ACU-2, ACU-3, ACU-4 & ACU-5.
 - 3) Filters and Filter Housings
 - 4) SA, RA, and Relief Air Distribution | Intake | Discharge System
 - 5) HVAC Controls.
 - b. Radiant Heating System:
 - 1) Gas Fired Infrared Heaters:: IRH-1, IRH-2, IRH-3, IRH-4, IRH-5, IRH-6, IRH-7, & IRH-8.

- c. Wall Mounted Indoor Cooling Unit
 - 1) Cooling Units: ICU-1
- d. Outdoor Air-Cooled Condensing Unit
 - 1) Condensing Units: ACCU-6
- e. Ventilation Systems
 - 1) Exhaust Fans: EF-1, EF-2, EF-3, EF-4, EF-5 & EF-6.
 - 2) Ductwork
- 2. Plumbing Systems
 - a. Domestic Hot Water Heater
 - b. Domestic Hot Water Recirculation System
 - c. Domestic Water
 - d. Pumps
- 3. Electrical Systems:
 - a. Power Distribution.
 - b. Lighting.
 - c. Lighting Controls.

1.8 COMMISSIONING ACTIVITIES

A. Construction Phase:

- 1. Draft Pre-functional Performance Test Checklists for insert into the Commissioning Report.
- 2. Draft Functional Performance Test narratives for insert into the Commissioning Report.
- 3. Facilitate a Commissioning Team Kick-off Meeting with handouts referencing Commissioning Task Schedule to provide a Commissioning Education Platform to the Commissioning Team.
- 4. Participate in regularly scheduled commissioning field coordination meetings facilitated by the Commissioning Firm at 4-6 week intervals (1-2 week intervals the last three months prior to completion) with the Contractor, Subcontractor, installing trade subcontractors, ATC subcontractor and TAB subcontractor. The purpose of the meetings will be to review the status of commissioning activities, schedule future activities, and resolve commissioning process issues.
- 5. Respond to comments on submittals that have been reviewed for commissionability.
- 6. Respond to comments on mechanical and electrical coordination drawings that have been reviewed for commissionability.
- 7. Observe and document Pre-Functional Performance Tests for systems being commissioned.
- 8. Observe and document Functional Performance Tests for systems being commissioned.
- 9. Participate in System Education/Training

B. Post-Construction Phase:

- 1. Facilitate in a Warranty/Project Closeout meeting at month 10.
- 2. Perform seasonal/deferred functional performance testing.
- 3. Complete Final Commissioning Report document.

PART 2 - PRODUCT

2.1 COMMISSIONING DOCUMENTATION

- A. The Trade Contractors shall provide the following documentation for inclusion in the commissioning report:
1. Startup Reports
 2. Completed Pre-Functional Test Checklists (blank checklists are provided by the CxA).
 3. Certificate of Readiness certifying that installation, prestart checks, and startup procedures have been completed (blank certificates are provided by the CxA).
 4. Certificate of Completion certifying that systems, subsystems, equipment, and associated controls are ready for testing (blank certificates are provided by the CxA).
 5. Test and Inspection Reports and Certificates
- B. The CxA shall provide the following documentation for inclusion in the commissioning report:
1. A commissioning plan that outlines the process for delivery and review of submittals, system manuals, process and schedule for completing pre-functional checklists, startup reports, and functional testing.
 2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
 3. Certificates of Readiness.
 4. Certificates of Completion
 5. Test and Inspection Reports and Certificates.
 6. Corrective Action Log
 7. Verification of Testing, Adjusting, and Balancing Reports.

2.2 COMMISSIONING TEAM

- A. The Commissioning Team shall consist of representatives from the following parties involved in the design and construction of this facility:
1. Owner's Representative
 2. Commissioning Firm
 3. Design Team Professionals (*associated with system to be commissioned*)
 4. General Contractor
 5. Testing Adjusting & Balancing (TAB) Contractor
 6. Installation Contractors (*associated with system to be commissioned*)
 7. Equipment Manufacturers (*associated with system to be commissioned*)

2.3 COMMISSIONING RESPONSIBILITY MATRIX

Work Description	TAB	Mech Contr	Elec Contr	Temp Cntrl Contr	GC	CxA	Architect Engineer	Owner's Rep.
Develop Cx Plan				S	S	P	S	S
Coordinate Cx Activities				S	S	P		
Prepare Construction Checklist Packages / Prefunctional Checklists						P		
Complete Construction Checklist Packages / Prefunctional Checklists	S	S	S	S	P			
Start-up and Debug	S	S	S	S	P	S		S
Prepare FPT's				S		P	S	
Preform FPT's		S	S	P		S		
Prepare Final Cx Report						P		
Review Cx Report							P	S
TAB Work	P	S	S	S				
Verify TAB Report Validity	S					P	S	
Owner Training		S	S	S	P			
Prepare Operating Manual		S	S	S	P	S	S	

P = Primary Responsibility
S = Support Role

2.4 PRE-FUNCTIONAL PERFORMANCE TESTS NARRATIVES

1. The Pre-Functional Performance Test Checklists will be included in the Commissioning Plan. The Commissioning Plan will be distributed at the "Kickoff" Commissioning Mtg.
2. Using the enhanced Pre-Functional Performance Test Checklists, the Contractor and/or installation Subcontractor shall complete the Pre-Functional Test and submit the completed sign forms and other appropriate start-up sheets, but limited to the equipment manufacturer's start-up sheets. Subcontractor shall submit the completed forms, initialed by the technician in-charge and attach other appropriate start-up sheets including but not limited to equipment manufacturer's start-up sheets. TAB contractor's field reports, etc., prior to the start of the Owner demonstration of the Functional Performance Tests.

2.5 FUNCTIONAL PERFORMANCE TEST NARRATIVES

1. The Contractor shall review and comment on the test actions specified in the Draft Functional Performance Test Narratives located in the Commissioning Plan and return documents to the Commissioning Firm prior to system commissioning.
2. The Commissioning Firm shall revise the Functional Performance Test Narratives during the Construction Phase to incorporate any changes required to comply with the approved submittals and any contract document changes. The revised Functional Performance Test Narratives shall be issued as Final and Approved for Executed Documents.
3. The Contractor shall use the Functional Performance Test format to test the systems prior to demonstrating the Functional Performance Test to the Owner, Facility Manager and Commissioning Firm. The Contractor shall submit a completed and signed Final Functional Performance Test form as evidence that the Contractor and/or the installation Subcontractor have tested the systems.
4. The Contractor shall use the Final Functional Performance Test Narrative format to commission the building systems demonstrating the Functional Performance to the Owner. During the Owner demonstration all deficiencies that can be corrected within 10 minutes, may be completed. Any corrective measures that will require more than a 10-minute corrective measure, will be documented by then Commissioning Firm on a Corrective Action Log for re-testing at a later, scheduled date.
5. The Contractor shall respond to the CxA's Corrective Action Log depicting non-compliant system demonstration items to be corrected within (2) business days after receipt of Corrective Action Log. CxA shall distribute log via email to Contractor within (2) business days after demonstration of systems to Owner to ensure their ability to comply. Upon CxA's receipt of executed Corrective Action Log from Contractor, re-testing of system will be scheduled upon notifying Owner of such intent.
 - a. The Contractor will be backcharged for CxA re-testing for manufacturer defects and/or the system requires more than one re-test.
 - b. The Contractor shall, with the Owner's approval, back charge the system installation Subcontractor for any additional costs incurred by the Owner for re-testing including, but not limited to, additional consultant fees. Contractor shall reimburse the Owner.

PART 3 - EXECUTION

3.1 COMMISSIONING GOALS

- A. The goal is to test/demonstrate the building systems to verify and document that they perform in accordance with the requirements of the contract documents and the BoD.
 1. A comprehensive, reusable Commissioning, Re-Commissioning, and Retro-Commissioning Plan
 2. Documented benefits from the Commissioning process
 3. A Commissioning Specification/Plan that defines the trade contractors' responsibilities as part of the commissioning process.
 4. Pre-Functional Performance Tests narratives to document the startup of equipment and systems and for future operation and maintenance information.
 5. Functional Performance Tests narratives to document the system performance, verification process and for future Re-Commissioning, and Retro-Commissioning Plan(s), as well as a lesson plan for system training in the future.
 6. A Re-Commissioning Management Manual for sustainable facility management.

3.2 COMMISSIONING TEAM MEMBER RESPONSIBILITIES

A. Owner

1. Champion the commissioning process
2. Provide the Design Intent Document to the CxA and the Design Professionals.
3. Review and comment on any revisions to the Basis of Design Document.
4. Provide the Basis of Design Document, prepared by the Design Professional and approved by the Owner, to the CxA, and each contractor for use in developing the Commissioning Plan, systems manual, and operation and maintenance training plan.
5. Participate in Pre-Functional Performance Testing
6. Participate in Functional Performance Testing
7. Facilitate the Commissioning process.
8. Participate in system education/training.
9. Periodically visit the construction site to become familiar with the project equipment/system installation.
10. Attend, if possible, commissioning coordination meetings.
11. Work with other commissioning team members to review CMMS preventive maintenance work order system.
12. Work with other commissioning team members with system education/training.
13. Witness and, to the greatest extent possible, participate in the following commissioning activities:
 - a. Initial equipment startup
 - b. Testing, adjusting and balancing
 - c. Component tests
 - d. Pre-functional Performance Tests
 - e. Functional Performance Test
14. Work with the Commissioning Team with interface of automatic control systems with existing building automation system, if available.

B. Commissioning Firm

1. Organize and lead the commissioning team.
2. Coordinate and direct the commissioning activities.
3. Provide a commissioning plan.
4. Convene commissioning team meetings.
5. Coordinate commissioning activities onto the project schedule with General Contractor.
6. Receive and review construction documentation (Requests for Information, Bulletins, Change Orders etc.) for impact on commissioning process.
7. Maintain Pending Issues and Deferred Seasonal Test Log.
8. Review equipment, system and control submittals for compliance with Basis of Design Document.
9. Provide an outline to the Trades Contractors what materials are required in the O&M documentation and assist in the assignment of someone who will organize the collection of this process.
10. Work with other commissioning team members to review O&M Manuals.
11. Work with other commissioning team members to establish CMMS preventive maintenance work order system.
12. Work with other commissioning team members with system education/training and provide written verification that training was conducted for all commissioning features and systems. Training program needs to address all training/education aspects.
13. Work with other commissioning team members to complete equipment, panel and valve bar code labeling/and tagging.
14. Each component, equipment or system shall be commissioned.

15. Installation observation according to the Basis of Design Document and the verification that no other systems compromise operation.
 16. Startup and checkout of equipment shall be completed by the contractor and documented per the manufacturer's instructions and contract documents.
 17. The Commissioning Firm shall apply a sampling method of start-up observation for systems to be commissioned. Ensure that all points are reading and reporting as expected and visually verify operation.
 18. Witness and observe to the greatest extent possible, participate in the following commissioning activities:
 - a. Initial equipment startup
 - b. Testing and balancing
 - c. Component tests
 - d. Pre-functional Performance Tests
 19. Work with building automation system contractor to create and maintain system trending data
 20. Facilitate Functional Performance Tests by testing each Sequence of Operation for each system.
 21. Maintain Corrective Action Logs
 22. Maintain Commissioning Pending Issues Log.
 23. Compile test data, inspection reports, and certificates; Include them in the commissioning report.
- C. Design Professionals
1. Fulfill construction administration per their contract with the Architect or Owner.
 2. Review equipment, system and control submittals for compliance with Design Intent Document.
- D. General Contractor
1. Champion and support the commissioning process.
 2. Attend commissioning coordination meetings.
 3. Manage the master scheduling process with regard to timing and duration of the commissioning activities.
 4. Manage the master prefunctional test checklists, master shop drawing log, data retrieval log, O&M Manuals and training schedule log.
 5. Immediately following the acceptance of each submittal and no later than 60-days from submittal acceptance, the Contractor's equipment supplier shall complete the Data Retrieval form included within Division 1 as an integral part of the submission process. Included with this form shall be also be the operation and maintenance requirements noted within the Division 1 Specification. In addition, the Contractor shall submit the equipment website where the O&M data can be located.
 6. Contractor shall provide a separate area within the Construction Trailer for the assembly of the O&M Manuals. An all-inclusive Table of Contents shall be displayed for the subcontractors to highlight open items and scheduled due dates of O&M insertions. The O&M Manuals will be built on a construction progress basis and will be reflective of each equipment/system that has been accepted and installed thus being in a completed state prior to demonstration of equipment/systems to Owner. Contractor shall assign a Project Coordinator to monitor this process thru to completion.
 7. Coordinate the completion and delivery of shop drawings, data retrieval log and O&M Manuals prior to system demonstration to allow Facility staff to reference during system education/training provided by the Contractor and observed by the Commissioning Firm.
 8. Ensure that Contractor correct deficiencies and make necessary adjustments to O&M Manuals and as-built drawings for applicable issues in any testing.

9. General Contractor shall provide Commissioning Firm with normal cut sheets and submittals of equipment/systems to be commissioned.
10. Coordinate equipment, panel and valve tagging process.
11. Contractor shall coordinate the individual databases (rooms, equipment, valves, panels and components) with the Owner's CMMS operator prior to production of labels. Each database shall be in Microsoft Excel for ease of downloading into the CMMS by the Owner.
12. Contractor shall follow Label Installation Procedures as so noted in Division 1.
13. Coordinate and schedule all equipment and system education/training.
14. Coordinate and schedule all testing compliance and maintain test log for equipment distribution and systems.
15. Coordinate and schedule Pre-Functional Performance Test and notify Commissioning Firm at least one (1) week prior to scheduled date.
16. Coordinate and schedule the contractor's initial Functional Performance Tests.
17. Coordinate and schedule Functional Performance Test demonstrations to the Owner and the Commissioning Firm at least two (2) weeks prior to scheduled date. Notify Commissioning Firm of any changes of scheduled testing giving Commissioning Firm at least 48-hour notice of change.
18. Coordinate and schedule deferred/seasonal tests in the appropriate season. All heating sequences to be tested in the winter and all cooling sequences in the summer.
19. Coordinate and schedule retest activities.
20. Ensure that commissioning activities are being scheduled into the Master Project Schedule and labeled as "Start-up" (PFPT) and "Demonstration of Systems" (FPT) and such schedule is distributed to Commissioning Team.

E. Installation Contractors

1. Trade Contractors required to participate in the commissioning process are as follows:
 - a. HVAC
 - b. Sheet Metal
 - c. Plumbing
 - d. Electrical
 - e. Equipment Manufacturers required to participate in the commissioning process that provides self-contained building automation equipment.
2. Attend commissioning coordinating meetings
3. Cooperate with the CxA for resolution of issues recorded in the issues log.
4. Complete the Pre-Functional Test and submit the completed signed forms and other appropriate start-up sheets.
 - a. Complete the Pre-Functional Tests **as work is completed** and provide copies to the CxA or CM on a regularly scheduled basis.
5. Submit completed data retrieval forms for the equipment specified on the preventive maintenance list.
6. Develop and deliver O&M manuals immediately after equipment submittal is approved (typical all equipment)
7. Refine and implement Pre-Functional Performance test procedures and, where applicable, have equipment manufacturer participation.
8. Develop and implement equipment education/training.
9. Prior to the system demonstrations with the commissioning team, perform systems Functional Performance Tests and submit documented results to the Commissioning Firm.
10. Demonstrate systems working with the commissioning team implementing Functional Performance Tests.

11. Demonstrate systems working with the commissioning team implementing deferred/seasonal test Functional Performance Tests.
12. Correct all contractor-related deficiencies identified during Functional Performance Tests and retest the corrected functions with the commissioning team.

F. Equipment Manufacturers

1. Equipment Manufacturers of commissioned equipment are required to participate in the commissioning process. Participation shall include demonstration of furnished equipment operation and packaged control system functions.
2. Prior to the systems demonstrations with the commissioning team, perform system Functional Performance Tests in conjunction with the Installation Trade Contractor.
3. Demonstrate systems working with the commissioning team implementing Functional Performance Tests in conjunction with the Installation Subcontractor.
4. Demonstrate systems working with the commissioning team implementing deferred/seasons test Functional Performance Tests in conjunction with the Installation Subcontractor.
5. Correct all equipment deficiencies identified during Functional Performance Tests and retest the corrected functions with the commissioning team.

G. Testing, Adjusting, Balancing (TAB) Contractor Agency

1. Attend all commissioning coordination meetings.
2. Submit TAB industry standard requirement including but not limited to schematic flow diagrams of each system to be commissioned with points where TAB readings will be taken, TAB strategy, and field notes.
3. Review and comment on field coordination drawings during the mechanical-electrical field drawing coordination meetings relative to testing, adjusting and balancing.
4. Participate in Pre-Functional Performance Tests.
5. Complete testing, adjusting and balancing of systems.
6. Participate in Functional Performance Tests.
7. Provide system performance verification data for commissioned systems.

3.3 RE-COMMISSIONING MANAGEMENT MANUAL

A. The Contractor shall be responsible for coordination and development of the Re-Commissioning Manual beginning immediately following the acceptance of equipment and component submittals.

B. The Re-Commissioning Manual shall include:

1. Design Team, Construction Team, Commissioning Firm and Contracting Officer Representatives.
2. Brief Description of each system commissioned.
3. Record documents of ATC Sequence of Operation.
4. Building Automation logic flow diagram (P&ID)
5. Building Occupancy Schedules
6. Trending Checklist with control logic to each trending program.
7. Equipment start-up, shutdown and restarting instructions.
8. Equipment manufacturer's re-calibration instructions for sensors, transmitters and actuators and frequency of tasking.
9. Listing of all systems commissioned adjustable setpoints and reset schedule with description of set point purpose and recommended adjustable range.

10. Automatic control manufacturer's recommended re-commissioning interval and continuous commissioning recommendations, as well as recommendation to reassess setpoints and schedule based on current system use.
11. Recommended energy monitoring and benchmarking of energy metering (all utilities) using the building automation for energy reporting.
12. List of diagnostic tools for those systems commissioned that will be useful for facility management in maintaining efficient operation of the equipment and systems.

3.4 PRE-FUNCTIONAL PERFORMANCE TESTS

- A. Test Checklists will be included with the Commissioning Plan

3.5 FUNCTIONAL PERFORMANCE TEST NARRATIVES

- A. Functional Performance Test Narratives will be included with the Commissioning Plan and will be in a "draft" format and will be finalized upon final approved sequence of operations and comments from the disciplines involved in demonstrating the systems to the Owner.

3.6 WARRANTY PERIOD

- A. The goals of the commissioning tasks during the Warranty Period include the following:
 1. Identify and correct any outstanding deficiencies.
 2. Perform seasonal and other deferred functional performance testing.
 3. Review facility operation at 10-month mark into the 12-month warranty period.
 4. Complete Final Commissioning Report document
- B. Team Member Responsibilities
 1. Owner Project Manager
 - a. Maintain records of problems or concerns associated with the systems during normal operation.
 - b. Distribute Post Construction Evaluation information to other commissioning team members for review and comment.
 - c. Coordinate and facilitate the meeting with the commissioning team at the 10-month mark to discuss operational problems and concerns.
 - d. Oversee the revision of the Owner Design and Construction Standards based on the results of the 10-month warranty meeting.
- C. Owner Facility Manager
 1. Maintain problems/complaints from occupants and Owner personnel regarding new building systems.
 2. Participate in seasonal/deferred functional performance tests.
 3. Maintain "as-commissioned" proper operation of the building systems.
 4. Participate in 10-month Warranty meeting present the problems, issues, and concerns.
 5. Identify warranty versus operational issues and concerns.
- D. Commissioning Firm
 1. Maintain Commissioning Corrective Action Log until all issues are resolved.
 2. Facilitate seasonal/deferred functional performance tests
 3. Complete Final Commissioning Report document.
 - a. Have in place a contractor for "near warranty end" or "post occupancy review".

4. Complete Final Commissioning Report document.
 5. Participate in 10-month Warranty meeting present the problems, issues, and concerns.
 6. Make suggestions for improvements and for recording these changes in the O&M manuals.
- E. Design Professionals
1. Be available to consult on the results of the seasonal/deferred functional performance test results.
 2. Meet with the commissioning team at the 10-month mark to discuss operational problems and concerns.
- F. General Contractor
1. Coordinate scheduling of seasonal/deferred functional performance tests.
 2. Participate in 10-month Warranty meeting present the problems, issues, and concerns.
 3. Address outstanding warranty issues and tasks identified as being under the original construction contract.
- G. Installation Contractors
1. Be present for and conduct seasonal/deferred functional performance tests.
 2. Address outstanding warranty issues and tasks identified as being under the original construction contract.
 3. Be available to meet with the commissioning team at the 10-month mark to discuss operational problems, issues, and concerns.
 4. Address outstanding warranty issues and tasks identified as being under the original construction contract.
- H. Equipment Manufacturers
1. Be present for and conduct seasonal/deferred functional performance tests.
 2. Address outstanding warranty issues and tasks identified as being under the original construction contract.
 3. Be available to meet with the commissioning team at the 10-month mark to discuss operational problems, issues and concerns.
 4. Address outstanding warranty issues and tasks identified as being under the original construction contract.
- I. Independent Test Agency
1. Conduct seasonal/deferred TAB associated with functional performance tests.

END OF SECTION

SECTION 04 27 00

MULTI & SINGLE WYTHE MASONRY ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes multi wythe and single wythe concrete masonry unit assemblies; and accessories as follows:
 - 1. Concrete masonry units (CMU).
 - 2. Brick.
 - 3. Mortar and grout.
 - 4. Flashing.
 - 5. Insulation materials.
 - 6. Masonry accessories.
 - 7. Cleaning materials.
- B. All Exterior walls are typically Multi Wythe assemblies with 4 inch face brick and Stone Veneer and 8 inch or 12 inch CMU back up, unless otherwise indicated.
- C. The Interior masonry walls are typically 8 inch or 12 inch CMU single wythe.

1.2 PERFORMANCE REQUIREMENTS

- A. Concrete Masonry Compressive Strength (f_m): 2,000 psi; determined by the prism test method.
- B. Concrete Masonry Weight: Normal Weight, 115 pcf.
- C. Brick Masonry Compressive Strength (f_m): 17,000 psi; determined by unit strength method.

1.3 RELATED WORK:

- A. Section 01 00 00 General Requirements: Testing and inspection requirements.
- B. Section 04 72 00 Architectural Cast Stone for stone accent veneers.
- C. Section 04 42 13 Stone for stone masonry veneer.
- D. Section 05 12 00 Structural Steel for steel lintels.
- E. Section 07 90 00 Joint Protection for sealants and backer rods.

1.4 PRODUCTS INSTALLED BUT NOT FURNISHED.

- A. Steel lintels and shelf angles for unit masonry are specified in Section 05 12 00 – Structural Steel Framing

B. Hollow metal frames are specified in Section 08 11 13 – Hollow Metal Doors and Frames.

1.5 SUBMITTALS

A. Product Data: For each indicated product.

B. Samples: For types and colors of masonry units and pigmented mortar.

C. Material Certificates: For each type of indicated product (including self-consolidating grout), include statement of properties and compliance with these Specifications. Include mix design for mortar and grout.

D. Masonry Material Cleaning Plan: Include products and techniques for each masonry product of the assembly and the combined masonry assembly. Prior to submission, the plan shall be signed and approved by:

1. General Contractor/Construction Manager
2. Mason Contractor
3. All Masonry Unit Manufacturers
4. Cleaning Materials Supplier and Manufacturer
5. Cleaning Subcontractor

E. Construction procedures for cold and hot weather.

F. Wall Bracing Plan showing braces and delineating the restricted zones.

1.6 QUALITY ASSURANCE

A. Masonry Inspection:

1. Level B. Periodic inspection.

B. Masonry construction and materials shall conform to the requirements of “Specifications for Masonry Structures (ACI 530.1/ASCE 6/TMS 602)” published by The Masonry Society, the American Concrete Institute, and the American Society of Civil Engineers, except as modified by the requirements of these contract documents.

C. Pre-construction Testing: Contractor shall employ a qualified independent masonry testing agency to perform the following tests. The Owner shall pay testing agency through Contractor as per General Requirements. Contractor shall provide materials in reasonable quantities for testing. Laboratory Technician shall be certified per ASTM C 1093.

1. Grout: Compressive strength tests per ASTM C 1019. Additionally, grout samples shall be obtained using molds that simulate the units used in the construction (cardboard forms shall not be utilized).
2. Self-consolidating grout: Compressive strength tests per ASTM C1019 and slump flow and visual stability index per ASTM C1611.
3. Mortar: Mortar aggregate ratio tests per ASTM C780, Annex 4.

D. Fire Ratings: Fire rated masonry units shall be in compliance when:

1. The masonry has been certified through the equivalent thickness method contained in Chapter 3 of ACI 216.1 for concrete masonry, and Chapter 5 for effects of finish materials.
 - E. Temporary Bracing: Comply with Mason Contractors Association of America's Standard Practice for Bracing Masonry Walls Under Construction, and Masonry Wall Bracing Design Handbook, published by the Mason Contractors Association of America.
(www.masoncontractors.org)
 - F. Fire Rated Wall Construction: Rating at locations as indicated on Drawings one hour rating (At Occupancy separation fire barrier wall between Apparatus Room 101 & Administrative/Living Areas.).
 1. Tested Rating: Determined in accordance with ASTM E119.
 2. Prescriptive Rating: Item Number 3-1.3; determined in accordance with table 720.1(2) of the 2009 Michigan Building Code.
 - G. Surface Burning Characteristics:
 1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
 - H. Perform Work in accordance with the 2009 Michigan Building Code.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Store aggregates on grades such that site drainage will not contaminate aggregates.
 - B. Store masonry units, cementitious materials and accessories on elevated platforms in a dry location. Materials shall be kept covered with weatherproof sheeting and secured from the wind. Do not use saturated concrete masonry per NCMA TEK Note 3-1B.
- 1.8 PROJECT CONDITIONS
- A. Cold Weather Requirements: When ambient temperature is below 40 degrees Fahrenheit, implement cold weather procedures. Comply with ACI 530.1/ASCE 6/TMS 602 Specification requirements. Provide approved admixtures only.
 - B. Hot Weather Requirements: When ambient temperatures during construction or during the protection period are greater than 100 degrees Fahrenheit, or are greater than 90 degrees Fahrenheit with a wind velocity greater than 8 miles per hour, comply with ACI 530.1/ASCE 6/TMS 602 Specification requirements. Provide approved admixtures only.
- 1.9 MASONRY PRE-CONSTRUCTION CONFERENCE
- A. Masonry Pre-Construction Conference Requirements:
 1. The General Contractor in conjunction with the Architect/Engineer shall schedule a Masonry Pre-Construction Conference at the jobsite at approximately 3 weeks prior to start of masonry work at the site.

2. All contractor submissions shall be submitted to the Architect/Engineer and reviewed prior to this conference.
3. Responsible assigned parties of the participants shall attend the conference. The General Contractor shall prepare and issue minutes of the meeting to all parties concerned.
4. Masonry work may not proceed without the Masonry Pre-Construction Conference.
5. Participants, representatives from:
 - Owner
 - Architect/Engineer
 - General Contractor
 - Project Superintendent
 - Mason Contractor Mason Foreman
 - Testing Laboratory Inspector

B. The following is the agenda for the Masonry Pre-Construction Conference:

1. Review Contract Documents for Mason's clarifications, Architect/Engineer's intent, and Masonry Inspector responsibilities.
 - a. Architect/Engineer's summary for typical/atypical aspects of the Project.
 - b. Locations of shear walls.
 - c. Locations of CMU control joints and brick expansion joints.
 - d. Contractor's concern for missing/incomplete details.
 - e. Verify use of up-to-date plans/specifications.
 - f. Contractor's responsibility for temporary wall bracing.
 - g. Installation procedures.
 - h. Coordination issues with other trades.
 - i. Protection of and scheduling of non-masonry construction that will interfere with masonry work.
 - j. Open issues/concerns.
 - k. Job-Site storage and staging areas.
2. Submittal issues.
 - a. Mortar type, proportions and mix design.
 - 1) Specific locations/applications for different mortars.
 - b. Grout type, proportions and mix design.
 - 1) Specific locations/applications for different grouts.
 - c. Review manufacturer's literature for special requirements and conditions of use.
 - d. Review joint reinforcement and accessories shop drawings.
 - e. Review Vertical and Horizontal Reinforcing Steel shop drawings, splice lengths, column reinforcement and ties, and bar positioners.
 - f. Lintels, door frames and other 'built-ins' materials status.
 - g. Review shelf angle shop drawings.
 - h. Review flashing details.
 - i. Review certificates of compliance.
 - j. Review each type and size of anchor, tie, and metal accessory.
 - k. Review specific ASTM Standards.
 - l. Review the approved masonry material cleaning plan.
3. Verify material samples that have been reviewed/accepted.
 - a. Color ranges.
 - b. Textures.

- c. Finishes.
- d. Dimensions of units.
- e. Mortar (pigmented).
4. Verify that any specified pre-construction tests have been performed and are acceptable to the Architect/Engineer.
 - a. Mortar and grout tests.
 - b. Masonry units.
 - c. Prism testing.
5. Review contractor's proposed cold and hot weather construction procedures and Project Specification requirements.
6. Review masonry inspection requirements and level.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. Concrete Masonry Units (CMU): ASTM C 90, normal weight.
 1. Size: Specified size to be 3/8 inches less than the nominal width, height and length.
 2. Provide special shapes for lintels, corners, jambs, sashes, movement joints, bond beams, and other special conditions as indicated on the Drawings.
- B. Masonry Lintels: Field assembled CMU in color, pattern, size and texture matching adjacent CMU wall with reinforcing bars as indicated, placed and filled with grout; or as otherwise noted.
- C. Precast Masonry Lintels: Precast units matching concrete unit masonry and with reinforcing bars indicated or required to support intended loads, ASTM C1623.
- D. Precast Concrete Lintels: Precast concrete lintels with reinforcing bars indicated or required to support intended loads, ACI 318.

2.2 BRICK (VENEER WYTHE)

- A. General: Provide shapes as indicated on the drawings and as follows:
 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide solid units without cores or frogs and with exposed surfaces finished.
 2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Brick: ASTM C 216, Grade SW, Type FBX, Smooth Texture.
 1. Initial Rate of Absorption: Less than 30 grams/30 square inches (30 grams/194 square centimeter) per minute when tested per ASTM C 67.
 2. Efflorescence: Provide brick that is rated "not effloresced."
 3. All brick units shall be produced from single runs and factory blended for specified color range.

4. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finished when viewed from 10 feet (3 meters).
5. Manufacturer/Color: Belden, Type FBX, Red Brick 503-505, Smooth Texture.
6. Size (Specified Dimensions):
 - a. Modular: 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

2.3 MORTAR AND GROUT MATERIALS

A. Contractor shall select one of the following cement options for mortar:

1. Masonry Cement: ASTM C 91.
2. Mortar Cement: ASTM C 1329.
3. Portland Cement-Lime:
 - a. Portland Cement: ASTM C150, Types I or II, except Type III may be used when temperature is below 40 degrees Fahrenheit during construction. Provide natural (gray) or white colored cement as required to produce mortar color indicated.
 - b. Blended Cement: ASTM C595, Types IS(<70) or IP.
 - c. Hydraulic Cement: ATM C1157, Type GU, except Type HE may be used when temperature is below 40 degrees Fahrenheit during construction.
 - d. Hydrated Lime: ASTM C 207, Type S.

B. Contractor shall select one of the following cement options for grout:

1. Portland cement: ASTM C150, Types I or II, except Type III may be used when the temperature is below 40 degrees Fahrenheit during construction.
2. Blended cement: ASTM C595, Types IS(<70) or IP .
3. Hydraulic cement: ASTM C1157, Type GU, except Type HE may be used when the temperature is below 40 degrees Fahrenheit during construction.
4. Combinations of cementitious materials that include Portland cement and supplementary cementitious materials (SCMs) in accordance with the following:
 - a. Ground Granulated Blast Furnace Slag (GGBFS or Slag Cement): ASTM C989. The cement slag replacement may be equal to up to 95% slag cement. The slag cement shall consist of either Grades 80, 100 or 120.
 - b. Fly Ash: ASTM C618. The fly ash replacement may be equal to up to 40% fly ash replacement. The fly ash shall consist of either Class C or F.
 - c. SCM's shall not be blended by the ready mixed grout supplier without the purchaser's approval. The SCM percentage(s) shall be indicated on the batch ticket(s).

C. Mortar Pigments: ASTM C 979, mineral oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Brick Mortar: Formulate blend as required to produce color as selected from samples by Solomon Colors (Product SGS – Mortar Colors).
2. Concrete Masonry Unit Mortar: Natural Gray color with no added pigment.

D. Aggregate for Mortar: ASTM C 144.

E. Aggregate for Grout: ASTM C 404.

F. Admixtures: Comply with ASTM C 1384, containing not more than 0.2 percent chloride ions, and as recommended by the manufacturer:

1. Admixture for Grout: As approved by Architect.
2. Other Admixtures: As approved by Architect.

G. Water: Potable, clean and free of deleterious materials.

2.4 REINFORCEMENTS

A. Deformed Reinforcing Bars: ASTM A 615/A 615M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951

1. Interior Walls: Mill galvanized, ASTM A 641 (0.10 ounces per square foot), carbon steel.
2. Exterior Walls: Hot dip galvanized, ASTM A153 Class B-2 (1.50 ounces per square foot), carbon steel.
3. Exterior Brick above loose steel lintels: Stainless steel, ASTM A 580 Type 304 or ASTM A153 Class B-2 (9 gauge).
4. Wire Size and Side Rods: W1.7 or 0.148 inch diameter (9 gauge).
5. Wire Size for Cross Rods: W1.7 or 0.148 inch diameter (9 gauge).
6. Wire Size for Veneer Ties: W2.8 or 0.1875 inch diameter (3/16 inch).
7. Spacing for Cross Rods: 16 inches on center.
8. Provide in lengths of not less than 10 feet.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

D. Masonry Joint Reinforcement for Multi-Wythe Masonry:

1. Ladder type with perpendicular cross rods spaced 16 inches on center and one side rod for each face shell of hollow masonry units.
2. Adjustable (two-piece) type, ladder type design, with one side rod at each face shell of backing wythe and with separate flush welded ties that extend into facing wythe. Ties shall have double hooks (or tab ties) that engage eyes (or slots) in reinforcement and resist movement perpendicular to wall. Tie length shall be sufficient to extend 1/2 inch minimum into the outer face shell for hollow units and 1 1/2 inches minimum into solid units, but with a minimum of 5/8 inch cover at outside face.

2.5 EMBEDDED FLASHING SYSTEM MATERIALS

A. Metal Drip Edges at Steel lintels: ASTM A 167, Type 304, stainless steel, 0.0156 inches thick.

1. Metal Configuration: Extend at least 3 inches horizontally into wall and 1/2 inch out from exterior face of wall with outer edge bent down 30 degrees and hemmed.
2. Sealant: One-part non-skinning butyl sealant conforming to ASTM C 1311.

B. Flexible Membrane Flashing: For membrane flashing not exposed to the exterior, provide one of the following:

1. Copper-Laminated Flashing: 5 ounces per square foot copper bonded with asphalt between 2 layers of glass-fiber cloth.

2. Rubberized-Asphalt Flashing: Composite bonded flashing product of a rubberized-asphalt adhesive compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch.
3. Elastomeric Thermoplastic Flashing: Composite of rubberized-asphalt adhesive, 0.025 inch thick, bonded to a polyester-reinforced ethylene interpolymer alloy.
4. EPDM Flashing: ASTM D 4637, ethylene-propylene-diene terpolymer, 0.040 inches thick.
5. Adhesives, Primers, Sealants, and Seam Tapes for Flexible Membrane Flashings: Provide manufacturer's recommended compatible products.

C. Weep/Vent:

1. Mesh Weep/Vent: Free-draining polyethylene strand mesh, veneer height and depth by 3/8 inch wide. Color to match mortar.

D. Cavity Drainage Material: Provide one of the following:

1. Pea Gravel: Clean, hard, durable free-flowing naturally rounded particle of rock, free of clay, silt, and fine particles, with 100 percent passing a 3/8 inch sieve and not over 5 percent passing a No. 8 sieve.
2. Free-Draining Mesh: Free-draining polyethylene strand mesh designed to catch mortar droppings and prevent weep holes from being clogged.

2.6 INSULATION MATERIALS

A. Insulation for cavity:

1. Extruded-Polystyrene Board Insulation: ASTM C 578, closed-cell product extruded with an integral skin.
 - i. Type IV 2 1/2 inch thickness, R-14.
 - ii. Dow Styrofoam Brand Cavitymate Ultra

2.7 MISCELLANEOUS ACCESSORIES

A. Connectors at Intersecting Shear Walls (not applicable at corners):

1. Rigid Z-Strap Anchors: Fabricate from ASTM A 36 steel bars, 1-1/2 inches by 1/4 inch by 24 inches long with ends turned up 2 inches (total 28 inches in length).

B. Connectors for Interior Non-Load Bearing Non-Shear Walls (not applicable at corners):

1. Wire Mesh Ties: Fabricate from 1/2 inch by 1/2 inch mesh, 16 gauge, in width 2 inches less than nominal thickness of the CMU wythe and length not less than 14 inches. Hot dip galvanized, ASTM A 153 Class B-2.

C. Flexible Anchors: Where masonry is to be laterally supported from structural steel provide flexible anchors consisting of two different components as follows:

1. Receiver Component: 1/4 inch diameter steel rod with 3/8 inch offset or 12 gauge galvanized steel straps and 4 inch adjustment for ties specified below. Zinc coated, ASTM A 641 (0.10 ounces per square foot, carbon steel).
2. Triangular Ties: 3/16 inch diameter steel wire, ASTM A 82. Tie length shall extend at least halfway through facing wythe but with at least 5/8 inch cover on outside

face. Closed end shall be 1 inch wide and split-end opening shall be 1/2 inch. Hot dip galvanized, ASTM A 153 Class B-2 (1.5 ounces per square foot, carbon steel).

- D. Preformed Control Joint Gasket: Cross shape of flexible rubber or PVC with shear key to fit into sash block grooves and minimum 1 inch flanges. (Optional)
 - 1. PVC complying with ASTM D 2287 (Type PVC 654-4).
 - 2. Rubber complying with ASTM D 2000 M2AA-805.
- E. Bond-Breaker Strips: Asphalt saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt). (As typically used in the "Michigan Control Joint").
- F. Grout Retainer: Mesh screen, width of CMU less 1 inch. Use at bottom of horizontal grout cell to retain grout without the use of special shaped CMUs, and without breaking mortar bond.
- G. Masonry Cleaners: Proprietary cleaner(s) for the appropriate masonry surface as recommended by the masonry material manufacturers and as stated in the approved Masonry Material Cleaning Plan.

2.8 MORTAR AND GROUT MIXES

- A. General: Specified admixtures may be provided as indicated below. If admixture is used, add at same rate for all exposed mortar to ensure consistent mortar color, regardless of weather. Test for compatibility with other products and assemblies.
- B. Mortar Mix: ASTM C 270, Proportion Specification.
 - 1. Type M or S for masonry below grade or in contact with earth.
 - 2. Type S for unreinforced masonry.
 - 3. Type S for reinforced masonry.
 - 4. Type N for veneer masonry.
 - 5. Admixture: Specified mortar admixtures.
 - 6. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce selected color. Do not add pigments to colored cement products.
 - a. Pigments shall not exceed 10 percent of Portland cement by weight.
 - b. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
- C. Standard Grout Mix: ASTM C 476, slump of 8 to 11 inches measured per ASTM C 143.
 - 1. Provide fine or coarse grout per ACI 530/ASCE 5/TMS 402, Table 1.15.1, Grout Space Requirements, based upon height and grout space.
 - 2. ASTM C 476 grout mix shall be determined by the following method:
 - a. By specified compressive strength tested in accordance ASTM C 1019, minimum compressive strength of 2,500 pounds per square inch.
 - 3. Approved grout admixtures.
- D. Self-Consolidating Grout Mix: Conforms to material requirements of ASTM C 476.
 - a. Provide fine or coarse self consolidating grout.

- b. Attains the specified compressive strength or 2,500 pounds per square inch, whichever is greater, at 28 days when tested in accordance with ASTM C1019.
- e. Has a slump flow of 24 to 30 inches per ASTM C 1611.
- d. Has a Visual Stability Index (VSI) less than or equal to 1 per ASTM C 1611, Appendix X.1.
- e. Job-Site proportioning of self-consolidating grout is NOT PERMITTED.
- f. Field addition of water and admixtures NOT PERMITTED.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify field conditions are acceptable and are ready to receive Work.

3.2 INSPECTION

- A. Inspect concrete foundations for compliance with tolerances of ACI 117, and verify reinforcing dowels are positioned in accordance with the Drawings.
- B. Foundation and/or Load-Bearing Masonry Wall Discrepancies:
 - 1. Notify the Architect/Engineer, the General Contractor in writing of discrepancies.
 - 2. Do not proceed with masonry work until conditions have been corrected.

3.3 PREPARATION

- A. Coordinate placement of anchors supplied by other sections.
- B. Contractor shall prepare the foundation surface for adequate masonry bond.
- C. Do not wet CMUs before placing.
- D. Place steel reinforcement free of mud and debris in grout spaces prior to grouting.
- E. Provide cleanouts in CMU walls to be grouted when height of constructed wall exceeds 5 feet in height.
- F. Protect non-masonry adjacent surfaces during construction until cleaned.

3.4 FIELD QUALITY CONTROL

- A. Testing for Grout: When the grout compressive strength is specified, test in accordance with ASTM C 1019.
- B. Testing for Self-Consolidating Grout:
 - 1. Grout compressive strength, test in accordance with ASTM C1019
 - 2. As delivered to site, verification of slump flow and Visual Stability Index (VSI) per ASTM C 1611.

C. All Field Technicians sampling, making, and curing specimens for acceptance testing shall be certified by the National Concrete Masonry Association, Grade 1 certification, or equivalent.

D. Testing for Mortar: Mortar aggregate ratio per ASTM C780.

3.5 PLACEMENT – GENERAL

A. Place masonry units in running bond pattern unless otherwise noted.

B. Construct 3/8 inch (plus or minus 1/8 inch) mortar bed joints when masonry units are compressed onto mortar.

C. Construct 3/8 inch (minus 1/4, plus 3/8 inch) mortar head joints when masonry units are shoved into mortar.

D. Construct full mortar bed joint on foundation. Joints shall not be less than 1/4 inch and not more than 3/4 inch when masonry units are compressed onto mortar.

E. Tool mortar joints to a concave profile on interior face of wall when mortar is thumbprint hard. Mortar joints on exterior (cavity) face of backup wythe may be tooled or struck flush.

F. Remove mortar joint protrusions extending 1/2 inch or more into CMU cells to be grouted.

G. Place hollow CMU with mortared face shells on head and bed joints.

H. Mortar bed joints on CMU cross webs where individual CMU cells are to be grouted, piers, columns and pilasters.

I. Place solid masonry units with full-mortared head and bed joints.

J. Retempering of non-colored mortar is permitted. Retempering of colored mortar is not permitted.

K. Where indicated, at integral corners, overlap units full width of wythe.

L. Where indicated, at shear wall intersecting walls, provide metal straps at maximum vertical spacing of 4 feet. Grout ends of straps into CMU cells.

M. Where indicated, at non-shear intersecting walls, provide mesh in joints at 16 inches maximum spacing. Grout mesh into CMU cells.

N. Install connectors, and other accessories.

1. Embed wall ties 1/2 inch in outer faceshell of hollow units and 1-1/2 inches in solid units.
2. Place connectors in accordance with the sizes, types, and locations indicated.

O. Bracing of masonry walls shall meet the requirements of MIOSHA Construction Safety Standards, Part 2. Masonry Wall Bracing. This may be accomplished by using the Standard Practice for Bracing Masonry Walls Under Construction and the Masonry Wall Bracing Design Handbook. Refer to the MIOSHA Construction Fact Sheet: Bracing Tall Masonry

Walls for more information

(http://www.michigan.gov/documents/cis/wsh_constfact_masonry_180828_7.htm).

- P. Place masonry assembly within the following tolerances:
1. Bed joints and top of bearing walls can vary from level plus or minus 1/4 inch in 10 feet up to plus or minus 1/2 inch maximum.
 2. Variation from plumb and true to a line may vary from plus or minus 1/4 inch in 10 feet, plus or minus 3/8 inch in 20 feet up to plus or minus 1/2 inch maximum.
 3. Alignment of the bottom of the wall to the top may vary plus or minus 1/2 inch for load-bearing walls and plus or minus 3/4 inch for non-load-bearing walls.
 4. Do not tooth masonry unless specifically approved in writing.
- Q. Install flashings, on clean, solid and undamaged surface. Provide flashing at all locations indicated. Extend flashings to outside face of wall and terminate as indicated. Form end dams at horizontal terminations of flashings. All vertical legs at the backup shall be mechanically fastened. Lap joints a minimum of 6 inches and seal with compatible material.
1. At lintels and shelf angles, install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
 2. Install weeps and cavity drainage material directly on top of flashing in a clean cavity.
- R. Construct expansion and/or control (movement) joints as indicated on the Drawings. Terminate horizontal reinforcing on both sides of the movement joint. Reinforcement for bond beams may be continuous or discontinuous depending upon indicated structural requirements.
- S. Keep masonry surfaces clean during construction. Remove all mortar drippings, tags and stains before they cure. Use a light brush sweep across the exposed masonry surfaces upon initial mortar set to minimize smearing.
- T. Cover tops of CMU walls at completion of each day's work as practicable as possible. Covering shall remain to minimize water and debris intrusion of ungrouted cells until permanent closure of walls occurs.

3.6 PLACEMENT – VENEER WYTHE

- A. Use full-size units without cutting if possible. If cutting is required, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying. Install cut units with cut surfaces concealed.
- B. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602, Section 3.3G. or as otherwise approved.
- C. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and where possible, at other locations.
- D. Bond Pattern: Unless otherwise indicated, lay masonry in running bond, do not use units with less than nominal 4 inch horizontal face dimensions at corners or jambs.

- E. Built-in Work: As construction progresses, build in items specified (door frames, window frames, fire extinguisher cabinets, etc.) as required. Fill in solidly with masonry around built-in items.
- F. Mortar Bedding and Jointing:
 - 1. Lay hollow units with face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
 - 3. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

3.7 CAVITY WALLS

- A. Bond wythes of cavity walls together using horizontal masonry joint reinforcement as follows:
 - 1. Use adjustable (two piece) type reinforcement to allow for differential movement.
- B. Keep cavities clean of mortar droppings and other materials during construction. Batter mortar beds away from cavity, to minimize mortar protrusions into cavity. Do not deeply furrow mortar. Do not attempt to trowel or remove mortar fins protruding into cavity.
- C. Installing Cavity-Wall Insulation: Fit insulation between wall ties and other confining obstructions, with edges butted tightly. Press units firmly against inside wythe of masonry. Adhere insulation to the inside wythe following manufacturer's recommendations.

3.8 REINFORCEMENT

- A. Place steel reinforcement in accordance with the sizes, types, and locations indicated.
 - 1. Lap splices as indicated.
 - 2. Install ties for vertical reinforcement in columns as indicated.
- B. Joint Reinforcement: Place joint reinforcing in bed joints of all CMU walls, at not more than 16 inches on center vertically, and place in additional locations where indicated. Locate joint reinforcement so that longitudinal wires are embedded in mortar, including wires within the lap length. Place cross wire over webs of CMU (16 inches on center). Lap length of joint reinforcement a minimum of 6 inches. Do not extend joint reinforcing through movement joint.
- C. Place Stainless steel horizontal joint reinforcement in two courses of brick veneer above loose steel lintels.
- D. Secure steel reinforcement to prevent displacement from the placement of grout and within the following tolerances:
 - 1. Place steel reinforcement prior to grouting.
 - 2. Maintain a clear distance between the reinforcement and the unit cell wall of at least 1/4 inch for fine grout and 1/2 inch for coarse grout.
 - 3. Place joint reinforcement with at least 5/8 inch mortar cover when exposed to weather or earth and 1/2 inch when not exposed.

4. Place vertical and horizontal reinforcing bars within walls and flexural elements (beams and lintels) as follows:
 - a. “d” less than or equal to 8 inches, within 1/2 inch (plus or minus).
 - b. “d” greater than 8 inches but less than or equal to 24 inches, within 1 inch (plus or minus).
 - c. “d” greater than 24”, within 1-1/4 inch (plus or minus).
5. Place vertical reinforcing bars within plus or minus 2 inches from the specified location along the length of the wall.

3.9 GROUT PLACEMENT

A. Place grout within 1-1/2 hours from mixing and prior to initial set of grout.

1. Do not exceed the grout pour heights of ACI 530.1/ASCE 6/TMS 602, Table 7.
2. Place grout in lifts not exceeding 12.67 feet high when the following conditions are met:
 - a. The masonry has cured for at least 4 hours.
 - b. The grout slump is maintained between 10 and 11 inches.
 - c. No intermediate reinforced bond beams are placed between the top and the bottom of the pour height.
3. If the conditions of 3.6A2 a and b are met but there are intermediate bond beams within the grout pour, limit the grout lift height to the bottom of the lowest bond beam that is more than 5 feet above the bottom of the lift, but do not exceed a grout lift height of 12.67 ft.
4. If the conditions of 3.6A2 a or b are not met, place grout in lifts not exceeding 5 feet.
5. Alternatively, place masonry units and grout using construction procedures employed in the accepted grout demonstration panel.

B. Consolidate grout at the time of placement.

1. Consolidate grout pours 12 in. or less in height by mechanical vibration or by puddling.
2. Consolidate pours exceeding 12 in. in height by mechanical vibration, and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.
3. Consolidation or reconsolidation is not required for self-consolidating grout.

C. Grout Key – When grouting, form grout keys between grout pours. Form grout keys between grout lifts when the first lift is permitted to set prior to placement of the subsequent lift.

1. Form a grout key by terminating the grout a minimum of 1-1/2 in. below a mortar joint.
2. Do not form grout keys within beams or lintels.
3. At beams or lintels laid with closed bottom units, terminate the grout pour at the bottom of the beam or lintel without forming a grout key.

D. Solidly fill cells below lintel or beam bearing minimum as noted on the drawings.

E. Bond Beams and Masonry Lintels:

1. Allow masonry lintels to attain sufficient strength to support loads imposed during construction before removing temporary supports.

3.10 MASONRY CLEANING

- A. Keep masonry faces clean during construction whenever possible, i.e. remove all mortar tags and stains before they cure, a light brushing with a soft brush upon initial mortar set, minimize mortar run-down with wet masonry units, minimize water entry into constructed walls, remove mortar build up from scaffold, protect all wall projections from mortar splashes, turn over planks to avoid mortar splashes when not working, protect base of wall from all mortar and mud splashes and remove and clean grout spills immediately.
- B. Demonstrate cleaning methods using the selected materials per the approved cleaning plan on the mockup or on an inconspicuous area of the new masonry to determine the suitability of cleaning materials and methods.
- C. Before cleaning masonry, protect other masonry and other non-masonry surfaces as necessary to prevent damage
- D. Cleaning procedures shall not damage finished masonry.

3.11 CLEAN UP

- A. Remove mock-up panels upon completion and approval of all masonry.
- B. Remove all masonry related debris and properly dispose of off site.

END OF SECTION

SECTION 04 42 13

MASONRY-SUPPORTED STONE CLADDING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Cut, Field, or Rubble stone veneer at exterior walls as selected by Architect; metal anchors and accessories; and mortar and joint pointing.

1.2 SUBMITTALS

- A. Product Data: Stone units, mortar products, reinforcement, wall tiles, anchors, and flashings.
- B. Samples:
 - 1. Two stone samples illustrating minimum and maximum stone sizes, general color range and texture, markings, and thickness.
 - 2. Mortar color samples.

1.3 QUALITY ASSURANCE

- A. Perform Work according to the 2015 Michigan Building Code.
- B. Manufacturer: Company specializing in manufacturing products specified in this Section with three years' experience.
- C. Installer: Company specializing in performing Work of this Section with three years' experience.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect stone from discoloration during storage on Site.
- B. Provide ventilation to prevent condensation from forming on stone.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: According to ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.
- B. Hot Weather Requirements: According to ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

PART 2 PRODUCTS

2.1 MORTAR-PLACED STONE ASSEMBLIES

- A. Furnish materials according to the Natural Stone Council and Building Stone Institute standards.

2.2 COMPONENTS

- A. Stone: Type, and variety as selected by Architect.
- B. Surface Texture: Split face.
- C. Color: As selected by Architect.
- D. Mortar: As specified in Section 04 27 00 Multi and Single Wythe Masonry Systems.

2.3 ACCESSORIES

- A. Horizontal Joint Reinforcement and Wall Ties: As specified in Section 04 27 00 Multi and Single Wythe Masonry Systems.
- B. Other Anchors in Direct Contact with Stone: ASTM A666, Type 304 stainless steel of sizes and configurations required for support of stone and applicable superimposed loads. Refer also to Section 04 72 00 – Architectural Cast Stone.
- C. Setting Buttons and Shims: Lead or Plastic.
- D. Flashings: Specified in Section 04 27 00 Multi and Single Wythe Masonry Systems but limited to one of the following.
- E. Through-wall Flashings: Sheet copper; 16 oz/sq ft .
- F. Through-wall Flashings: Sheet neoprene or polyethylene; 20 mil thick.
- G. Cavity Vents: Polyethylene tubing, 1/4 inch diameter.
- H. Weeps: Polyethylene tubing, 1/4 inch diameter or Open head joints.
- I. Joint Filler: Closed cell foam.
- J. Bond Breaker: 10 mil thick plastic sheet.
- K. Dampproofing: Bituminous.
- L. Cleaning Solution: Non-acid, not harmful to stone, joint materials, or adjacent surfaces.

2.4 FABRICATION

- A. Nominal Thickness: 4 inch.

- B. Nominal Face Size: varies.
- C. Pattern and Coursing: Random Ashlar.
- D. Fabricate for 3/8 inch beds and joints.
- E. Bed and Joint Surfaces: Sawn or cut full square at least two-thirds of unit thickness back from face; remainder of surface under square not more than 1 inch in 12 inches.
- F. Backs: Sawn.
- G. Slope exposed top surfaces of stone and horizontal sill surfaces for shedding water.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify support Work and Site conditions are ready to receive Work of this Section.
- B. Verify items built-in under other Sections are properly located and sized.

3.2 PREPARATION

- A. Coat back cavity surfaces with dampproofing prior to setting. Allow coating to cure.
- B. Clean sawn surfaces of rust stains and iron particles.

3.3 INSTALLATION

- A. Install flashings of longest practical length and seal watertight to back-up. Lap end joints minimum 6 inches and seal watertight.
- B. Cut and Split stone at site to produce clean faces.
- C. Size stone units to fit opening dimensions and perimeter conditions.
- D. Wet absorptive stone in preparation for placement to minimize moisture suction from mortar.
- E. Arrange stone pattern in color uniformity and minimize visual variations, and in uniform blend of stone unit sizes.
- F. Install setting bed and pointing mortar according to Section 04 27 00 Multi and Single Wythe Masonry Systems.
- G. Fill dowel holes in stone units with mortar.
- H. Arrange stone coursing in random ashlar bond with consistent joint width.

- I. Set stone in full mortar setting bed to fully support stone over bearing surface. Use setting buttons or shims to maintain correct joint width.
- J. Reinforcement And Anchorage:
 - 1. Install horizontal joint reinforcement 16 inches o.c.
 - 2. Place joint reinforcement continuous in first joint below top of walls.
 - 3. Lap joint reinforcement ends minimum 6 inches.
 - 4. Embed wall ties in masonry backing to bond veneer to back-up at minimum of one for every 2 sq ft.
 - 5. In addition, place wall ties at maximum 3 inches o.c. each way around perimeter of openings, within 12 inches of openings.
- K. Joints:
 - 1. Rake out mortar joints 5/8 to 3/4 inch and brush joints clean to accommodate pointing mortar. Fill joints with pointing mortar.
 - 2. Pack mortar into joints and work into voids. Neatly tool surface to concave joint.
 - 3. At joints to be sealed, clean mortar out of joint before mortar sets. Brush joints clean.
 - 4. Seal joints indicated with sealant. Perform sealant Work according to requirements of Section 07 90 00 – Joint Protection.
- L. Accessories:
 - 1. Install cavity vents at top of each cavity space, below shelf angles, at spacing of 24 inches on center, horizontally.
 - 2. Install weeps in vertical stone joints at 24 inches o.c., horizontally; immediately above horizontal flashings, above shelf angles and supports, and at bottom of walls. Do not permit mortar accumulation in cavity space.

3.4 FIELD QUALITY CONTROL

- A. Testing of Mortar: According to Section 04 27 00 Multi and Single Wythe Masonry Systems.

3.5 CLEANING

- A. Remove excess mortar as Work progresses, and upon completion of Work.
- B. Clean soiled surfaces with non-acid cleaning solution.
- C. Use non-metallic tools in cleaning operations.

END OF SECTION

SECTION 04 72 00

ARCHITECTURAL CAST STONE

PART 1 - GENERAL

1.1. SECTION INCLUDES - Architectural Cast Stone (Pre-cast Stone).

- A. Scope - All labor, materials and equipment to provide the Cast Stone shown on architectural drawings and as described in this specification.
 - 1. Manufacturer shall furnish Cast Stone covered by this specification.
 - 2. Installing contractor shall unload, store, furnish all anchors, set, patch, clean and seal the Cast Stone as required.
 - 3. All joints of Cast Stone to Cast Stone shall be sealed per Section 07 90 00.

1.2. RELATED SECTIONS

- A. Section – 01 00 00 – General Requirements.
- B. Section – 04 27 00 – Multi & Single Wythe Masonry Assemblies: Concrete Masonry Units, Brick, Mortar, & Grout.
- C. Section – 04 42 13 – Masonry-Supported Stone Veneer: Exterior Stone veneer.
- D. Section – 07 90 00 – Joint Protection.

1.3. REFERENCES

- A. ACI 318 – Building Code Requirements for Reinforced Concrete.
- B. ASTM A 185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
- C. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Reinforced Concrete.
- D. ASTM C 33 - Standard Specification for Concrete Aggregates.
- E. ASTM C 150 - Standard Specification for Portland Cement.
- F. ASTM C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volume Method.
- G. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- H. ASTM C 260 - Standard Specification for Air Entrained Admixtures for Concrete.

- I. ASTM C 270 - Standard Specification for Mortar for Unit Masonry.
- J. ASTM C 426 - Standard Test Method for Linear Shrinkage of Concrete Masonry Units.
- K. ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete.
- L. ASTM C 618 – Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Concrete.
- M. ASTM C 666 - Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
- N. ASTM C 979 - Standard Specification for Coloring Pigments for Integrally Pigmented Concrete.
- O. ASTM C 989 – Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete.
- P. ASTM C 1194 - Standard Test Method for Compressive Strength of Architectural Cast Stone.
- Q. ASTM C 1195 - Standard Test Method for Absorption of Architectural Cast Stone.
- R. ASTM C 1364 - Standard Specification for Architectural Cast Stone.
- S. ASTM D 2244 - Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- T. Cast Stone Institute® Technical Manual (Current Edition)

1.4. DEFINITIONS

- A. Cast Stone (Pre-cast Stone) - a refined architectural concrete building unit manufactured to simulate natural cut stone, used in unit masonry applications.
 - 1. Dry Cast Concrete Products – manufactured from zero slump concrete.
 - a. Vibrant Dry Tamp (VDT) casting method: Vibratory ramming of earth moist, zero-slump concrete against a rigid mold until it is densely compacted.
 - b. Machine casting method: manufactured from earth moist, zero-slump concrete compacted by machinery using vibration and pressure against a mold until it becomes densely consolidated.
 - 2. Wet Cast Concrete Products – manufactured from measurable slump concrete.
 - a. Wet casting method: manufactured from measurable slump concrete and vibrated into a mold until it becomes densely consolidated.

1.5. SUBMITTAL PROCEDURES

- A. Comply with Section 01 00 00 – General Requirements.

- B. Samples: Submit pieces of the Cast Stone that are representative of the general range of finish and color proposed to be furnished for the project.
- C. Test results: Submit manufacturers test results of Cast Stone previously made by the manufacturer.
- D. Shop Drawings: Submit manufacturers shop drawings including profiles, cross-sections, reinforcement, exposed faces, arrangement of joints (optional for standard or semi-custom installations), anchoring methods, anchors (if required), annotation of stone types and their location.

1.6. QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Manufacturer shall have sufficient plant facilities to produce the shapes, quantities and size of Cast Stone required in accordance with the project schedule.
 - 2. Manufacturer shall submit a written list of projects similar in scope and at least three (3) years of age, along with owner, architect and contractor references.
- B. Standards:
 - 1. Comply with the requirements of the Cast Stone Institute® Technical Manual and the project specifications. Where a conflict may occur, the contract documents shall prevail.

PART 2 - PRODUCTS

2.1. ARCHITECTURAL CAST STONE

- A. Comply with ASTM C 1364
- B. Manufacturers:
 - 1. Custom Stone Works, Livonia, Michigan; www.cswstone.com; Stone Color: As selected by Architect.
 - 2. Royal Stone, 3014 Dietz Rd., Williamston, MI 48895; phone: (248)343-6231.
 - 2. Terry's Precast Products, Inc.: www.terrys-precast.com.
 - 3. Superior Precast Products, Inc.: www.superiorprecast.com.
 - 4. Any current producer member of the Cast Stone Institute.
 - 5. Substitutions: Permitted with approval.
- C. Physical Properties: Provide the following:
 - 1. Compressive Strength - ASTM C 1194: 6,500 psi (45 Mpa) minimum for products at 28 days.
 - 2. Absorption - ASTM C 1195: 6% maximum by the cold water method, or 10% maximum by the boiling method for products at 28 days.
 - 3. Air Content – ASTM C173 or C 231, for wet cast product shall be 4-8% for units exposed to freeze-thaw environments. Air entrainment is not required for

- VDT products.
4. Freeze-Thaw – ASTM C 1364: The CPWL shall be less than 5% after 300 cycles of freezing and thawing.
 5. Linear Shrinkage – ASTM C 426: Shrinkage shall not exceed 0.065%.
- D. Job Site Testing – One (1) sample from production units may be selected at random from the field for each 500 cubic feet (14 m³) delivered to the job site.
1. Three (3) field cut cube specimens from each of these samples shall have an average minimum compressive strength of not less than 85% with no single specimen testing less than 75% of design strength as allowed by ACI 318.
 2. Three (3) field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6%.
 3. Field specimens shall be tested in accordance with ASTM C 1194 and C 1195.

2.2. RAW MATERIALS

- A. Portland cement - Type I or Type III, white and/or grey, ASTM C 150.
- B. Coarse aggregates - Granite, quartz or limestone, ASTM C 33, except for gradation, and are optional for the VDT casting method.
- C. Fine aggregates - Manufactured or natural sands, ASTM C 33, except for gradation.
- D. Colors - Inorganic iron oxide pigments, ASTM C 979 except that carbon black pigments shall not be used.
- E. Admixtures - Comply with the following:
 1. ASTM C 260 for air-entraining admixtures.
 2. ASTM C 494/C 495M Types A - G for water reducing, retarding, accelerating and high range admixtures.
 3. Other admixtures: integral water repellents and other chemicals, for which no ASTM Standard exists, shall be previously established as suitable for use in concrete by proven field performance or through laboratory testing.
 4. ASTM C 618 mineral admixtures of dark and variable colors shall not be used in surfaces intended to be exposed to view.
 5. ASTM C 989 granulated blast furnace slag may be used to improve physical properties. Tests are required to verify these features.
- F. Water – Potable
- G. Reinforcing bars:
 1. ASTM A 615/A 615M. Grade 40 or 60 steel galvanized or epoxy coated when cover is less than 1.5 in. (37 mm).
 2. Welded Wire Fabric: ASTM A 185 where applicable for wet cast units.
- H. All anchors, dowels and other anchoring devices and shims shall be standard building stone anchors commercially available in a non-corrosive material. Provide stainless steel Type 302 or 304 anchors. Anchors shall include types as needed for steel stud back-up system including Standard 'Z' Ashlar Anchors; Ashlar Anchors; Dowel &

Bent Strap Anchors; Eyebolt & Dowel Anchors; and Bent Bolt Anchors. Corrugated metal brick ties and adjustable wall ties are not allowed for use with stone.

- I. Refer to section 04 27 00 Multi & Single Wythe Masonry Assemblies for grout and mortar specifications of Stone to Concrete Masonry Unit Joints.
- J. Weeps at Stone Joints: Where vertical joints are spaced further than allowed for weeps then the following cavity weep system must be used: Heckmann Building Products, Inc. No. 366 Cavity Vent Weep System, installed per manufacturers specifications.

2.3. COLOR AND FINISH

- A. Color: As selected by Architect.
- B. All surfaces intend to be exposed to view shall have a fine-grained texture similar to natural stone, with no air voids in excess of 1/32 in. (0.8 mm) and the density of such voids shall be less than 3 occurrences per any 1 in. 2 (25 mm²) and not obvious under direct daylight illumination at a 5 ft (1.5m) distance.
- C. Units shall exhibit a texture approximately equal to the approved sample when viewed under direct daylight illumination at a 10 ft (3m) distance.
 - 1. ASTM D 2244 permissible variation in color between units of comparable age subjected to similar weathering exposure.
 - a. Total color difference – not greater than 6 units.
 - 2. Total hue difference – not greater than 2 units.
- D. Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under direct daylight illumination from a 20-ft (6 m) distance.
- E. The occurrence of crazing or efflorescence shall not constitute a cause for rejection.
- F. Remove cement film, if required, from exposed surfaces prior to packaging for shipment.

2.4. REINFORCING

- A. Reinforce the units as required by the drawings and for safe handling and structural stress.
- B. Minimum reinforcing shall be 0.25 percent of the cross section area.
- C. Reinforcement shall be non-corrosive where faces exposed to weather are covered with less than 1.5 in. (38 mm) of concrete material. All reinforcement shall have minimum coverage of twice the diameter of the bars.
- D. Panels, soffits and similar stones greater than 24 in. (600 mm) in one direction shall be reinforced in that direction. Units less than 24 in. (600 mm) in both their length and width dimension shall be non-reinforced unless otherwise specified.

- E. Welded wire fabric reinforcing shall not be used in dry cast products.

2.5. CURING

- A. Cure units in a warm curing chamber approximately 100°F (37.8°C) at 95 percent relative humidity for approximately 12 hours, or cure in a 95 percent moist environment at a minimum 70°F (21.1°C) for 16 hours after casting. Additional yard curing at 95 percent relative humidity shall be 350 degree-days (i.e. 7 days @ 50°F (10°C) or 5 days @ 70°F (21°C)) prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

2.6. MANUFACTURING TOLERANCES

- A. Cross section dimensions shall not deviate by more than $\pm 1/8$ in. (3mm) from approved dimensions.
- B. Length of units shall not deviate by more than length/ 360 or $\pm 1/8$ in. (3 mm), whichever is greater, not to exceed $\pm 1/4$ in. (6 mm).
 - 1. Maximum length of any unit shall not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.
- C. Warp, bow or twist of units shall not exceed length/ 360 or $\pm 1/8$ in. (3 mm), whichever is greater.
- D. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features – On formed sides of unit, 1/8 in. (3 mm), on unformed sides of unit, 3/8in. (9 mm) maximum deviation.

2.7. PRODUCTION QUALITY CONTROL

- A. Testing.
 - 1. Test compressive strength and absorption from specimens selected at random from plant production.
 - 2. Samples shall be taken and tested from every 500 (14 m³) cubic feet of product produced.
 - 3. Perform tests in accordance ASTM C 1194 and C 1195.
 - 4. New and existing mix designs shall be tested for strength and absorption compliance prior to producing units.

2.8. DELIVERY, STORAGE AND HANDLING

- A. Mark production units with the identification marks as shown on the shop drawings.
- B. Package units and protect them from staining or damage during shipping and storage.
- C. Provide an itemized list of product to support the bill of lading.

PART 3 EXECUTION

3.1. EXAMINATION

- A. Installing contractor shall check Cast Stone materials for fit and finish prior to installation. Do not set unacceptable units.

3.2. SETTING TOLERANCES

- A. Comply with Cast Stone Institute ® Technical Manual.
- B. Set stones 1/8 in. (3mm) or less, within the plane of adjacent units.
- C. Joints, plus - 1/16 in. (1.5mm), minus - 1/8 in. (3mm).

3.3. JOINTING

- A. Joint size:
 - 1. At stone/CMU joints 3/8 in. (9.5 cm).
 - 2. At stone/stone joints in vertical position 1/4 in. (6 mm) (3/8in. (9.5 mm) optional).
 - 3. Stone/stone joints exposed on top 3/8 in. (9.5mm).
- B. Joint materials:
 - 1. Mortar, Type N, ASTM C 270 at Joints between CMU and Cast Stone.
 - 2. Use a full bed of mortar at all bed joints.
 - 3. Flush vertical joints sealant per Section 07 90 00.
 - 4. Leave all joints with exposed tops or under relieving angles open for sealant.
 - 5. Leave head joints in copings and projecting components open for sealant.
 - 6. All Cast Stone to Cast Stone Joints to be sealed per Section 07 90 00.
- C. Location of joints:
 - 1. As shown on shop drawings.
 - 2. At control and expansion joints unless otherwise shown.

3.4. SETTING

- A. Refer also to Sections 04 27 00 Multi & Single Wythe Masonry Assemblies.
- B. Drench units with clean water prior to setting.
- C. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.
- D. Set units in full bed of mortar, unless otherwise detailed.
- E. Rake mortar joints 3/4 in. (18 mm) in. for pointing.
- F. Remove excess mortar from unit faces immediately after setting.
- G. Tuck point unit joints to a slight concave profile.
- H. Install Stone Anchors at a minimum of two anchor straps per stone but not less than one anchor for each 2.67 square foot of wall area. Horizontal spacing must be at 24 inches on

center maximum. Vertical spacing must be at 16 inches on center maximum.

3.5. JOINT PROTECTION

- A. Comply with requirements of Section 07 90 00.
- B. Prime ends of units, insert properly sized backing rod and install required sealant.

3.6. REPAIR AND CLEANING

- A. Repair chips with touchup materials furnished by manufacturer.
- B. Saturate units to be cleaned prior to applying an approved masonry cleaner.
- C. Consult with manufacturer for appropriate cleaners.

3.7. INSPECTION AND ACCEPTANCE

- A. Inspect finished installation according to Bulletin #36.
- B. Do not field apply water repellent until repair, cleaning, inspection and acceptance is complete.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes wall sheathing; preservative treatment; blocking in wall and roof openings; wood furring and grounds; electrical panel back boards, concealed wood blocking.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate framing system, loads and cambers, bearing details, framed openings, lumber grades and stresses, and framing sizes.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
 - 1. Lumber Grading Agency: Certified by DOC PS 20.
 - 2. Wood Structural Panel Grading Agency: Certified by EWA - The Engineered Wood Association.
 - 3. Lumber: DOC PS 20.
 - 4. Wood Structural Panels: DOC PS 1 or DOC PS 2.
- B. Apply label from agency approved by authority having jurisdiction to identify each preservative treated material.
- C. Perform Work in accordance with 2015 Michigan Building Code.

PART 2 PRODUCTS

2.1 LUMBER MATERIALS

- A. Lumber Grading Rules: WWPA G-5.
- B. Non-structural Light Framing: Stress Group Spruce-Pine-Fir species, grade and size as indicated on structural drawings. 19 percent maximum moisture content.

2.2 SHEATHING MATERIALS

- A. Wall Sheathing (as backing at fiber-cement board wall covering and as noted on drawings): APA Rated Sheathing, Structural I, plywood, C-D INT-APA, span rating 32/16, ½ inch thickness, exterior glue; or oriented strand board, as indicated on structural drawings Exposure Durability 1; unsanded.

- B. Telephone and Electrical Panel Boards: Plywood. APA/EWA Rated Sheathing; Rated C-D; Exposure Durability 2; unsanded.

2.3 SHEATHING AND UNDERLAYMENT LOCATIONS

- A. Above Grade Wall Sheathing: 1/2 inch thick, 48 x 96 inch sized sheets, square edges.

2.4 ACCESSORIES

A. Fasteners and Anchors:

- 1. Fasteners: ASTM A153/A153M, hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.

- B. Drywall Screws: Bugle head, hardened steel, power driven type, length to achieve full penetration of decking substrate.

- C. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

- D. Building Paper (over plywood wall sheathing): ASTM D226; Type II, No. 15 unperforated asphalt felt.

- E. Building Paper: Spun bonded polyethylene.

2.5 WOOD TREATMENT

- A. Wood Preservative (Pressure Treatment): AWWA U1, Commodity Specification A-Sawn Products or F-Wood Composites using water-borne ACQ preservative.

- B. Shop preservative treat wood materials in contact with concrete or masonry or indicated on Drawings.

C. Moisture Content after Treatment: Redried.

- 1. Lumber: Maximum 19 percent.
- 2. Structural Panels: Maximum 15 percent.

2.6 SOURCE QUALITY CONTROL

- A. Section 01 00 00 - General Requirements: Testing, inspection and analysis requirements.

- B. Inspect Work performed at fabricator's facility to verify conformance to Contract Documents.

- C. When fabricator is approved by authority having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

- 1. Specified shop inspections are not required for Work performed by approved fabricator.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify supports are ready to receive units.
- B. Verify sufficient end bearing area.

3.2 PREPARATION

- A. Coordinate placement of bearing or support items.

3.3 SHEATHING

- A. Fasten sheathing in accordance with applicable code.
- B. Install sheathing to combination single and two span continuous.
- C. Place building paper on vertical wall sheathing.
- D. Secure wall sheathing with ends staggered, over firm bearing.
- E. Install telephone and electrical panel back boards with plywood sheathing material where required. Size back board by 12 inches beyond size of electrical panel.

3.4 SUPPORT BLOCKING

- A. Support Blocking: Install wood blocking in stud walls for support of stair handrails, toilet accessories, toilet partitions, wall mounted cabinets, fire extinguisher cabinets, and other wall mounted items requiring support as indicated on drawings.

3.5 ERECTION TOLERANCES

- A. Surface Flatness of Sheathing Without Load: 1/4 inch in 10 feet maximum, and 1/2 inch in 30 feet maximum.

3.6 SCHEDULES

- A. Refer to structural & architectural drawings for materials used on the project.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes wall sheathing; preservative treatment; blocking in wall and roof openings; wood furring and grounds; electrical panel back boards, concealed wood blocking.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate framing system, loads and cambers, bearing details, framed openings, lumber grades and stresses, and framing sizes.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
 - 1. Lumber Grading Agency: Certified by DOC PS 20.
 - 2. Wood Structural Panel Grading Agency: Certified by EWA - The Engineered Wood Association.
 - 3. Lumber: DOC PS 20.
 - 4. Wood Structural Panels: DOC PS 1 or DOC PS 2.
- B. Apply label from agency approved by authority having jurisdiction to identify each preservative treated material.
- C. Perform Work in accordance with 2015 Michigan Building Code.

PART 2 PRODUCTS

2.1 LUMBER MATERIALS

- A. Lumber Grading Rules: WWPA G-5.
- B. Non-structural Light Framing: Stress Group Spruce-Pine-Fir species, grade and size as indicated on structural drawings. 19 percent maximum moisture content.

2.2 SHEATHING MATERIALS

- A. Wall Sheathing (as backing at fiber-cement board wall covering and as noted on drawings): APA Rated Sheathing, Structural I, plywood, C-D INT-APA, span rating 32/16, ½ inch thickness, exterior glue; or oriented strand board, as indicated on structural drawings Exposure Durability 1; unsanded.

- B. Telephone and Electrical Panel Boards: Plywood. APA/EWA Rated Sheathing; Rated C-D; Exposure Durability 2; unsanded.

2.3 SHEATHING AND UNDERLAYMENT LOCATIONS

- A. Above Grade Wall Sheathing: 1/2 inch thick, 48 x 96 inch sized sheets, square edges.

2.4 ACCESSORIES

A. Fasteners and Anchors:

- 1. Fasteners: ASTM A153/A153M, hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.

- B. Drywall Screws: Bugle head, hardened steel, power driven type, length to achieve full penetration of decking substrate.

- C. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

- D. Building Paper (over plywood wall sheathing): ASTM D226; Type II, No. 15 unperforated asphalt felt.

- E. Building Paper: Spun bonded polyethylene.

2.5 WOOD TREATMENT

- A. Wood Preservative (Pressure Treatment): AWWA U1, Commodity Specification A-Sawn Products or F-Wood Composites using water-borne ACQ preservative.

- B. Shop preservative treat wood materials in contact with concrete or masonry or indicated on Drawings.

C. Moisture Content after Treatment: Redried.

- 1. Lumber: Maximum 19 percent.
- 2. Structural Panels: Maximum 15 percent.

2.6 SOURCE QUALITY CONTROL

- A. Section 01 00 00 - General Requirements: Testing, inspection and analysis requirements.

- B. Inspect Work performed at fabricator's facility to verify conformance to Contract Documents.

- C. When fabricator is approved by authority having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

- 1. Specified shop inspections are not required for Work performed by approved fabricator.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify supports are ready to receive units.
- B. Verify sufficient end bearing area.

3.2 PREPARATION

- A. Coordinate placement of bearing or support items.

3.3 SHEATHING

- A. Fasten sheathing in accordance with applicable code.
- B. Install sheathing to combination single and two span continuous.
- C. Place building paper on vertical wall sheathing.
- D. Secure wall sheathing with ends staggered, over firm bearing.
- E. Install telephone and electrical panel back boards with plywood sheathing material where required. Size back board by 12 inches beyond size of electrical panel.

3.4 SUPPORT BLOCKING

- A. Support Blocking: Install wood blocking in stud walls for support of stair handrails, toilet accessories, toilet partitions, wall mounted cabinets, fire extinguisher cabinets, and other wall mounted items requiring support as indicated on drawings.

3.5 ERECTION TOLERANCES

- A. Surface Flatness of Sheathing Without Load: 1/4 inch in 10 feet maximum, and 1/2 inch in 30 feet maximum.

3.6 SCHEDULES

- A. Refer to structural & architectural drawings for materials used on the project.

END OF SECTION

SECTION 06 41 00
CUSTOM CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Plastic Laminate Shelving in Linen Closet No. 115.
- B. Hardboard Trim at Plastic Laminate Shelving.

1.02 RELATED SECTIONS

- A. Section 06 10 00 - Rough Carpentry: Grounds and support framing.
- B. Section 06 61 00 – Solid Surface Fabrications: Countertops in toilet rooms, locker rooms, Training Room and Study Room.
- C. Division 15: Plumbing fixtures.
- D. Section 12 35 30 – Manufactured Casework: Base cabinets, Pantry cabinets, and wall cabinets installed in conjunction with items of this section.

1.03 REFERENCES

- A. AWI - Quality Standards.
- B. FS MM-L-736 - Lumber, Hardwood.
- C. FS MMM-A-130 - Adhesive, Contact.
- D. National Electric Manufacturers Association (NEMA) LD3 - High Pressure Decorative Laminates.
- E. PS 1 - Construction and Industrial Plywood.
- F. PS 20 - American Softwood Lumber Standard.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location, and schedule of finishes.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with AWI Custom quality.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

1.08 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated.

1.09 COORDINATION

- A. Coordinate the work with plumbing rough-in.

PART 2 PRODUCTS

2.01 MATERIALS, GRADES, AND SPECIES OF WOOD:

- A. Particle Board: High density; 1 inch particle board for use as plastic laminated tops and backsplashes.
- B. Plywood: Fir plywood core material for items less than 1 inch thick.
- C. Hardwood Lumber: Graded in accordance with AWI I Custom; Red Oak Species; maximum moisture content of 6 percent; with mixed grain.

2.02 MANUFACTURERS - PLASTIC LAMINATE

- A. Manufacturer:
 - 1. Formica
 - 2. Nevamar
 - 3. Wilsonart
 - 4. Substitutions: permitted
- B. Laminate Materials
 - 1. Plastic Laminate: NEMA LD3, PF 42 Post Forming GP - 50 General Purpose type; color, pattern, and surface texture as selected.
 - 2. Laminate Backing Sheet: LD3 BK20 backing grade, undecorated plastic laminate.

2.03 ACCESSORIES

- A. Adhesive: FS MMM-A-130 contact adhesive, Type recommended by AWI to suit application.
- B. Fasteners: Size and type to suit application.
- C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; stainless steel finish in concealed locations and in exposed locations.

- D. Concealed Joint Fasteners: Threaded steel.

2.04 FABRICATION

- A. Shop assemble casework as per details and deliver to site in units easily handled and to permit passage through building openings.
- B. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- D. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
- E. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
- F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint contact surfaces of cut edges.

2.05 FINISH

- A. Plastic laminate as specified in this section.
- B. Hardwood Lumber: Stain and varnish as specified in Section 09 90 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.

3.02 INSTALLATION

- A. Set and secure casework in place; rigid, plumb, and level.
- B. Use fixture attachments in concealed locations for wall mounted components.
- C. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- D. Secure items to floor using appropriate angles and anchorages.
- E. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

F. Shelves:

1. Shelving and support structure under plastic top covering shall be particleboard or plywood free of all irregularities and sanded smooth.
2. Apply plastic top with approved adhesive per manufacturer's directions.
3. Joints shall be hairline, practically invisible.
4. Provide back and end splash against all abutting vertical surfaces or as indicated on Drawings.
5. Cut-outs in counter tops for sinks, pipes, fixtures and similar items as conditions require. Cooperate with mechanical and other trades, whose work is involved. Obtain approved shop drawings and all other required information. All work shall fit perfectly.

3.03 ADJUSTING

- A. Adjust work under provisions of General Requirements.

3.04 CLEANING

- A. Clean work under provisions of General Requirements
- B. Clean casework, counters, shelves, hardware, fittings and fixtures.

3.05 SCHEDULES

- A. See drawing for location of all custom casework.

END OF SECTION

SECTION 06 61 00

SOLID SURFACE FABRICATIONS

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Window Stools.
 - 2. Counter Tops
- B. Related sections:
 - 1. Section 07 90 00 – Joint Protection.
 - 2. Section 09 21 16 – Gypsum Board Assemblies.
 - 3. Section 12 35 30 – Manufactured Casework
 - 4. Plumbing: Division 22.

1.2 REFERENCES

- A. Standards of the following as referenced:
 - 1. American National Standards Institute (ANSI).
 - 2. American Society for Testing and Materials (ASTM).
 - 3. International Cast Polymer Association (ICPA).
 - 4. Environmental Protection Agency (EPA).
 - 5. National Association of Home Builders, Research Foundation, Inc. (NAHB/RF).
 - 6. National Fire Protection Agency (NFPA).

1.3 DEFINITIONS

- A. Terms:
 - 1. Solid Surface Fabrication: Cast Polymer; synonymous Terms.
 - 2. Contractor: General Contractor and/or its employees.
 - 3. Manufacturer: Solid Surface Fabrication Manufacturing Company.
 - 4. Installer: Solid Surface Fabrication Installation Company.
- B. Description:
 - 1. A patterned, non-porous homogeneous mixture of natural minerals and polyester resins thermally bonded to produce solid fabrications with polished sealed surfaces. Colors and grain pattern shall run all the way through the base material.

1.4 SUBMITTALS

- A. Shop Drawings: Submit top views, elevations and sections (as needed). Indicate dimensions, material thickness, location and sizes of cutouts, anchorage provisions and attachment methods. Indicate coordination requirements with adjacent and interfacing work.

- B. Samples: 6" by 6" samples or as requested; indicate full color range and pattern variation. Approved samples will be standard for solid surface fabrications.
- C. Product Data:
 - 1. Submit manufacturer's product data indicating compliance with specified performance requirements.
 - 2. Operation and maintenance data. Manufacturer's data indicating cleaning and maintenance requirements.
 - 3. Quality Assurance submittals outlined in Section 01 00 00.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Solid Surface Fabrication manufacturer qualifications:
 - a. ICPA member one calendar year, minimum, prior to Contract date.
 - b. Five years experience, minimum, in manufacturing similar type units.
 - c. Fabricated five Projects, minimum, of comparable magnitude in last three years.
 - 2. Installer qualifications:
 - a. Installed five Projects, minimum, of comparable magnitude in last three years. Provide reference list of those completed Projects for review and verification.
- B. Quality control submittals:
 - 1. Test reports:
 - a. Copies of certified test reports for the current year indicating compliance with ANSI Z-124.3 requirements. Four quarterly reports, minimum, are required.
 - 2. Certificates:
 - a. Current copy of ICPA membership.
 - b. Completed and current EPA, Office of Toxic Substances, TS-779.
 - c. Toxic Chemical Release Inventory Reporting Form R and Instructions, Section 313 of the Emergency Planning and Community Right-to-Know Act, Revised 1990 Version
 - 3. Qualification statements indicating compliance with QUALITY ASSURANCE Article; address each item

1.6 DELIVERY, STORAGE AND HANDLING

- A. Packing and shipping: to be packed in wooden crates to minimize damage in shipping.
- B. Acceptance at site: Contractor to supervise unloading of materials. A forklift is required. Check for damaged crates. Mark bill of lading if there is any obvious damage and notify marble supplier immediately. Otherwise, proceed with offloading crates.

- C. Storage and protection: Store materials under cover, off of ground, protect from moisture. Handle materials to prevent physical damage. Protect surfaces from staining, scratching and other damage during handling.

1.7 PROJECT CONDITIONS

- A. Field measurements: Shop drawings are to be field verified by Contractor to ensure proper fit of materials.
- B. Maintain relative humidity planned for building occupants and an ambient temperature between 65 and 75 F° for 48 hours prior to and during installation. After installation, maintain relative humidity and ambient temperature planned for building occupants.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate construction activities in this Section with construction activities specified in related Sections or other construction activities required for fabrication and installation.

1.9 WARRANTY

- A. Furnish manufacturer's limited 10 year warranty.

PART 2 – PRODUCTS

2.1 MANUFACTURER

- A. Corian Solid Surfaces.
- B. Wilsonart International, (800) 433-3222, www.wilsonart.com
Wilsonart Solid Surface.
- C. Color: As selected by Architect/Owner.
- D. Substitutions: Permitted.

2.2 WINDOW STOOLS AND COUNTER TOPS

- A. Product standard of quality: NFPA Class A rated material
 1. ½ inch thick solid surface fabrication. Width and depth as indicated on drawings and as field verified.
 2. Color: As selected by Architect, and as approved by Owner. Owner approval required prior to ordering materials.
- B. Performance requirements:
 1. 2009 Michigan Building Code: Class A material as measured by the ASTM E84-95 tunnel test. Documentation required.
 - a. Flame spread of 25 or less
 - b. Smoke density of 25 or less
 - c. Liquid Absorption, ISO 4586-2, for ½ inch material thickness: 0.4 percent after 2 hour period.

- d. Izod Impact, ASTM D 256, Method A: 0.3 foot pounds per inch.
 - e. Tensile Modulus, ASTM D 638 Nominal: 1.2 million pounds per square inch.
 - f. Thermal Expansion, ASTM D 696: 0.000018 inch per inch per degree F, maximum.
 - g. Hardness, ASTM D 2583, Barcol Impressor: 57.
 - h. Flexural Toughness, ASTM D 790: 3 (in.-lb./in³)
 - i. Deflection Temperature under load, ASTM D 648: 90 degrees C.
 - j. Stain Resistance, ANSI Z-124.3 Modified; 3.4: No effect.
 - k. Boiling Water Resistance, NEMA LD 3-3.05: No effect.
 - l. High Temperature Resistance, NEMA LD 3-3.06: No effect.
 - m. Radiant Heat Resistance, NEMA LD 3-3.10: No effect.
 - n. Light Resistance, NEMA LD 3-3.03: No effect.
 - o. Ball Impact Resistance, NEMA LD 3-3.08, one half pound ball, unsupported: 125 inches.
 - p. Specific Gravity (Density ASTM D792): 1.60 grams per cubic centimeter.
 - q. Approximate weight: 4.20 pounds per square foot.
 - r. Weatherability, ASTM D 2565: Pass.
 - s. Fungus Resistance, ASTM G 21: Pass
 - t. Bacterial Resistance, ASTM G 22: Pass.
 - u. Pittsburgh Protocol Toxicity: 66.9 grams.
 - v. Pattern & Color: As selected by Architect.
 - w. Edge Detail: See drawings (1/8 inch Radius).
- C. Adhesives and sealants:
- 1. Joint adhesive: Manufacturer's standard adhesive to create inconspicuous, nonporous joints, with a chemical bond (WA8215).
 - 2. Sealant: Standard mildew resistant, FDA/UL® recognized silicone sealant in color matched or clear formulations, as specified. Refer to Section 07 90 00 – Joint Sealers
 - a. Dow Corning Corp., #786 Mildew Resistant Silicone Sealant
 - 3. To caulk solid surface panels to adjoining gypsum board, or paint, use mildew resistant acrylic caulk sealant:
 - a. Phenoseal Acrylic Caulk (Gibson-Homans)
 - b. Refer to Section 07 90 00 – Joint Sealers
- D. Fabrication:
- 1. Fabrication to be performed by a Corian or Wilsonart® certified solid surface fabricator/installer.
 - 2. Fabricate components in shop to greatest extent practical to size and shape indicated, in accordance with approved shop drawing and Corian or Wilsonart® published requirements.
 - 3. Wilsonart® Solid Surface Fabrication Manual (SS0319) or Corian Technical Bulletin 102 and 127..
 - 4. Form joints between components using manufacturer's standard joint adhesive. Joints shall be inconspicuous in appearance and without voids. Attach 4" (100mm) wide Wilsonart Solid Surface reinforcing strip under joints required by Deck Seam Section of the Wilsonart® Solid Surface Fabrication Manual (SS0319).

5. Provide holes and cutouts for plumbing and bath accessories as indicated on shop drawings.
 6. Rout and finish component edges to a smooth, uniform finish. Rout all cutouts then sand all edges smooth. Repair or reject defective or inaccurate work.
 7. Finish: Surfaces shall have a uniform finish.
- E. Color: As selected by Architect.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive solid surfacing. Identify conditions detrimental to proper or timely installation. Do not commence installation until conditions have been corrected.

3.2 PREPARATION

- A. Precondition Wilsonart® Solid Surfacing in accordance with manufacturer's printed installation instructions.

3.3 INSTALLATION

- A. Install components plumb and level, in accordance with approved shop drawings, project installation details and manufacturer's printed instructions.
- B. Form joints using manufacturer's approved adhesive, with joints inconspicuous in finished work.
- C. Remove excessive adhesive and sealants. Components shall be clean on Date of Substantial Completion.
- D. Coordinate plumbing installation with Division 22.

3.4 CLEANING

- A. Contractor to protect all finished work until final acceptance by Owner.
- B. Clean installed units not more than 48 hours prior to Date of Substantial Completion. Repair or replace damaged or stained solid surface fabrication work.

3.5 SCHEDULE:

- A. As noted on the Drawings.

END OF SECTION

SECTION 07 21 00

THERMAL INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes batt thermal insulation and vapor retarder in roof truss cavity; and board thermal insulation at foundation perimeter.

1.2 SYSTEM DESCRIPTION

- A. System performance to provide continuity of thermal barrier and vapor retarder at building enclosure elements in conjunction with air barrier and vapor retarder materials in Section 07 26 00.
- B. Vapor Retarder Permeance: In accordance with Section 07 26 00.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data including thermal performance of materials.

1.4 QUALITY ASSURANCE

- A. Insulation Installed in Concealed Locations Surface Burning Characteristics:
 - 1. Foam Plastic Insulation: 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
 - 2. Other Insulation: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- B. Insulation Installed in Exposed Locations Surface Burning Characteristics:
 - 1. Other Insulation Materials: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
 - 2. Attic Insulation: Minimum 0.12 watt per sq cm critical radiant flux when tested in accordance with ASTM E970.
- C. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board and cellulose loose fill insulation package.
- D. Perform Work in accordance with the 2015 Michigan Building Code.

PART 2 PRODUCTS

2.1 BUILDING INSULATION

A. Manufacturers:

1. Dow Chemical
2. Johns Manville
3. Certain Teed
4. Knauf Fiber Glass
5. Owens-Corning Fiberglas
6. Substitutions: Permitted.

2.2 COMPONENTS

A. Batt Insulation: ASTM C665, preformed glass fiber batt, friction fit, Thermal Batt Insulation – Unfaced Fiberglass manufactured by Owens Corning, conforming to the following:

1. Thermal Resistance: R of 49
2. Batt Size: 14 inch thickness x 48 inch length.
3. Facing: Unfaced
4. Flame Spread/Smoke Developed = 25/50 in accordance with ASTM E84

B. Extruded Polystyrene Foundation Perimeter Insulation: ASTM C578, Type IV, cellular type, Styrofoam Perimate Manufactured by Dow.

1. Thermal Resistance: R of 5 per inch minimum.
2. Board Thickness = 2 1/8 inches.
3. Water Absorption: In accordance with ASTM C2842: 0.1 percent by volume maximum.
4. Compressive Strength: 25 psi.
5. Board Edges: Square.

C. Ventilation Baffles: Formed metal used with Roof cavity Batt Insulation.

2.3 ACCESSORIES

A. Adhesive: Type recommended by insulation manufacturer for application.

B. Sheet Vapor Retarder: As specified in Section 07 26 00.

C. Tape: Polyethylene self-adhering type, mesh reinforced, 2 inch wide.

D. Insulation Fasteners: Type recommended by insulation manufacturer capable of securely and rigidly fastening insulation in place.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify substrate, adjacent materials, and insulation boards are dry and ready to receive insulation and adhesive.

3.2 INSTALLATION

- A. Batt Insulation: Roof Truss Cavity.
 - 1. Place vapor retarder in accordance with Section 07 26 00.
 - 2. Place vapor retarder on warm side of insulation by securing in place. Extend vapor retarder tight to full perimeter of wall construction and other items interrupting plane of membrane. Tape seal in place.
 - 3. Install in between roof truss spaces without gaps or voids.
 - 4. Fit insulation tight in spaces. Leave no gaps or voids.
 - 5. Install friction fit insulation tight to framing members, completely filling prepared spaces.
- B. Foundation Perimeter - Board Insulation:
 - 1. Adhere strip of polyethylene sheet over substrate joints with beads of adhesive. Tape seal joints.
 - 2. Apply same adhesive and install boards on foundation perimeter. Stagger joints. Butt edges and ends tight to adjacent board and to protrusions.
 - 3. Install 24 inches vertical at foundation wall and 24 inches horizontal below slab.

3.3 SCHEDULES

- A. Roof Cavity Insulation: R-49, 14 inch fiber glass batt, un-faced; separate vapor retarder.
- B. Foundation Walls: 2 inch rigid polystyrene at 24 inches vertical and horizontal; R-10.

END OF SECTION

SECTION 07 26 00

VAPOR RETARDERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes sheet and sealant materials for controlling vapor diffusion; materials to continue vapor retarder from wall to roof construction.

1.2 SYSTEM DESCRIPTION

- A. Materials and installation methods to provide continuity of vapor retarder:
 - 1. In conjunction with materials described in Section 07 21 00, and 07 90 00.
 - 2. To seal gaps between enclosure components and opening frames.
- B. Vapor Retarder Permeance: Maximum 0.062 perms when tested in accordance with ASTM E96.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data including performance of vapor retarder.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with the 2015 Michigan Building Code.

PART 2 PRODUCTS

2.1 VAPOR RETARDERS

- A. Manufacturers:
 - 1. Carlisle, Reef Industries: Type-55 FR.
 - 2. Substitutions: Permitted.

2.2 COMPONENTS

- A. Sheet Retarder: Natural color polyethylene film reinforced with glass fiber square mesh; 3 ply; 0.062 permeance per ASTM E96; 80 lb/4900 psi tensile strength per ASTM D882; 25 lb PPT resistance per ASTM D2582; 30 lb puncture strength per ASTM D4833; Class 1/Class A flame spread rating with 10/70, flame spread/smoke developed rating per ASTM E84.

2.3 ACCESSORIES

- A. Sealant: Butyl type. Type D specified in Section 07 90 00.
- B. Primer and Backer Rods: Recommended by sealant manufacturer to suit application.

- C. Cleaner: Non-corrosive type; recommended by sealant manufacturer; compatible with joint forming materials.
- D. Tape: Polyethylene self-adhering type; mesh reinforced; 2 inch wide, compatible with sheet material.
- E. Attachments: Galvanized steel bars and anchors.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify substrate materials are dry and clean. Remove loose or foreign matter impairing adhesion.

3.2 PREPARATION

- A. Coordinate with Work of other affected sections.
- B. Clean and prime substrate surfaces to receive adhesive and sealants.

3.3 INSTALLATION

- A. Lap sheet retarder over underside roof structure and seal with tape.
- B. Caulk with sealant to ensure complete seal.

3.4 SCHEDULE

- A. Vapor retarder at interior side of attic cavity using un-faced insulation.

END OF SECTION

SECTION 07 31 13

ASPHALT SHINGLES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Asphalt shingles.
2. Ice dam membrane.
3. Underlayment.
4. Valley protection.
5. Ridge and Hip vents.
6. Vented soffit panels.
7. Metal flashings and accessories.

1.2 SUBMITTALS

- A. Product Data: Submit data indicating material characteristics, and limitations.
- B. Samples: Submit two samples of each shingle color indicating color range and finish texture/pattern; for color and texture selection.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with the 2015 Michigan Building Code.

1.4 AMBIENT CONDITIONS

- A. Do not install ice dam membrane and shingles when surface, ambient air, or wind chill temperatures are below 45 degrees F.

1.5 WARRANTY

- A. Furnish standard manufacturer warranty for asphalt shingles as selected.

PART 2 PRODUCTS

2.1 ASPHALT SHINGLES

A. Manufacturer List:

1. Owens Corning Fiberglas Corp.: Oakridge Shingles Pro Series AR; color as selected; limited lifetime warranty; as basis of design.
2. CertainTeed: Landmark (and AR); Color as selected; limited lifetime warranty.
3. GAF Building Materials Corporation: Timberline HD; Color as selected; limited lifetime warranty.

B. Substitution Limitations:

1. Substitutions permitted for products meeting basis of design.

C. Description: ASTM D3462; glass fiber mat base, mineral granule surface type; self sealing type; 13 ¼ inch x 39 inch; 5 5/8 inch exposure; 64 shingles per square; 98.4 sq. ft. per square; 240 lb per square; color and texture as selected above, and approved by Owner and Architect.

2.2 MATERIALS

A. Ice Dam Membrane: ASTM D1970; self adhering polymer modified bituminous sheet material, slip resistant surface, 40 mils thick, 36 inches wide, with strippable release paper to expose adhesive surface; WeatherLock Self-Sealing Ice & Water Barrier Products as manufactured by Owens Corning.

B. Underlayment: ASTM D226; Type I, No. 15 unperforated asphalt felt.

C. Underlayment: ASTM D4869; Type I, No. 8 asphalt organic felt.

2.3 RIDGE, HIP, AND SOFFIT VENTS

A. Ridge and Hip Vents: Plastic, nominal 12 inches wide with vent openings that do not permit direct water or weather entry; to receive cap shingles; minimum 12 sq inches/foot net free area; VentSure Rigid Roll Ridge Vents with Weather PROtector Moisture Barrier manufactured by Owens Corning.

B. Soffit Vents and Panels: Aluminum vented soffit panels; invisibly vented; 0.019 guage aluminum; ½ inch deep; ¾ inch F-channel installation and trim; 12 inches wide; minimum 1.1 sq inches/ square foot net free area; used at all soffits for uniform appearance; color as selected; Triple 3 3/4" TruVent Hidden Vent Soffit, manufactured by Quality Edge.

C. Starter and End Caps and Trim: As required to suit application.

2.4 FABRICATION

A. Form flashings to profiles indicated on Drawings, and to protect roofing materials from physical damage and shed water; and in accordance with Section 07 62 00 – Sheet Metal Flashing and Trim.

B. Form eave edge and gable edge flashing to extend minimum 2 inches onto roof and minimum 0.25 inches below sheathing.

C. Form flashing sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.

D. Hem exposed edges of flashings minimum 1/4 inch on underside.

E. Apply bituminous paint on concealed surfaces of flashings.

2.5 ACCESSORIES

- A. Nails: ASTM F1667; standard round wire roofing nails hot dipped galvanized steel type, minimum 0.105 inch (2.67 mm) diameter shank, minimum 0.375 inch (9.5 mm) diameter head; of sufficient length to penetrate 3/4 inch (19 mm) into roof sheathing.
- B. Plastic Cement: ASTM D4586, Asphalt type with mineral fiber components, free of toxic solvents, capable of setting within 24 hours at temperatures of 75 degrees F (24 degrees C) and 50 percent RH.
- C. Lap Cement: Fibrated cutback asphalt type, recommended for use in application of underlayment, free of toxic solvents.
- D. Flashing Materials: 0.032 inch thick aluminum as specified in Section 07 76 00 Sheet Metal Flashing and Trim.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify roof penetrations and plumbing stacks are in place and flashed to deck surface.
- B. Verify roof openings are correctly framed.
- C. Verify deck surfaces are dry, free of ridges, warps, or voids.

3.2 PREPARATION

- A. Fill knot holes and surface cracks with latex filler at areas of bonded ice dam membrane.
- B. Broom clean deck surfaces under ice dam membrane and underlayment.

3.3 INSTALLATION

A. Ice Dam Membrane Installation:

1. Place eave edge and gable edge metal flashings tight with fascia boards. Weather lap joints minimum 2 inches (50 mm) and seal with plastic cement. Secure flange with nails at maximum 12 inches (300 mm) on center.
2. Install ice dam membrane parallel with eave edge, flush with face of eave edge flashing with edges lapped shingle style and ends lapped and staggered between rows.
3. Apply lap cement at rate of approximately 1-1/4 gal/100 sq ft (0.5 L/sq m) over starter strip.
4. Extend ice dam membrane minimum 2 ft up-slope beyond interior face of exterior wall.

B. Underlayment Installation:

1. Place one ply of underlayment over substrate not covered by ice dam membrane, with ends and edges weather lapped 2 inches (50 mm). Stagger end laps of each consecutive layer. Weather lap ice dam membrane minimum 2 inches (50 mm). Nail underlayment in place.
2. Weather lap and seal items projecting through or mounted on roof watertight with plastic cement.

C. Valley Protection Installation:

1. Ice Dam Membrane - Closed Valleys:
2. Place ice dam membrane sheet, 36 inches (900 mm) wide, centered over valley as valley protection.

D. Metal Flashing and Accessories Installation:

1. Weather lap joints minimum 2 inches (50 mm) and seal weather tight with plastic cement.
2. Secure in place with nails. Conceal fastenings.
3. Flash and seal Work weather tight, projecting through or mounted on roofing with plastic cement.

E. Asphalt Shingles Installation:

1. Place shingles in straight coursing pattern with 5 inch (125 mm) weather exposure to produce double thickness over full roof area.
2. Project first course of shingles 3/4 inch (19 mm) beyond fascia boards.
3. Extend shingles 1/2 inch (13 mm) beyond face of gable edge fascia boards.
4. Extend shingles on both slopes across valley in weave pattern and fasten. Extend shingles minimum of 12 inches (300 mm) beyond valley center line to achieve woven valley, concealing valley protection.
5. Cap hips and ridges with individual shingles, maintaining 5 inch (125 mm) weather exposure. Place to avoid exposed nails.
6. Install ridge and hip vents centered over ridges and hips.
7. Cap hips and ridges with individual shingles. Place to avoid exposed nails.
8. Coordinate installation of roof mounted components or Work projecting through roof with weather tight placement of Counterflashings.
9. Complete installation to provide weather tight service.

F. Soffit Panel Installation:

1. Verify that framing is ready to receive soffit panel installation.
2. Install vented soffit panels, trim, and accessories as required for a complete installation, in accordance with manufacturer's requirements.

END OF SECTION

SECTION 07 46 00
FIBER CEMENT SIDING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fiber cement siding for walls, related trim, flashings, accessories, and fastenings.

1.2 SUBMITTALS

A. Product Data: Submit data indicating materials, component profiles, fastening methods, jointing details, sizes, surface texture, finishes, and accessories.

B. Samples: Submit two samples 12 x inch in size illustrating surface texture and color.

1.3 RELATED SECTIONS

A. Section 07 31 13 – Asphalt Shingles: Vented Soffit Panels.

B. Section 06 10 00 – Rough Carpentry: Wall sheathing and building paper under siding.

1.4 WARRANTY

A. Furnish one year manufacturer's warranty for fiber cement siding, including deterioration of finish for factory prefinished products.

PART 2 PRODUCTS

2.1 FIBER CEMENT SIDING

A. Manufacturers:

1. CertainTeed Weatherboards Fiber Cement Siding and Trim: Cedar Texture Lap Siding and Trim Board; sizes as indicated on drawings; Color as selected; 5/16 inch thickness Lap Siding and 7/16 inch thickness Trim Board.
2. Substitutions: Permitted.

B. Product Description: Furnish Prefinished Horizontal Fiber Cement siding and trim boards.

2.2 COMPONENTS

A. Fiber Cement Siding: ASTM C1186 Type A; fiber reinforced cement composite board for exterior use, minimum 5/16 inches thick; cedar wood grained pattern surface; factory finished.

2.3 ACCESSORIES

- A. Nails, Hot dipped galvanized type, non-staining, prefinished to match siding finish.
- B. Building Paper: Specified in Section 06 10 00 – Rough Carpentry.
- C. Flashings: 0,032 inch thick Aluminum flashing as specified in Section 07 62 00 – Sheet Metal Flashing and Trim.
- D. Accessory Components: fascia, trim and corner boards; of same material and finish as siding.
- E. Vented Soffit Panels: Specified in Section 07 31 13 – Asphalt Shingles.

2.4 SHOP FINISHING

- A. Pre-finish Color: Color as selected by Architect. ColorMax Finishing System by CertainTeed with 100 percent acrylic solid color or Premium Stain Color.

PART 3 EXECUTION

3.1 PREPARATION

- A. Prior to commencing installation, verify governing dimensions of building and substrate conditions.
- B. Examine, clean, and repair as necessary any substrate conditions that would be detrimental to proper installation.
- C. Do not begin installation until unacceptable conditions have been corrected.

3.2 INSTALLATION

- A. Install fiber cement siding in accordance with manufacturer's instructions.
- B. Installation of building paper horizontally on sheathed walls is specified in Section 06 10 00 – Rough Carpentry.
- C. Fiber Cement Horizontal Lap Siding: Install siding using single course method. Lap siding minimum 1.25 inches, seal end joints or install flashing behind joints. Nail siding at 16 inches on center into solid backing.
- D. Nail to aligned pattern.
- E. Install siding for natural watershed.
- F. Align level, and plumb. Locate cut board edges and ends over bearing.
- G. Install metal flashings at internal and external corners, and horizontal joints of sheet materials.

H. Install corner strips, closures, and trim.

I. Install sealant to prevent weather penetration. Maintain neat appearance.

J. Touch-up damaged prefinished paint surfaces.

3.3 SCHEDULE

A. Band of Fiber Cement Board and Trim below eaves and overhangs all around building.

B. Fascia Board at all roof overhangs.

C. Head & Jamb trim board at window openings.

D. Trim Board Soffit fascia above exposed steel columns.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes firestopping and through-penetration protection systems materials and accessories.

1.2 SUBMITTALS

- A. Product Data: Submit data on product characteristics, performance and limitation criteria.
- B. Design Data: Provide schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

- A. Through Penetration Firestopping of Fire Rated Assemblies: One hour fire stop for metallic pipe through concrete block or concrete wall: UL No. WJ-1055, ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated, but not less than 1-hour.
 - 1. Product: SpecSeal Series 100 Sealant
- B. Through Penetration Firestopping of Fire Rated Assemblies: One hour fire stop for insulated metallic pipe through concrete block or concrete wall: UL No. CAJ-5021, CAJ-5079, CAJ-5087, or CAJ-5101, ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated, but not less than 1-hour.
 - 1. Product: SpecSeal Series 100 Sealant with mineral wool batt backing.
- C. Through Penetration Firestopping of Fire Rated Assemblies: One or two hour fire stop for non-metallic pipe through concrete block or concrete wall: UL No. CAJ-2124, ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated, but not less than 1-hour.
 - 1. Product: SpecSeal Series 100 Sealant with RED Wrap Strip.
- D. Optional: One hour firestop for 6 inch diameter maximum metallic pipe through concrete block or concrete walls: Pack annular space with full thickness concrete, mortar, or grout as specified in sections 03 30 00 and 04 27 00. (In accordance with the 2015 Michigan Building Code, section 712.3.1.)

- E. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- F. Perform Work in accordance with the 2009 Michigan Building Code.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F.
- B. Maintain this minimum temperature before, during, and minimum 3 days after installation of materials.
- C. Provide ventilation in areas to receive solvent cured materials.

PART 2 PRODUCTS

2.1 FIRESTOPPING

- A. Manufacturers:
 - 1. STI SpecSeal.
 - 2. Dow Corning Corp.
 - 3. Hilti Corp.
 - 4. 3M fire Protection Products.
 - 5. Pecora Corporation.
 - 6. Substitutions: Permitted.
- B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
 - 1. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
 - 2. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
 - 3. Mortar or Grout as specified in Section 04 27 00 or Concrete as specified by Section 03 30 00 where permitted by applicable code.
 - 4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
- C. Color: As selected from manufacturer's full range of colors.

2.2 ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces.
- B. Dam Material: Permanent:

1. Mineral fiberboard.
 2. Mineral fiber matting.
 3. Sheet metal.
- C. Installation Accessories: Clips, collars, fasteners, temporary stops or dams, diamond shaped wire lath and other devices required to position and retain materials in place.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive work of this section.

3.2 PREPARATION

- A. Clean substrate surfaces of matter effecting bond of firestopping material.
- B. Install backing materials to arrest liquid material leakage.

3.3 APPLICATION

- A. Apply primer where recommended by manufacturer for specific material and substrate.
- B. Apply firestopping material in sufficient thickness to achieve required fire rating, to uniform density and texture.
- C. Install material at walls or partition openings containing penetrating sleeves, piping, duct work, conduit and other items, requiring firestopping.

3.4 SCHEDULES

LOCATION	UL/FM/WH #	FIRE RATING
Fire Area Separation Wall between Apparatus Room 136 – Use Group S-2 and Administrative/Living Areas - Residential Use Group R-2.	See Quality Assurance	1 hour

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes firestopping and through-penetration protection systems materials and accessories.

1.2 SUBMITTALS

- A. Product Data: Submit data on product characteristics, performance and limitation criteria.
- B. Design Data: Provide schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

- A. Through Penetration Firestopping of Fire Rated Assemblies: One hour fire stop for metallic pipe through concrete block or concrete wall: UL No. WJ-1055, ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated, but not less than 1-hour.
 - 1. Product: SpecSeal Series 100 Sealant
- B. Through Penetration Firestopping of Fire Rated Assemblies: One hour fire stop for insulated metallic pipe through concrete block or concrete wall: UL No. CAJ-5021, CAJ-5079, CAJ-5087, or CAJ-5101, ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated, but not less than 1-hour.
 - 1. Product: SpecSeal Series 100 Sealant with mineral wool batt backing.
- C. Through Penetration Firestopping of Fire Rated Assemblies: One or two hour fire stop for non-metallic pipe through concrete block or concrete wall: UL No. CAJ-2124, ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated, but not less than 1-hour.
 - 1. Product: SpecSeal Series 100 Sealant with RED Wrap Strip.
- D. Optional: One hour firestop for 6 inch diameter maximum metallic pipe through concrete block or concrete walls: Pack annular space with full thickness concrete, mortar, or grout as specified in sections 03 30 00 and 04 27 00. (In accordance with the 2015 Michigan Building Code, section 712.3.1.)

- E. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- F. Perform Work in accordance with the 2009 Michigan Building Code.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F.
- B. Maintain this minimum temperature before, during, and minimum 3 days after installation of materials.
- C. Provide ventilation in areas to receive solvent cured materials.

PART 2 PRODUCTS

2.1 FIRESTOPPING

- A. Manufacturers:
 - 1. STI SpecSeal.
 - 2. Dow Corning Corp.
 - 3. Hilti Corp.
 - 4. 3M fire Protection Products.
 - 5. Pecora Corporation.
 - 6. Substitutions: Permitted.
- B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
 - 1. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
 - 2. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
 - 3. Mortar or Grout as specified in Section 04 27 00 or Concrete as specified by Section 03 30 00 where permitted by applicable code.
 - 4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
- C. Color: As selected from manufacturer's full range of colors.

2.2 ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces.
- B. Dam Material: Permanent:

1. Mineral fiberboard.
 2. Mineral fiber matting.
 3. Sheet metal.
- C. Installation Accessories: Clips, collars, fasteners, temporary stops or dams, diamond shaped wire lath and other devices required to position and retain materials in place.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive work of this section.

3.2 PREPARATION

- A. Clean substrate surfaces of matter effecting bond of firestopping material.
- B. Install backing materials to arrest liquid material leakage.

3.3 APPLICATION

- A. Apply primer where recommended by manufacturer for specific material and substrate.
- B. Apply firestopping material in sufficient thickness to achieve required fire rating, to uniform density and texture.
- C. Install material at walls or partition openings containing penetrating sleeves, piping, duct work, conduit and other items, requiring firestopping.

3.4 SCHEDULES

LOCATION	UL/FM/WH #	FIRE RATING
Fire Area Separation Wall between Apparatus Room 136 – Use Group S-2 and Administrative/Living Areas - Residential Use Group R-2.	See Quality Assurance	1 hour

END OF SECTION



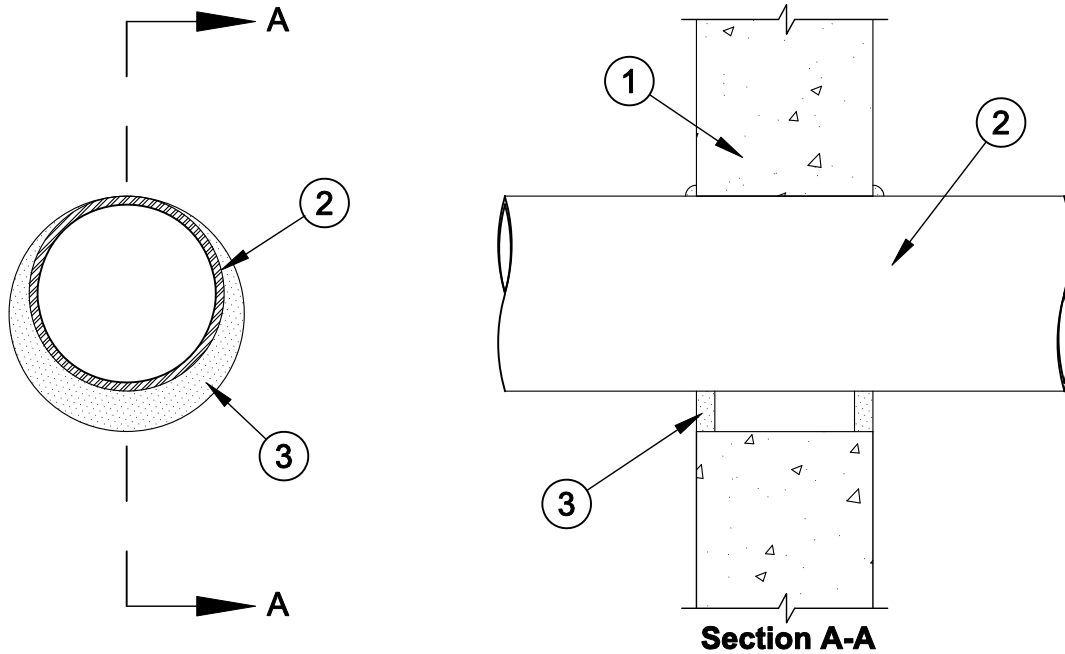
System No. W-J-1055

F Rating - 2 Hr

T Rating - 0 Hr

L Rating At Ambient - Less Than 1 CFM/sq ft

L Rating At 400 F - Less Than 1 CFM/sq ft



1. **Wall Assembly** - Min 6 in. (152 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete. Wall may also be constructed of any UL Classified **Concrete Blocks***. Max diam of opening is 26 in. (660 mm).
See **Concrete Blocks (CAZT)** category in the Fire Resistance Directory for names of manufacturers.
2. **Through Penetrant** - One metallic pipe, conduit or tubing to be installed either concentrically or eccentrically within the firestop system. Pipe, conduit or tubing may be installed at an angle not greater than 45 degrees from perpendicular. The annular space between pipe, conduit or tubing and periphery of opening shall be min 0 in. (0 mm, point contact) to max 2 in. (51 mm). Pipe, conduit or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes, conduit or tubing may be used:
 - A. **Steel Pipe** - Nom 24 in. (610 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
 - B. **Iron Pipe** - Nom 24 in. (610 mm) diam (or smaller) cast or ductile iron pipe.
 - C. **Conduit** - Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing, nom 6 in. (152 mm) diam (or smaller) steel conduit or nom 1 in. (25 mm) diam (or smaller) flexible steel conduit.
 - D. **Copper Tubing** - Nom 6 in. (152 mm) diam (or smaller) Type L (or heavier) copper tubing.
 - E. **Copper Pipe** - Nom 6 in. (152 mm) diam (or smaller) Regular (or heavier) copper pipe.
3. **Fill, Void or Cavity Material* - Sealant** - Min 5/8 in. (16 mm) thickness of fill material applied within annulus, flush with both surfaces of wall. At the point contact location between through penetrant and concrete, a min 3/8 in. (10 mm) diam bead of fill material shall be applied at the concrete/through penetrant interface on both surfaces of wall.

SPECIFIED TECHNOLOGIES INC - SpecSeal Series SSS Sealant or SpecSeal LCI Sealant

*Bearing the UL Classification Mark



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System No. C-AJ-5021

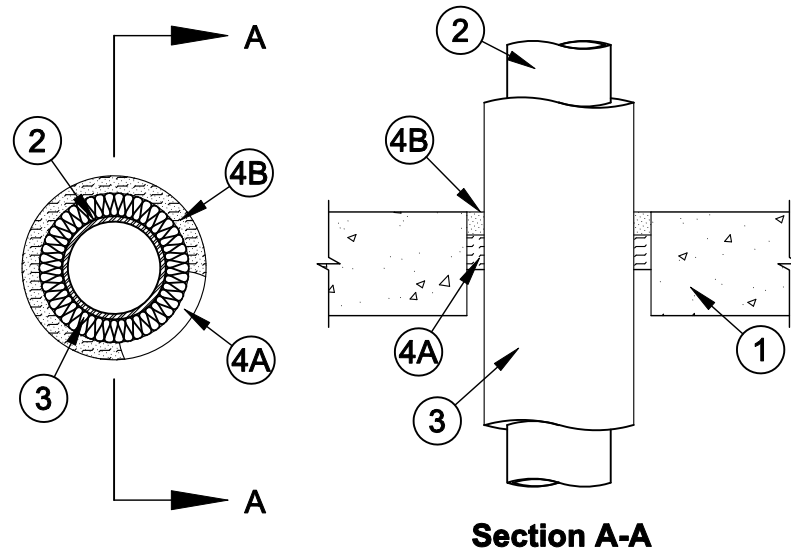
(Formerly System No. 479)

F Rating - 2 and 3 Hr (See Item 3)

T Rating - 1/2 and 1 Hr (See Item 3)

L Rating At Ambient - Less Than 1 CFM/sq ft

L Rating At 400 F - Less Than 1 CFM/sq ft



- Floor or Wall Assembly** - Min 4-1/2 in. thick reinforced lightweight or normal weight (100-150 pcf) concrete. Wall may also be constructed of any UL Classified **Concrete Blocks***. Max diam of opening is 8 in.
See **Concrete Block (CAZT)** category in the Fire Resistance Directory for names of manufacturers.
- Through Penetrants** - One metallic pipe or tubing to be centered within the firestop system. Pipe or tubing to be rigidly supported on both sides of floor or wall assembly.
 - Steel Pipe** - Nom 4 in. diam (or smaller) Schedule 5 (or heavier) steel pipe.
 - Copper Tubing** - Nom 4 in. diam (or smaller) Type L (or heavier) copper tubing.
 - Copper Pipe** - Nom 4 in. diam (or smaller) Regular (or heavier) copper pipe.
- Pipe Coverings** - One of the following types of pipe coverings shall be used:
 - Pipe and Equipment Coverings - Materials*** - Nom 1/2 or 1 in. thick hollow cylindrical heavy density (min 3.5 pcf) glass fiber units jacketed on the outside with an all service jacket. Longitudinal joints sealed with metal fasteners or factory-applied self-sealing lap tape. Transverse joints secured with metal fasteners or with butt tape supplied with the product. The annular space between the insulated through penetrant and periphery opening shall be a nom 5/16 in.
See **Pipe and Equipment Covering - Materials** - (BRGU) category in the Building Materials Directory for names of manufacturers. Any pipe covering material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.
 - Pipe Covering Materials*** - Nom 1/2 or 1 in. thick unfaced mineral fiber pipe insulation sized to the outside diam of pipe or tube. Pipe insulation secured with min 8 AWG steel wire spaced max 12 in. OC. The annular space between the insulated through penetrant and periphery opening shall be a nom 5/16 in.
IIG MINWOOL L L C - High Temperature Pipe Insulation 1200, High Temperature Pipe Insulation BWT or High Temperature Pipe Insulation Thermaloc



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- C. **Sheathing Material*** - (Not Shown) - Used in conjunction with Item 3B. Foil-scrim-kraft or all service jacket material shall be wrapped around the outer circumference of the pipe insulation (Item 3B) with the kraft side exposed. Longitudinal joints and transverse joints sealed with metal fasteners or butt tape.

See **Sheathing Materials** (BVDV) category in the Building Materials Directory for names of manufacturers. Any sheathing material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.

The F and T Ratings of the firestop system are dependent upon the max diam of the through penetrant, nom thickness of pipe covering and the nom annular space within the firestop system as tabulated below:

Max Diam of Through Penetrant In.	Nom Thkns of Pipe Covering In.	Nom Annular Space In.	H Rating hr	T Rating hr
3	1/2	15/16	3	1/2
4	1	7/16	2	1

4. **Firestop System** - The firestop system shall consist of the following:

- A. **Packing Material** - Min 1-1/2 in. thickness of min 6 pcf mineral wool batt insulation firmly packed into opening as a permanent form. Packing material to be recessed from top surface of floor or from both surfaces of wall as required to accommodate the required thickness of fill material.
- B. **Fill, Void or Cavity Material* - Caulk** - Min 1 in. thickness of fill material applied within the annulus, flush with top surface of floor or with both surfaces of wall.

SPECIFIED TECHNOLOGIES INC - SpecSeal 100, 101 or 105 Sealant

*Bearing the UL Classification Mark



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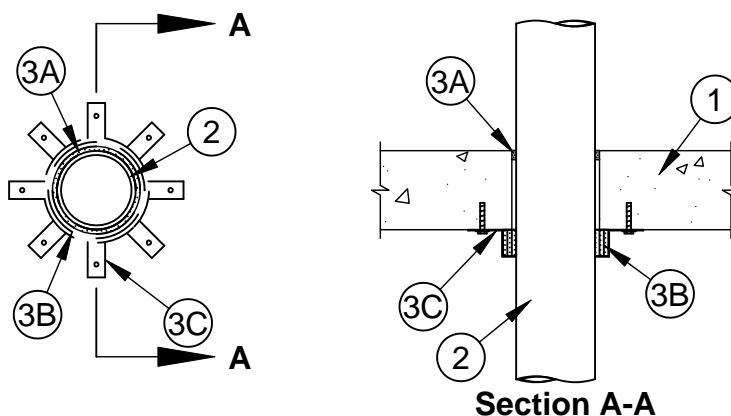
System No. C-AJ-2124



F Ratings - 2 and 3 Hr (See Item 2)

T Ratings - 0, 3/4 and 2 Hr (See Item 2)

W Rating - Class 1 (See Item 3A)



1. **Floor or Wall Assembly** - Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete. Floor assembly may be also constructed of any min 6 in. thick UL Classified hollow-core Precast Concrete Units*. Wall may also be constructed of any UL Classified **Concrete Blocks***. Max diam of opening is 5 in. (127 mm).

See **Concrete Blocks** (CAZT) and Precast Concrete Units (CFTV) categories in the Fire Resistance Directory for names of manufacturers.

2. **Through Penetrants** - One nonmetallic pipe or conduit to be centered within the firestop system. A nom annular space of 1/4 in. (6 mm) is required within the firestop system. The pipe or conduit to be rigidly supported on both sides of floor or wall. The following types and sizes of pipes or conduits may be used:
 - A. **Polyvinyl Chloride (PVC) Pipe** - Nom 4 in. (102 mm) diam (or smaller) Schedule 40 cellular or solid core PVC pipe for use in closed (process or supply) or vented (drain, waste, or vent) piping systems.
 - B. **Flame Retardant Polypropylene (FRPP) Pipe** - Nom 4 in. (102 mm) diam (or smaller) Schedule 40 FRPP pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.
 - C. **Acrylonitrile Butadiene Styrene (ABS) Pipe** - Nom 4 in. (102 mm) diam (or smaller) Schedule 40 cellular or solid core ABS pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.
 - D. **Chlorinated Polyvinyl Chloride (CPVC) Pipe** - Nom 4 in. (102 mm) diam (or smaller) SDR 13.5 CPVC pipe for use in closed (process or supply) piping systems.
 - E. **Rigid Nonmetallic Conduit+** - Nom 4 in. (102 mm) diam (or smaller) Schedule 40 PVC conduit installed in accordance with Article 347 of the National Electrical Code, (NFPA No. 70)
 - F. **Polyvinylidene Fluoride (PVDF) Pipe** - Nom 4 in. (102 mm) diam (or smaller) Schedule 40 PVDF pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.
 - G. **Fiberglass Reinforced Pipe (FRP) Pipe** - Nom 4 in. (102 mm) diam (or smaller) glass fiber reinforced thermosetting resin pipe for use in closed (process or control) or vented (drain, waste or vent) piping systems.

The F and T Ratings of the firestop system are dependent upon the type of through penetrant used as tabulated below:

Through Penetrant	F RATING Hr	T RATING Hr
PVC Pipe	3	2
FRPP Pipe	3	0
ABS Pipe	2	0
CPVC Pipe	3	2
PVC Conduit	3	2
PVDF Pipe	2	2
FRP Pipe	2	3/4



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3. **Firestop System** - The firestop system shall consist of the following:

- A. **Fill, Void or Cavity Material* - Sealant** - Min 1/2 in. (13 mm) thickness of fill material applied within the annulus, flush with top surface of floor or with both surfaces of wall.

SPECIFIED TECHNOLOGIES INC - SpecSeal Series SSS Sealant, SpecSeal LCI Sealant, Pensil 300 Sealant or SpecSeal Series SIL 300 Sealant for floors or walls and Pensil 300 S/L Sealant or SpecSeal Series SIL 300SL Sealants for floors only.

W Rating applies only when Pensil 300, SpecSeal Series SIL 300, Pensil 300 S/L or SpecSeal Series SIL 300SL Sealants are used.

- B. **Fill, Void or Cavity Material* - Wrap Strip** - Nom 1/4 in. (6 mm) thick intumescent material faced on both sides with a plastic film, supplied in 1-1/2 in. (38 mm) wide strips. The layers of wrap strip are individually wrapped around the through-penetrant with the ends butted and held in place with masking tape. Butted ends in successive layers may be aligned or offset. The edge of the wrap strips shall abut the surface of the concrete floor or wall. In floor assemblies, the wrap strips are installed on the bottom side of the concrete floor. In wall assemblies, the wrap strips are installed on each side of the concrete wall. The number of wrap strips required is dependent upon the diam of the through penetrant as tabulated below:

Diam of Thought-Penetrant In. (mm)	No. of Wrap Strips
2 (51)	1
3 (76)	2
4 (102)	3

SPECIFIED TECHNOLOGIES INC - SpecSeal RED Wrap Strip

- C. **Steel Collar** - Collar fabricated from coils of precut 0.016 in. thick (0.4 mm) galv sheet steel available from wrap strip manufacturer. Collar shall be nom 1-1/2 in. (38 mm) deep with 1 in. (25 mm) wide by 2 in. (51 mm) long anchor tabs for attachment to the concrete floor or wall. Retainer tabs, 3/4 in. (19 mm) wide tapering down to 3/8 in. (10 mm) wide and located opposite the anchor tabs, are folded 90 degrees toward through-penetrant surface to maintain the annular space around the through-penetrant and to retain the wrap strips. Steel collar wrapped around wrap strips and through penetrant with a 1 in. (25 mm) wide overlap along its perimeter joint. Steel collar tightened around wrap strips and through penetrant using min 1/2 in. (13 mm) wide by 0.028 in. (0.7 mm) thick stainless steel hose clamp installed at midheight of the collar. As an alternate to the steel hose clamp, the steel collar may be secured together by means of three No. 8 steel sheet metal screws. The length of the steel screws is dependent upon the number of layers of wrap strip used within the steel collar. For steel collars incorporating a single layer of wrap strip, the length of the steel screws shall be 1/4 in. (6 mm) long. For steel collars incorporating two or more layers of wrap strip, the length of the steel screws shall be 3/8 in. (10 mm) long. Collar secured to concrete surface with 1/4 in. (6 mm) diam by min 1-1/4 in. (32 mm) long steel concrete screws in conjunction with min 1 in. (25 mm) diam steel fender washers. The number of fasteners used is dependent upon the nom diam of the through penetrant. Two fasteners, symmetrically located, are required for nom 1-1/2 in. (38 mm) and 2 in. (51 mm) diam through penetrants. Three fasteners, symmetrically located, are required for nom 2-1/2 in. (64 mm) and 3 in. (76 mm) diam through penetrants. Four fasteners, symmetrically located, are required for nom 3-1/2 in. (89 mm) and 4 in. (102 mm) diam through penetrants.

*Bearing the UL Classification Mark

+Bearing the UL Listing Mark



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SECTION 07 90 00

JOINT PROTECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes sealants and joint backing.

1.2 SUBMITTALS

- A. Product Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

1.3 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

PART 2 PRODUCTS

2.1 JOINT SEALERS

- A. Manufacturers:
 - 1. Dow Corning Corp.
 - 2. GE Silicones.
 - 3. Pecora Corp..
 - 4. Sika Corp..
 - 5. Tremco.
 - 6. Substitutions: Permitted.
- B. Product Description:
 - 1. High Performance General Purpose Exterior (Nontraffic) Sealant Type A: Silicone; ASTM C920, Type S, Grade NS, Class 100/50, Uses NT, M, G, A and O; single component.
 - a. Type: Spectrem 1 manufactured by Tremco.
 - b. Color: Standard colors matching finished surfaces, as selected.
 - c. Applications: Use for:
 - 1) Control, expansion, and soft joints in masonry or EIFS.
 - 2) Joints between concrete and other materials.
 - 3) Joints between metal frames and other materials.
 - 4) Other exterior nontraffic joints for which no other sealant is indicated.
 - 2. High Performance Exterior (Nontraffic) Sealant Type B: Polyurethane, moisture curing; ASTM C920, Type S, Grade NS, Class 25, Uses NT, M, A, and O; single component.

- a. Type: Vulkem 116 manufactured by Tremco.
- b. Color: Standard colors matching finished surfaces, as selected.
- c. Applications: Use for:
 - 1) Control, expansion, and soft joints in masonry.
 - 2) Joints between concrete and other materials.
 - 3) Joints between metal frames and other materials.
 - 4) Other exterior nontraffic joints for which no other sealant is indicated.
3. General Purpose Traffic Bearing Sealant Type C: Polyurethane; ASTM C920, Type S, Grade P, Class 25, Use T, M, A, O, and I; single component.
 - a. Type: Vulkem 45 manufactured by Tremco.
 - b. Color: Standard colors matching finished surfaces, as selected.
 - c. Applications: Use for exterior and interior pedestrian and vehicular traffic bearing joints.
 - d. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
4. Exterior Metal Lap Joint Sealant Type D: Butyl or polyisobutylene, non-drying, non-skinning, non-curing.
 - a. Type: Tremco Butyl Sealant manufactured by Tremco.
 - b. Applications: Use for concealed sealant bead in sheet metal work, under thresholds, and concealed sealant bead in flashing overlaps.
5. General Purpose Interior Sealant Type E: Acrylic emulsion latex; ASTM C834, single component, paintable.
 - a. Type: Tremflex 834 manufactured by Tremco.
 - b. Color: Standard colors matching finished surfaces as selected.
 - c. Applications: Use for interior wall and ceiling control joints, joints between door and window frames and wall surfaces, and other interior joints for which no other type of sealant is indicated.
 - d. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
6. Sanitary Sealant Type F: Silicone; ASTM C920, Uses M and A; single component, mildew resistant.
 - a. Type: Tremsil 200 manufactured by Tremco or Dow Corning Mildew Resistant Silicone Sealant # 786.
 - b. Applications: Use for joints between plumbing fixtures and floor and wall surfaces, and joints between counter tops and wall surfaces.
 - c. Color: Standard colors matching finished surfaces as selected.
 - d. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.

2.2 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
 1. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

- C. Joint Backing: Round foam rod compatible with sealant; ASTM D1056, closed cell Polyethylene; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify substrate surfaces and joint openings are ready to receive work.
- B. Verify joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

- A. Remove loose materials and foreign matter impairing adhesion of sealant.
- B. Clean and prime joints.
- C. Perform preparation in accordance with ASTM C1193.

3.3 INSTALLATION

- A. Perform installation in accordance with ASTM C1193.
- B. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer , except where specific dimensions are indicated.
- C. Install bond breaker where joint backing is not used.
- D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Tool joints concave.

3.4 SCHEDULE

- A. Exterior Joints for Which No Other Sealant Type is Indicated: Type A or B.
- B. Control and Expansion Joints in Paving: Type C.
- C. Control, Expansion, and Soft Joints in Fiber Cement Siding, and Between Fiber Cement Siding and Adjacent Work: Type A.

- D. Control Joints in Clay Masonry, and between Masonry and adjacent work: Type B.
- E. Lap Joints in Exterior Sheet Metal Work: Type D.
- F. Butt Joints in Exterior Metal Work: Type A or B.
- G. Exterior Joints in Stone Masonry: Type B.
- H. Exterior Joints in Cast Stone: Type A.
- I. Joints Between Exterior Metal Frames and Adjacent Work: Type A or B.
- J. Under Exterior Door Thresholds: Type D.
- K. Interior Joints for Which No Other Sealant is Indicated: Type E.
- L. Control and Expansion Joints in Interior Concrete Slabs and Floors: Type C.
- M. Joints Between Plumbing Fixtures and Walls and Floors, and Between Counter tops and Walls and at Cultured Marble joints: Type F.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes steel doors, and frames; fire rated, and non-rated, and interior borrowed light frames.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate door and frame elevations, internal reinforcement, and finishes.
- B. Product Data: Submit door and frame configurations, location of cut-outs for hardware reinforcement.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
 - 1. ANSI 250.8 - Recommended Specifications for Standard Steel Doors and Frames.
 - 2. DHI - Door Hardware Institute - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
- B. Fire Rated Door Construction: Conform to NFPA 252.
- C. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated on Drawings.
- D. Attach label from agency approved by authority having jurisdiction to identify each fire rated door.
- E. Perform Work in accordance with the 2015 State of Michigan Building Code.

PART 2 PRODUCTS

2.1 STEEL DOORS AND FRAMES

- A. Manufacturers:
 - 1. Amweld Building Products, Inc..
 - 2. Ceco Door Products.
 - 3. Pioneer Industries.
 - 4. Republic Builders Products.
 - 5. Steelcraft.
 - 6. Substitutions: Permitted.

- B. Product Description: Standard shop fabricated steel doors, and frames; fire rated; non-rated types; flush face.

2.2 COMPONENTS

- A. Interior Doors: ANSI A250.8, and SDI 108, 1-3/4 inch thick.
 - 1. Level 2 - Heavy Duty, Model 1, full flush design.
- B. Interior Frames:
 - 1. Level 2 for Door Models 1, nominal 16 gage/0.053 inch thick material, base metal thickness.
- C. Door Core: mineral fiberboard.
- D. End Closure: Channel, 0.04 inch thick, flush.

2.3 ACCESSORIES

- A. Silencers: Resilient rubber fitted into drilled hole.
- B. Removable Stops: Rolled steel channel shape.
- C. Bituminous Coating: Fibered asphalt emulsion.
- D. Primer: ANSI A250.10 rust inhibitive type.

2.4 FABRICATION

- A. Fabricate doors and frames with hardware reinforcement welded in place. Protect frame hardware preparations with mortar guard boxes.
- B. Fabricate frames as face welded units and for metal wall panels.
- C. Fabricate frames with 2 inches head member as indicated on drawings.
- D. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.
- E. Prepare interior frames for silencers and install.
- F. Attach fire rating label to each fire rated door and frame.

2.5 SHOP FINISHING

- A. Primer: Air dried.
- B. Coat inside of frame profile with bituminous coating.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify opening sizes and tolerances are acceptable.

3.2 INSTALLATION

- A. Install doors and frames in accordance with ANSI A250.8.
- B. Coordinate installation of doors and frames with installation of hardware specified in Section 08 71 00.
- C. Coordinate door frames with masonry & gypsum board construction for frame anchor placement.
- D. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.
- E. Coordinate installation of Glass and Glazing specified in Section 08 80 00 - Glazing.
- F. Adjust door for smooth and balanced door movement.
- G. Tolerances:
 - 1. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.3 SCHEDULE

- A. See Door Schedule on Drawings.

END OF SECTION

SECTION 08 11 16
ALUMINUM THERMAL FLUSH DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum Thermal Flush Doors.
- B. Thermal Aluminum Door Frames

1.02 RELATED SECTIONS

- A. Section 04 27 00: Multi & Single Wythe Masonry Assemblies (Frame Installation)
- B. Section 07 90 00: Joint Protection
- C. Section 08 71 00: Door Hardware
- D. Section 08 80 00: Glazing

1.03 REFERENCES

- A. ASTM B 209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- B. ASTM B 221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- C. ASTM B 308 - Aluminum-Alloy 6061-T6 Standard Structural Profiles.
- D. ASTM E 283 - Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- E. ASTM E 330 - Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- F. ASTM E 331 - Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- G. ASTM E 1886 – Standard Test Method for Performance of Exterior Windows, Curtain Walls, Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
- H. ASTM E 1996 – Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.

- I. ASTM E 90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- J. NFRC 102-2004 – Test Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems.
- K. AAMA 1503-09 – Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections.

1.04 SYSTEM DESCRIPTION

- A. System Performance Requirements:
 - 1. Air infiltration: When tested in accordance with ASTM E 283, the air infiltration should not exceed .04 cfm per square foot of fixed area.
 - 2. Water Penetration: No water will pass through the entry system when tested in accordance with ASTM E 331 at a pressure of 6.24.
 - 3. Sound Transmission Loss: STC rating shall be no lower the 32 when tested in accordance with ASTM E 413. OITC rating shall be 30 when tested in accordance with ASTM E 1332.
 - 4. Thermal Performance: U factor of entry system shall be no more than 0.34 when tested with the CTS Method. The condensation resistance factor (CRF) shall be no less than 75 when tested in accordance with AAMA 1503-09.
 - 5. Uniform Load Deflection: Entry system shall be tested in accordance with ASTM E 330: 3840 Pa or 80.0 psf positive and negative.
 - 6. Uniform Load Structural: Entry system shall be tested in accordance with ASTM E 330: 5760 Pa or 120.0 psf positive and negative.
 - 7. Missile Impact: Entry system will pass double impact from large missile; ASTM E 1886.

1.05 SUBMITTALS

- A. General: Refer to Submittal Procedures – Section 01 00 00.
- B. Product Data: Include manufacturer’s product information, including material, elemental construction, fabrication, and finishes.
- C. Shop Drawings: Include shop drawings relating to dimensions, fabrication, finish and installation.
 - 1. Drawings should include the following:
 - a. Dimensions
 - b. Elevations with necessary detail keys

- c. Entry system reinforcements (if applicable)
- d. Fabrication and Finish

- D. Samples:
 - 1. Color: Provide manufacturer's samples of standard and non-standard finishes.
 - 2. Door: Supply manufacturer's door sample presenting finish, interior insulation, and standard reinforcement components.

- E. Test Results: Offer any required test results for particular jobs. Accredited test reports will be available upon request.

- F. Manufacturer's Instructions: Provide all necessary instructions for installation including glazing, anchoring, reinforcement (if applicable), and optimum performance installation.

1.06 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 - 1. Manufacturing process with contemporary inspection using neoteric checklist for optimum field performance.
 - 2. Manufacturing same product specified for over 30 years.

- B. Pre-Installation Meetings: Plan initial pre-installation meetings for job details and regional regulations.

1.07 DELIVERY, STORAGE, HANDLING

- A. Packing: Finished products shall be packaged securely with appropriate labeling for protection and product identification visible on packaging.

- B. Shipping and Handling: Deliver materials to site in original condition and packaging without any damage to packaging or materials.

- C. Unloading: Individually packaged products to be unloaded by hand truck or 2-person team lift (or more if needed) to avoid unnecessary damage.

- D. Storage and Protection:
 - 1. Store items indoors away from excessive amounts of moisture.
 - 2. Protect entry doors against damage from outdoor hazards and during the entire installation

- E. Waste Management: Refer to contact information apparent on packaging for appropriate recycling opportunities.

1.08 WARRANTY

- A. Warrant doors and frames to be free from defects and premature degradation of finish and door structure.

- B. Warranty period will be ten years from the date of manufacture.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Cross Aluminum Products Inc.,
Address: 1770 Mayflower Rd., Niles, Michigan 49120.
Phone: (800) 806-3667 or (269) 697-8340
Fax: (269) 697-8348
Web: www.crossaluminum.com
Email: door@crossaluminum.com

- B. Substitutions: Permitted.

2.02 THERMAL ALUMINUM FLUSH DOORS

- A. Product: FLT-400 Series with required aluminum frames.
- B. Door Opening Size: refer to drawings
- C. Door Assembly:
 - 1. Door Stile: To be aluminum alloy 6063; temper to be T5 with a minimum 1/8" wall thickness. Stiles to be thermally broken using Technoform I-Strut™ in 2 places.
 - 2. Stile Thickness: To be 1 3/4" thick tubular extrusion.
 - 3. Door Joinery: Joinery shall be 3/8" diameter cadmium tie rods bolted through interlocking stiles. Minimum of 3 tie rods per door (where applicable).
 - 4. Top of Door: To receive added 1/8" reinforcement closer plate adhered to interior wall for door closer hardware.
 - 5. Top/Bottom of Door: To receive 1/8" thick cap for further seal and to trim the top and bottom of door.
- D. Pattern:
 - 1. Inside Door Face Fluted
 - 2. Outside Door Face Fluted
- E. Insulation: Polyisocyanurate Rigid Foam

2.03 MATERIALS & ACCESSORIES

- A. Aluminum:
 - 1. ASTM B 221, alloy and temper to be 6063 T-5 or similar alloy and temper recommended by manufacturer for optimum finish results and consistency.
- B. Internal Reinforcement
 - 1. ASTM B 308, for structural aluminum.

- C. Fasteners
 - 1. Material: Aluminum, 18-8 Stainless Steel, or other non-corrosive materials compatible with items being screw applied.
 - 2. Exposed:
 - a. Type: Fasteners exposed will be Philips flathead fasteners unless provided by other supplier.
 - b. Finish: Fasteners to match appropriate finish on standard doors and frames.
 - 3. Concealed: To be standard according to manufacturer's standards.
- D. Weather stripping:
 - 1. Wool pile:
 - a. Material: Solid Propylene Base with resilient fibers.
 - b. Color: Manufacturer's standard black color.
- E. Glazing:
 - 1. Door Glazing: Interlocking door glazing to be screw fastened and removable from interior with NORSEAL® V710 and/or V740 moisture seal foam tape applied to both interior and exterior sides of door. Exterior glazing to be non-removable.
 - a. Material: To be 1/8" thick extruded channels-6063-T5.
 - b. Color: To match finish of door.
- F. Thermal Bar:
 - 1. Thermal I-Strut™: Mechanically attached to thermally break tubular extrusions.
 - a. Material: To be Polyamide 6.6 with 25% glass fibers.
 - b. Color: Manufacturer's standard black color.

2.04 HARDWARE

- A. Hardware Preparation: To be fabricated at factory according to hardware templates provided.
- B. Hardware Installation: To factory install all applicable and supplied hardware to doors and frames.
- C. Hardware Reinforcement: To provide necessary reinforcement for proper longevity and hardware function; ASTM B 209 and/or ASTM 308.
- D. Hardware types: Refer to Section 08 71 00 – Door Hardware
- E. Hardware Finish: Refer to Section 08 71 00 – Door Hardware.

2.05 FABRICATION

- A. Processes:
 - 1. Job Preparation:
 - a. Preliminary Analysis: Job drawings to indicate door types, sizes, vision lite configuration(s), and finishes.

- b. Fulfill Custom Requirements: Follow through on any specific deviations from standard requirements.
- 2. Assembly:
 - a. Product Operation: Measure, cut, and fabricate required materials for designated job.
 - b. Product Refinement: Smooth rough cut edges.
 - c. Arrangement: Place prepared structural fasteners inside door to conceal from view.
 - d. Reinforcement Preparation: To apply necessary structural and hardware reinforcement in beneficial areas of doors and frames where needed.
- 3. Fitting:
 - a. Placement: Product materials to fit accurately in appropriate locations.
 - b. Alignment: Doors to be in proper alignment with intended elevations.
- B. Tolerances: Doors and/or frame elevations will not deviate from last revised and approved drawings.

2.06 FRAMING SYSTEMS

- A. Framing Members: Manufacturer's standard aluminum extruded profiles with required thickness for load support.
 - 1. Vertical Jamb Sizes: 2"x 4 1/2"
 - 2. Header Sizes: 2" x 4 1/2"
- B. Clips and Reinforcements: Manufacturer's standard high strength aluminum: ASTM B 221 and/or ASTM B 308.
- C. Fasteners and Accessories: Manufacturer's standard non-bleeding and non-corrosive material congruent to adjacent material.
 - 1. Exposed Fasteners: To be stainless steel Philips flathead screws with appropriate finish: ASME B 18.6.4
 - 2. Concealed Fasteners: To be manufacturer's standard.
- D. Assembly:
 - 1. Framing members are separate aluminum pieces cut to length and mechanically fastened from either spline or clip systems.
 - 2. Joinery to be hairline.
 - 3. Sommer and Maca Dymonic or Dow Corning® 795 Sealants applied on applicable areas.
 - 4. Framing elevations to be identified according to final approved drawings.
- E. Anchoring:
 - 1. Appropriate anchoring fasteners to be secured no more than 18" apart on entire frame opening.
 - 2. Frame headers to receive no less than 2 anchoring fasteners.

3. Add extra fasteners where hardware and hinge may require more.

F. Doorstop:

1. To be #CDM-32.
 - a. Wall Thickness: To be 3/16" thick for receiving applicable hardware.
 - b. Profile Height: To be no less than 5/8" high.
2. Snap-in: Fits standard manufacturer's door jamb profiles.
3. To receive weather strip around acting door leafs.
 - a. Wool pile: Solid Propylene Base with resilient fibers in a standard black color.

G. Hardware Preparation:

1. Intramural Work: Hardware preparation according to hardware suppliers' templates.
2. Field Work: Refer to manufacturers' installation instructions.

2.07 GLAZING

A. Reference section Glazing accessories (08 80 00)

B. Door Glass Stops:

1. Profile: 1/8" thick interlocking flush fit screw-applied extruded aluminum-stops with color matching door finish and removable from interior. Exterior glass stops to be non-removable.
2. Standard vision lite sizes at FLT-400-NG: 8" x 32"
3. Full Glass Vision lite at FLT-400-FG: 8" Jamb stiles; 8" top rail; 12" bottom rail.

2.09 FINISHES

A. Anodic Finishes:

1. Medium Bronze: Architectural Class 1, AA-M12C22A44, 0.7 mils.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine conditions for compliance with requirements for installation tolerances and other conditions affecting proper installation.

3.02 INSTALLATION

- A. Comply with manufacturer's instructions.
- B. Do not install damaged components.
- C. Install doors plumb, level, and square, with no warp or rack in frame.
- D. Hang doors with the following required clearances:

1. Lock Stiles: 0.125"
 2. Between Meeting Stiles: 0.187"- 0.250"
 3. At Top Rails: 0.125"
 4. Between Bottom Rail and Threshold: 0.125" - 0.187"
- E. Fit joints to produce hairline joints free of burrs and distortion.
- F. Rigidly secure non movement joints.
- G. Install recommended anchors with separators to prevent metal corrosion and electrolytic deterioration.
- H. Seal joints watertight, unless otherwise indicated.
- I. Glazers to provide necessary glazing shims for proper glass installation on vision lites and side lites. Reference section Glazing Accessories (08 80 00).
- J. Place thresholds in proper weather sealant.

3.03 ADJUSTING

- A. Fine-tune doors and hinges to operate properly without bind or sag.
- B. Adjust pressure settings on closers.
1. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch measured to the leading door edge.

3.04 CLEANING

- A. Immediately clean doors after installation.
- B. Avoid any harsh cleaners not specified on manufacturer's cleaning and care guide.

3.05 PROTECTION

- A. Follow Manufacturer's guide to cleaning and care for proper treatment on entrances for optimum longevity, function, and performance.

3.06 SCHEDULE

- A. See Door Schedule on Drawings.

END OF SECTION

SECTION 08 14 10

INTERIOR WOOD DOORS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Flush wood doors, non-rated.
 - 2. Door glazing.

1.2 SUBMITTALS

- A. Product Data:
 - 1. Submit data for door core materials and construction.
- B. Shop Drawings:
 - 1. Indicate door elevations and hardware preparation.
 - 2. Indicate cutouts for glazing.
- C. Samples:
 - 1. Submit two samples of door veneer, in size illustrating wood grain, veneer pattern veneer joints, color, and finish.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with AWI AWS Section 9, Premium Grade.
- B. Perform Work in accordance with the 2015 Michigan Building Code.

1.4 WARRANTY

- A. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.
- B. Interior Doors:
 - 1. Factory Finished Doors: Furnish manufacturer's standard warranty.

PART 2 PRODUCTS

2.1 WOOD DOORS

- A. Manufacturer and Product List:
 - 1. Eggers Industries/VT Industries.

2. Marshfield Door Systems Inc.
 3. Mohawk Flush Doors, Inc.
 4. Substitutions permitted.
- B. Flush Interior Doors: Solid core.
1. Thickness: 1-3/4 inches.
 2. Core: PC and FD.
 3. Face Construction: five ply.
 4. Performance Duty Level: Extra heavy duty.
 5. Quality Grade: Premium.
- C. Performance / Design Criteria:
1. Performance Duty Level: WDMA I.S. 1A.
 2. Sound Transmission Resistance: ASTM E413; minimum STC 35 for door and frame assemblies indicated as acoustically rated.

2.2 MATERIALS

- A. Door Cores: AWI AWS Section 9.
1. Solid Core, Non-Fire Rated:
 - a. Type: PC; particleboard.
- B. Interior Door Faces:
1. Transparent Finished Faces: Wood veneer.
 - a. Species: Red oak.
 - b. Veneer Cut: Plain sliced.
 - c. Veneer Matching: Book matched.
- C. Hardboard: ANSI A135.4; type as specified for door faces; 1/8 inch (3 mm) thick.
- D. Facing Adhesive: Type II - water resistant.

2.3 FABRICATION

- A. Fabricate doors in accordance with AWI AWS Section 9 requirements.
- B. Furnish lock blocks at lock edge and top of door for closer for hardware reinforcement.
- C. Vertical Exposed Edge of Stiles: Wood veneer matching door facing.
- D. Factory machine doors for finish hardware.
- E. Factory fit doors for frame opening dimensions identified on shop drawings.
- F. Provide edge clearances in accordance with AWI AWS Section 9.

2.4 FINISH

- A. Finish work in accordance with AWI AWS Section 5; Premium Grade.

- B. Transparent Finish System: Clear, color; sheen as selected.
 - 1. System 11; catalyzed polyurethane.
- C. Seal door top edge with color sealer to match door facing.
- D. Color: Graham Clear Finish Color (No Stain) as approved by Owner and Architect.

2.5 ACCESSORIES

- A. Door Glazing:
 - 1. Glass: As specified in Section 08 80 00.
 - 2. Glazing Stops: Wood, of same species as door facing for non-rated doors.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install doors in accordance with AWI AWS Section 9 and manufacturer's instructions.
- B. Coordinate installation of doors with installation of metal frames specified in Section 08 11 13 and hardware specified in Section 08 71 00. Glass specified in Section 08 80 00.
- C. Adjust door for smooth and balanced door movement.
- D. Coordinate installation of glass and glazing specified in Section 08 80 00.

3.2 TOLERANCES

- A. Conform to AWI AWS Section 9 requirements for the following:
 - 1. Fit and clearance tolerances.
 - 2. Gaps.
 - 3. Flushness.
 - 4. Flatness.
 - 5. Squareness.
- B. Maximum Diagonal Distortion (Warp): 1/8 inch (3 mm) measured with straight edge or taut string, corner to corner, over imaginary 36 x 84 inches (915 X 2 130 mm) surface area.
- C. Maximum Vertical Distortion (Bow): 1/8 inch (3 mm) measured with straight edge or taut string, top to bottom, over imaginary 36 x 84 inches (915 X 2 130 mm) surface area.
- D. Maximum Width Distortion (Cup): 1/8 inch (3 mm) measured with straight edge or taut string, edge to edge, over imaginary 36 x 84 inches (915 X 2 130 mm) surface area.

3.3 SCHEDULE

- A. Refer to Door and Frame Schedule on drawing sheet A-900.

SECTION 08 32 13

SLIDING ALUMINUM-FRAMED GLASS DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes Heavy Commercial (HC) performance grade sliding aluminum-framed glass doors, including factory glazing, operating hardware and accessories designed for exterior applications.
 - 1. Types of sliding aluminum-framed glass doors include:
 - a. Kawneer Series HPS Sliding Door
 - b. SGD-HC100
- B. Related Sections:
 - 1. Division 07 90 00 "Joint Protection" for joint sealants installed as part of the aluminum sliding door system
 - 2. Division 08 51 13 "Aluminum Windows"
 - 3. Division 08 71 00 "Door Hardware"
 - 4. Division 08 80 00 "Glazing"

1.3 DEFINITIONS

- A. Performance class designations according to:
 - ANSI/AAMA 101-88:
 - SGD-HC: Sliding Glass Door Heavy Commercial
- B. Performance grade number according to ANSI/AAMA 101-88:
 - 1. Design pressure number in pounds force per square foot used to determine the structural test pressure and water test pressure.
- C. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.
- D. Minimum Test Size: Smallest gateway test size permitted for performance class. Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide sliding aluminum-framed glass doors capable of complying with performance requirements indicated, based on testing manufacturer's sliding doors that are representative of those specified, and that are of minimum test size indicated below:
 - 1. Size required by ANSI/AAMA 101-88 for minimum gateway performance.
 - 2. Test size per configuration:
 - OX or XO: 114-1/4" x 94" (2902 mm x 2388 mm)
- B. Structural Performance: Provide sliding aluminum-framed glass doors capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass ANSI/AAMA101-88 Uniform Load Structural Test:

1. Design Wind Loads: Determine design wind loads applicable to the Project from basic wind speed indicated in miles per hour, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
 - a. Basic Wind Speed (MPH): 90
 - b. Importance Factor: 1.15 for Occuoancy Category IV.
 - c. Exposure Category: B

1.5 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, and fabrication methods, dimensions of individual components and profiles, hardware, finishes, and installation instructions for each type of sliding aluminum-framed glass door indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.
- C. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.
- D. Samples for Verification: For sliding aluminum-framed glass door and components required.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type, class, grade, and size of sliding aluminum-framed glass doors. Test results based on use of downsized test units will not be accepted.
- F. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.
- B. Manufacturer Qualifications: A manufacturer capable of fabricating sliding aluminum-framed glass doors that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.
- C. Source Limitations: Obtain sliding aluminum-framed glass door through one source from a single manufacturer.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of sliding aluminum-framed glass doors and are based on the specific system indicated. Refer to Division 01 Section 01 00 00 "General Requirements." Do not modify size and dimensional requirements.
 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- E. Fenestration Standard: Comply with, ANSI/AAMA 101-88 for windows, doors, and skylights for definitions and minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
- F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "General Requirements".

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of sliding aluminum-framed glass door openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

1.8 WARRANTY

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.

1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product:
 1. Kawneer Company Inc.
 2. NX-840 Sliding Glass Doors
 3. 4-5/8" sill frame depth
 4. SGD-HC-100
- B. Subject to compliance with requirements, provide a comparable product by the following:
 1. Manufacturer: Tubelite; EFCO; Wausau Metals.
- C. Substitutions: Permitted.

2.2 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by sliding aluminum-framed glass door manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" wall thickness at any location for the main frame and sash members.
- B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with sliding aluminum-framed glass door members, trim hardware, anchors, and other components.
- C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- E. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
 1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semi-rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
- F. Sealant: For sealants required within fabricated sliding door, provide sliding door manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

2.3 SLIDING DOOR

- A. Performance Requirements: Provide sliding aluminum-framed glass doors of performance indicated that comply with
ANSI/AAMA 101-88:
 1. Performance Class and Grade: SGD-HC-100
- B. Air Leakage Resistance: Maximum rate not more than indicated when tested according to, ANSI/AAMA 101-88 Air Infiltration Test.
 1. Maximum Rate: 0.30 cfm/sq. ft. (1.5 L/s•m²) of area at an inward test pressure of 6.24 psf (300 Pa) in accordance with ASTM E283.

- C. Water Penetration Resistance: No water leakage as defined in ANSI/AAMA 101-88 referenced test methods at a water test pressure equaling that indicated, when tested according to ASTM E547 and ASTM E331.
 - 1. Test Pressure: 15 percent of positive design pressure, but not more than 12 psf (574 Pa).
- D. Forced-Entry Resistance: Comply with Performance Grade 10 requirements when tested according to AAMA 1303.5.
- E. Deglazing Force: When tested in accordance with ASTM E 987, the panel shall not move from their original position, in relation to the glazing materials, by more than the original glass bite.
- F. Operating Force Tests: With each movable panel adjusted, the maximum force to open shall not exceed 40 lbs and the force to keep in motion shall not exceed 25 lbs.

2.4 GLAZING

- A. Glass and Glazing System: Refer to Division 08 Section 08 80 00 "Glazing" for glass units and glazing requirements applicable to glazed sliding aluminum- framed glass doors units.
- B. Glass: Comply with Division 08 Section 08 80 00 "Glazing" for requirements applicable to safety glazing, insulating-glass units, and laminated glass units.
- C. Glazing System: Glazing method shall be a channel type PVC gasket (marine glazed) which is compatible with aluminum and shall be resistant to deterioration by all forms of weathering and suitably retained to maintain a watertight seal between the glass and the surrounding frame.

2.5 HARDWARE

- A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock sliding aluminum-framed glass doors.
- B. Standard Hardware:
 - 1. One pair of stainless steel tandem rollers per sliding panel.
 - 2. Stainless steel roller track.
 - 3. Adams Rite 1847 Stainless Steel Deadlock.
 - 4. Extruded pull handle exterior.

2.6 INSECT SCREENS

- A. General: Design sliding aluminum-framed glass doors and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with door frame. Locate screens on the exterior side of door and provide for each operable sliding door panel.
 - 1. Comply with SMA 1004 for minimum standards of appearance, fabrication, attachment of screen fabric, hardware, and accessories unless more stringent requirements are indicated
- B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners and removable PVC spline.
 - 1. Extruded-Aluminum or Aluminum Tubular Framing Sections and Cross Braces: Not less than 0.062-inch (1.6-mm) typical wall thickness.
 - 2. Finish: Manufacturer's standard.
- C. Glass-Fiber Mesh Fabric: 18-by-16 mesh/inch (18-by-16 mesh/25.4mm) of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration; in the following color. Comply with ASTM D 3656.
 - 1. Mesh Color: Charcoal Grey.

- D. Hardware: Manufactures standard flush pull, adjustable stainless steel or steel rollers and continuous EPDM closure strip at jamb.

2.7 FABRICATION

- A. Fabricate sliding aluminum-framed glass doors in sizes indicated. Include a complete system for assembling components and anchoring doors.
- B. Fabricate sliding aluminum-framed glass doors that are reglazable without dismantling perimeter framing.
 - 1. Master Frame: Joined together with butt type joints, neatly sealed and assembled by a minimum of 2 stainless steel fasteners per joint anchored into continuous integral screw raceways.
 - 2. Sliding Panels: Shall have coped butt type joinery secured by means of 2 stainless steel fasteners per joint. Sliding panels shall not be removable when in a locked position
 - 3. Fixed Panels: Shall have coped butt type joinery secured by means of 2 stainless steel fasteners per joint.
- C. Weather Stripping: Provide weather stripping locked into extruded grooves in door panels or frames as indicated on manufactures drawings and details.
- D. Weep Holes: Provide weep holes and internal drainage passages to conduct infiltrating water to exterior as detailed.
- E. Factory-Glazed Fabrication: Glaze sliding aluminum-framed glass doors in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440.

2.8 FINISHES, GENERAL

- A. Comply with AAMA-AFPA "Anodic Finishes/Painted Aluminum" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Factory Finishing:
 - 1. Kawneer Permanodic[®] AA-M12C22A44, AAMA 611, Architectural Class I Color Anodic Coating. Color as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight sliding door installation.
 - 1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
 - 2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing sliding doors, hardware, accessories, and other components.
- B. Install sliding doors level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.
- D. Install sliding doors and components to drain condensation, water penetrating joints, and moisture migrating within sliding door to the exterior.
- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weather tight closure. Lubricate hardware and moving parts.
- B. Clean aluminum surfaces immediately after installing sliding doors. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- C. Clean factory-glazed glass immediately after installing sliding doors. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- E. Protect sliding door surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, mortar, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

3.4 DEMONSTRATION

- A. Engage a manufacturer's technical support service representative to train Owner's maintenance personnel to adjust, operate, and maintain sliding door operating system.

END OF SECTION

SECTION 083500 – ELECTRIC FOUR FOLD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Electric four fold doors for exterior locations.
 - 2. Door operators and controls for four fold doors and overhead doors.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For electric four fold doors showing all work to be provided, including dimensions, detail, anchors, and complete details, and wiring diagrams for electric operators and controls.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification data.
- B. Product test reports.
- C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Door Engineering and Manufacturing Company, model “FF300 Series”.
- B. Comparable product by approval per Section 012500 “Substitutions Procedures” and Architect’s approval.

2.2 PERFORMANCE REQUIREMENTS

- A. Door construction, including tracks, guides, windlocks and other accessories, shall be of sufficient rigidity and design as to withstand a wind pressure of 20 p.s.f., uniformly applied from either side of door, when door is in fully closed position.
- B. The Maximum allowable deflection shall not exceed 1/120 of the span. Fiber stress in main members shall be limited to 27,000 pounds per square inch. Steel frames shall be designed in accordance with AISC "Steel Construction Manual".

2.3 MATERIALS

- A. Steel Sheet: ASTM A366/366M cold-rolled steel sheet or A569/A569M hot-rolled steel sheet.
- B. Structural Steel: Conforming to ASTM A36/A36M.
- C. Fasteners: Zinc-coated steel.
- D. Prime Paint: Manufacturer's standard paint.

2.4 CONSTRUCTION

- A. Door frame shall be 11 gauge structural steel tube with 16 gauge sheet steel on the exterior and interior faces. Sheeting shall be formed on the vertical edges with no visible welds on the interior or exterior panel faces. All frames and framing members shall be true to dimension and square in all directions, and doors shall not be bowed, warped or out of line in the vertical or horizontal plane of the door opening by more than 1/8 inch in 20 feet. Grind exposed welds smooth and flush.
- B. Insulation shall be manufacturer's standard polyisocyanurate.
- C. Door finish shall be manufacturer's standard factor applied gray oxide primer.

2.5 HARDWARE

- A. Include guide tracks and brackets, trolleys center guides, not less than three pairs of jamb and fold hinges per opening, and all bolts, nuts, and fasteners necessary for a complete installation.
- B. Jamb hinges shall be dual shear and have two thrust bearings and two needle bearings. Fold hinges shall be dual shear with two thrust bearings. All bearings shall be completely concealed within the hinge barrel. All hinge pins shall be minimum 3/4 inch diameter hardened steel. All trolleys to be equipped with nylon, bronze or ball bearing rollers.
- C. Door weatherstripping shall be adjustable and readily replaceable and provide a weathertight installation. Weatherstripping at center and bottom shall be 1/16 inch cloth inserted neoprene and continuously retained.
- D. Perimeter weatherstripping as jambs and head shall be 1/16 inch cloth inserted neoprene bulb.

2.6 GLAZING

- A. Glass and Glazing: 3/4 inch (19-mm) clear in shape and size as indicated on drawings.
 - 1. Glass: ASTM C 1036, Type 1, q3, Category II safety glass complying with testing requirements in 16 CFR 1201.
 - 2. Safety Glazing Labeling: Permanently mark safety glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
 - 3. Insulating-Glass Units: ASTM E 2190.
 - a. Filling: Fill space between glass lites with air.

2.7 DOOR OPERATORS AND CONTROLS

- A. Each door shall be operated by an overhead mounted electro-mechanical drive unit design for high-cycle operation. Operator shall consist of an electric motor, gear reducer and rotating drive arm. The door shall be operated with connecting rods attached to the rotating drive arm on the operator and to control arms attached to the jamb door section and to the door lintel. The connecting rods shall be fitted with spherical bearings and control arms shall be equipped with oil impregnated bronze bearings on polished shafts.
- B. Operator shall be instantly reversible, open and close rapidly and start and stop gradually. Operator shall be adjustable to allow door to fully clear the opening. Operator shall automatically lock the door in the closed position. Operator shall be equipped with disengaging mechanism to convert to free-wheeling mode for manual operation.
- C. Electric motor shall be sufficient size to operate doors under normal operating conditions at no more than 75 percent of rated capacity. The motor shall be wound for three phase 208/260/480 VAC, 60 hertz operation.
- D. Electric controls shall be furnished by the door manufacturer, built in accordance with NEMA Standards. Control circuits shall not exceed a nominal 110 volts.
 - 1. Controls shall include a self diagnostic programmable logic controller with digital message display and input LEDs. Controller shall include programmable close time delays and maximum open and close run timers.
 - 2. Motor starters shall be magnetic reversing, factory wired with overload and under voltage protection, and equipped with mechanical interlocks. All control components shall be enclosed in one enclosure with a wiring diagram placed on the inside of the cover.
 - 3. Enclosures shall be NEMA 4 with disconnect switch.
 - 4. Each four fold door and overhead door shall include a pushbutton station with one momentary pressure three button station marked "OPEN", "CLOSE", and "STOP". Pushbutton enclosure shall be NEMA 4.
 - 5. Limit switches shall be proved to stop the travel of the door in its fully open or fully closed position.

- E. Electric safety edges shall be provided on the leading edge of all doors to reverse door upon contact with obstruction.
- F. One interior and one exterior mounted photo eye (sender/receiver type) with mounting brackets shall be provided. Photo eyes shall be NEMA 4.
- G. "Open" and "safety" loop detectors, Model #610 detector with Model #865 preformed loop by Marsh Products, shall be provided for each four fold door and overhead door opening. Detector shall be powered through respective four fold door controller and signal a hold-open condition when activated. Control panel shall have an Auto/Manual switch for activating and deactivating the "open" loop function for each door.
- H. Radio receiver and (2) 2-button (2-channel) remote control transmitters shall be provided for each door. Each receiver to have dedicated frequency operation and each transmitter to have 2-button, 2-frequency capability for control of opposing apparatus bay doors. Radio operators shall be capable of operating doors from truck cab 150 feet from doors. Provide special antenna length, location or operator power as required to operate doors from this distance.
- I. Installer is responsible for installation and wiring of all detection loops, radio receivers (and respective antennae), and push button stations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing doors, hardware, accessories, and other components.
- B. Install folding doors level, plumb, square, true to line, without distortion, without warp or rack of frames and panels, and without impeding thermal movement; anchored securely in place to structural support. All moving parts to be tested and adjusted to provide smooth operating and weathertight condition.
- C. Install controls, wiring, and other related electrical work required for four fold and overhead doors.
- D. Coordinate installation of detector loops for all openings with all trades to insure proper placement prior to concrete pour and installation of building components.
- E. Demonstrate operations and maintenance, including radio control distance compliance to Owner's personnel.

END OF SECTION 083500

SECTION 08 51 13

ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes Kawneer Architectural Aluminum Windows including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of window units.
 - 1. Types of aluminum windows include:
 - a. Kawneer Series 8225TL ISOLOCK™ (Thermally Broken)
 - b. Outswing Casement Windows
 - c. 2-1/4" (57.2 mm) frame depth
 - d. C-AW90
- B. Related Sections:
 - 1. Division 07 90 00 "Joint Protection" for joint sealants installed as part of the window system.
 - 2. Division 08 32 13 "Sliding Aluminum-Framed Glass Doors"

1.3 DEFINITIONS

- A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufacturers Association (AAMA) – AAMA Glossary (AAMA AG).

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Aluminum-framed window system shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Design Wind Loads: Determine design wind loads applicable to the Project from basic wind speed indicated in miles per hour, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
 - a. Basic Wind Speed (MPH): 90
 - b. Importance Factor: 1.15 for Occupancy Category IV.
 - c. Exposure Category: B
- B. Window Performance Requirements:
 - 1. Performance Requirements: Provide aluminum windows of performance indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS)
 - a. Performance Class and Grade: C-AW90
 - 2. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283 at a minimum window size of 36" x 60" (91.44 x 152.4 mm). The air infiltration rate shall not exceed 0.10 cfm/ft at a static air pressure differential of 6.24 psf (300 Pa).

3. Water Resistance: The test specimen shall be tested in accordance with ASTM E 547 and ASTM E 331 at a minimum window size of 36" x 60" (91.44 x 152.4 mm). There shall be no leakage as defined in the test method at a static air pressure differential of 12 psf (574 Pa).
4. Uniform Load Deflection: A minimum static air pressure difference of 90 psf (4310 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member.
5. Uniform Load Structural Test: A minimum static air pressure difference of 135 psf (6465 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. The unit shall be evaluated after each load.
6. Component Testing: Window components shall be tested in accordance with procedures described in AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS).
7. Condensation Resistance Test (CRF): When tested in accordance with AAMA 1503, the condensation resistance factor (CRF) shall not be less than:
 - a. Outswing Casement: (CRF_f) frame not less than 56 with clear glass.
Outswing Casement: (CRF_g) glass not less than 55 with clear glass.
8. Thermal Transmittance Test (U-Factor): When tested in accordance with AAMA 1503, the conductive thermal transmittance (U-Factor) shall not be more than:
 - a. Outswing Casement: U-Factor not more than .60 BTU/hr/sf/°F per AAMA 507 or NFRC100 when using project specified glass.
9. Forced Entry Resistance: All windows shall conform to ASTM F588, Grade 10.
10. Thermal Barrier Tests: Testing shall be in general accordance with AAMA 505 Dry Shrinkage and Composite Thermal Cycling test procedure, AAMA TIR-A8, Structural Performance of Composite Thermal Barrier systems.

1.5 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances and installation details.
- C. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.
- D. Samples for Verification: For aluminum windows and components required.
- E. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type, class, grade, and size of aluminum window. Test results based on use of downsized test units will not be accepted.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An installer which has had successful experiences with installation of the same or similar units required for this project and other projects of similar size and scope.

- B. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.
- C. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum windows and are based on the specific system indicated. Refer to Division 01 Section "General Requirements." Do not modify size and dimensional requirements.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "General Requirements."

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.
 - 1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.
- B. Insulating Glass: Warranted to be free from defects (excluding breakage) for a period of five (5) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product:
 - 1. Kawneer Company Inc.
 - 2. Series 8225TL ISOLOCK™ (Thermally Broken) Outswing Casement Windows
 - 3. 2-1/4" (57.2 mm) frame depth
 - 4. C-AW90
- B. Subject to compliance with requirements, provide a comparable product by the following:
 - 1. Manufacturers: Tubelite; EFCO; Wausau Metals.
- C. Substitutions: Refer to Substitutions Section for procedures and submission requirements.
 - 1. Pre-Contract (Bidding Period) Substitutions: In accordance with Section 01 00 00 – General Requirements..
 - 2. Post-Contract (Construction Period) Substitutions: Submit written request in order to avoid window installation and construction delays.
 - 3. Product Literature and Drawings: Submit product literature and drawings modified to suit specific project requirements and job conditions.
 - 4. Certificates: Submit certificate(s) certifying substitute manufacturer (1) attesting to adherence to specification requirements for window system performance criteria, and (2) has been engaged in

the design, manufacturer and fabrication of aluminum windows for a period of not less than ten (10) years. (Company Name)

5. Test Reports: Submit test reports verifying compliance with each test requirement required by the project.
 6. Samples: Provide samples of typical product sections and finish samples in manufacturer's standard sizes.
- D. Substitution Acceptance: Acceptance will be in written form, either as an addendum or modification, and documented by a formal change order signed by the Owner and Contractor.

2.2 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.090" (2.3 mm) wall thickness at any location for the main frame and sash members.
- B. Thermal Barrier: The thermal barrier shall be Kawneer ISOLOCK™ with a nominal 3/8" (9.5 mm) separation consisting of a two-part, chemically curing high density polyurethane which is mechanically and adhesively bonded to the aluminum.
- C. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.
- D. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
- E. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
- F. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

2.3 WINDOW SYSTEM

- A. Series 8225TL ISOLOCK™ (Thermally Broken) Outswing Casement Windows

2.4 GLAZING

- A. Glass and Glazing Materials: Refer to Division 08 Section 08 80 00 "Glazing" for glass units and glazing requirements applicable to glazed aluminum window units.
- B. Glazing System: Glazing method shall be a wet/dry type in accordance with manufacturer's standards. Exterior glazing shall be silicone back bedding sealant. Interior glazing shall be snap-in type .062" (1.57 mm) glazing beads with an interior gasket in accordance with AAMA 702 or ASTM C864.

2.5 HARDWARE

- A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows, and sized to accommodate sash weight and dimensions.
- B. Casement Window Typical Hardware:

1. Locking:
 - a. Roto-Operator
 - b. Multipoint Lock
 2. Hinging:
 - a. Butt Hinges
 - b. Friction Adjusters
 - c. Limit Stop
- C. Exterior Panning and Trims: Extruded aluminum, 6063-T6 alloy and temper, extruded to profiles and details indicated. Seal exterior joints with manufacturer's standard sealant to assure water-tight joints.
1. Exterior Panning and Trims: All panning profiles shall be a minimum thickness of 0.062" (1.57 mm) to match the profiles as shown the drawings. Any profile variations shall be submitted to the architect and/or owner for approval 10 days prior to bid date. All panning shall be factory fabricated for field assembly. All corner joinery shall be factory cut. Joinery at the sill shall be coped and butt-type construction. All preparations for assembly shall be completed by the window manufacturer. Upon assembly, panning frame joints shall be back-sealed to prevent moisture penetration. Include Head Receptor; Jamb Receptor; and Sill, as indicated on drawings.

2.6 ACCESSORIES

- A. Insect Screens: Extruded aluminum frames, 6063-T6 alloy and temper, joined at corners: 18 x 16 mesh aluminum screen cloth; frames finished to match aluminum windows; splines shall be extruded vinyl, removable to permit rescreening.

2.7 FABRICATION

- A. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
 1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fit joints; make joints flush, hairline and weatherproof.
 3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
 4. Physical and thermal isolation of glazing from framing members.
 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 6. Provisions for field replacement of glazing.
 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- B. Window Frame Joinery: Screw-Spline, Factory sealed frame and vent corner Joints
- C. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
- D. Fabricate aluminum windows that are re-glazable without dismantling sash or framing.
- E. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

- F. Sub frames: Provide sub frames with anchors for window units as shown, of profile and dimensions indicated but not less than 0.093" (2.4 mm) thick extruded aluminum. Miter or cope corners, and join with concealed mechanical joint fasteners. Finish to match window units. Provide sub frames capable of withstanding design loads of window units.
- G. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS).
- H. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match frame.

2.8 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Factory Finishing:
 - 1. Kawneer Permanodic™ AA-M10C22A44, AAMA 611, Architectural Class I Color Anodic Coating Color as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight window installation.
 - 1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
 - 2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
- B. Install aluminum framed window system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.
- D. Install aluminum framed window system and components to drain condensation, water penetrating joints, and moisture migrating within system to the exterior.
- E. Separate aluminum from dissimilar materials to prevent corrosion or electrolytic action at points of contact.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
 1. Testing Methodology: Testing Standard shall be per AAMA 502 including reference to ASTM E 783 for Air Infiltration Test and ASTM E 1105 for Water Penetration Test.
 - a. Air Infiltration Test: Conduct test in accordance with ASTM E 783 at a minimum uniform static test pressure of 1.57 psf (75 Pa) for CW or 6.24 psf (300 Pa) for AW. The maximum allowable rates of air leakage for field testing shall not exceed 1.5 times the project specifications.
 - b. Water Infiltration Test: Water penetration resistance tests shall be conducted in accordance with ASTM E 1105 at a static test pressure equal to 2/3 the specified water test pressure.
 2. Testing Extent: Architect shall select window units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present.
 3. Test Reports: Shall be prepared according to AAMA 502.

3.4 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weather tight closure. Lubricate hardware and moving parts.
- B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- C. Clean glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- E. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART I - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. The extent of finish hardware is indicated on the drawings and in schedules.
- B. Related Work Specified in Other Sections:
 - 1. Aluminum Doors
 - 2. Sliding Aluminum Framed Glass Door
 - 3. Adjustable Shelving Supports
 - 4. Drawer Slides
 - 5. Access Panels
- C. The Finish Hardware Supplier shall make a survey of all drawings and specifications, and any item of finish hardware not specifically mentioned in the "Finish Hardware Groups" but required for completion of the work shall be provided under this Section without additional cost to the Owner. Such items shall be of type suitable for service required and of equal quality to hardware for similar service.
- D. Where the type of hardware specified is not adaptable to the finished size of members requiring hardware, submit an item having a similar operation and quality to the Architect for review.
- E. The contractor shall obtain all information required as to details, sizes, thickness, shapes, and bevel of doors and other items requiring hardware from subcontractor furnishing same or from the Architect. Should any openings require hardware not listed in this specification, the contractor shall consult Architect for specifications.

1.3 QUALITY ASSURANCE

- A. Supplier
 - 1. A recognized architectural finish hardware supplier, with warehousing facilities, who has been furnishing hardware in the project's vicinity for a period of not less than 2 years, and who is, or who employs an experienced architectural hardware consultant

who is available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to Owner, Architect and Contractor.

2. The hardware supplier must be able to show evidence of past experience furnishing and servicing detention hardware.

B. Service

1. The hardware supplier shall have at least one builder's hardware contract man on the staff to service the work to be done. He shall be available on short notice if his services are required. When project is turned over to the Owner, all parts shall be in perfect order.
2. Contractor shall have the factory representative inspect and properly adjust each door closer, lock and exit device at completion of building.
3. At the time of final inspection of building, furnish the Owner with two complete sets of installation instructions, service manuals, maintenance helps, special wrenches or keys required to keep hardware in perfect adjustment. This material shall be in two separate packets - one for the Owner's files and one for the Owner's maintenance staff.

C. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA Standard No. 80 and local building code requirements. Provide only hardware which has been tested and listed by UL or FM for types and sizes of doors required and complies with requirements of door and door frame labels.

1. Where emergency exit devices are required on fire-rated doors (with supplementary marking on doors' UL or FM labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL or FM label on exit devices indicating "Fire Exit Hardware".

D. Furnish all finish hardware to comply with the requirements of all laws, codes, ordinances and regulations of the governmental authorities having jurisdiction where such requirements exceed the requirements of the Specifications. Comply with the requirements of the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and the State of Michigan Construction Code Act Barrier Free Design Law.

E. Hardware to hazardous areas shall comply with the requirements of the regulations for public building accommodations for physically handicapped persons of the governmental authority having jurisdiction.

F. Contract Document Review Log

1. The Contractor's Field Superintendent shall review the requirements of the Contract Documents with each subcontractor's foreman or workman that comes to the job site for the first time. This review shall include a paragraph-by-paragraph joint reading of the appropriate specification section. The Superintendent shall keep a log of this review with the date and initials of both the Superintendent and foreman or workman.

This log shall be subject to the Architect's review upon request and failure to comply may be cause for adjustment to the Application for Payment.

1.4 SUBMITTALS

- A. **Manufacturer's Literature:** Furnish to Architect, when required, copies of manufacturer's specifications, maintenance and keying manuals and installation instructions (templates to suit each particular installation), for each item of finish hardware. Include photographs, catalog cuts, marked templates and other data as may be required to show compliance with these specifications.
- B. **Finish and Color:** Submit to the Architect, when requested, prior to the submission of finish hardware, item finish samples. Architect's review and selection shall be for color and texture only of surface finish. Compliance with all other requirements is the exclusive responsibility of the Contractor.
- C. **Samples:** If requested by the Architect, a sample of each hardware item, properly marked and tagged for identification shall be submitted for review.
 - 1. After final review, deliver samples to job site for comparison with hardware delivered for installation. Unblemished samples may be used in the work.
- D. **Finish Hardware Schedule:** Submit to the Architect for review, copies of finish hardware schedule covering complete identification of all items required for the project. Include manufacturer's names and identification of finishes. Include a separate schedule of key and master-key system with final submittal of schedule. Architect's review and approval of schedules shall neither be construed as a complete check nor shall it relieve the supplier of responsibility for errors, deviations or omissions from requirement to provide complete hardware for project.
- E. Schedules of hardware shall include a preface sheet showing category only on manufacturers' names of all items to be furnished in the following format:

<u>Category</u>	<u>Specified</u>	<u>Scheduled</u>
Hinges	Manufacturer A	Manufacturer B
Locksets	Manufacturer X	Manufacturer X
Kick Plates	Manufacturer Z	Manufacturer Z

- 1. Door description shall include single or pair, number, location, hand, active leaf, degree of swing, size, material, frame material and UL listing mark.
- 2. Hardware description shall include quantity, category, catalog number, fasteners and finish.
- 3. Supplier's scheduling sequence shall be in duplication of that shown in Hardware Groups. Furnish "Vertical" scheduling format only.
- 4. Each heading number in supplier's schedule shall include a reference to Architect's Hardware Group Number.

5. The scheduling format and sequence of schedule shall comply with recommendations of the American Society of Architectural Hardware Consultants.
 6. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordinated review of hardware schedule.
- F. Catalog Cuts
1. Provide in booklet form using Supplier's schedule covers as binders four copies of catalog pages of all pieces of hardware listed in Supplier's Schedule that are other than those shown in the Specification.
 2. Submit Catalog Booklets concurrently with copies of Hardware Schedule.
 3. Review of Hardware Schedule will not begin until Catalog Booklets have been received. At least one copy of Catalog Booklet will be stamped and returned.
- G. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check shop drawings of such other work, to confirm that adequate provisions are made for proper location and installation of hardware.

1.5 PRODUCT HANDLING

- A. Package each item of Finish Hardware complete with all screws, bolts, expansion shields, anchors and other fasteners, installation instructions, templates and special adjusting keys or wrenches required for installation. Mark door location and Finish Hardware Schedule Item number on each Package.
- B. Delivery of Materials
1. Deliver Hardware to the job site unless otherwise directed. Hardware shall be delivered in their original containers and each item clearly marked so as to agree with Hardware Schedule showing the designated locations. A packing list shall accompany each shipment using item numbers that conform with the approved schedule.
 2. The Contractors receiving hardware from this supplier shall sign receipt for same and any subsequent loss and/or missing articles of hardware shall then become the responsibility of the receiving Contractor.
 3. Inventory hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
 4. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.

5. Provide secure lock-up for hardware delivered to the project, but not yet installed. Control handling and installation of hardware items which are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.
6. Provide typewritten schedule with each shipment in conformity with the approved and filed schedule. The parties receiving hardware from this contractor will receipt for hardware in duplicate.

1.6 GUARANTEE

- A. All material furnished under this Contract shall be guaranteed free from defects in manufacture and capable of performing the duties required for which it is designed for a period of one (1) year after final acceptance. Any material failing to comply with the above guarantee shall be replaced with satisfactory material.
- B. All door closers shall be guaranteed for five (5) years.

PART II - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers are shown with each product category. Furnish each category with the products of only one manufacturer, except where noted otherwise in Hardware Groups. This requirement is mandatory, whether various producers are listed or not.

2.2 MATERIALS SPECIFIED IN SCHEDULE

- A. For simplicity and convenience, the Hardware Groups designate hardware items by catalog numbers as manufactured by the following, except as noted for individual items:
 1. Locks - Schlage
 2. Butts – Ives
 3. Closers – LCN
 4. Stops – Ives and Brookline
 5. Kickplates – Ives and Brookline
 6. Threshold, Weather Seal, Light Seal – National Guard Products and Reese

2.3 FINISHES

- A. Hinges - 626
- B. Locksets - 626
- C. Closers - Sprayed Aluminum
- D. Door Stops - 626
- E. Kick Plates - 630

2.4 HARDWARE MOUNTING LOCATIONS

- A. Location of Hardware
 - 1. Locate finish hardware in accordance with the following schedule except where door manufacturer's standard required other placement. Consult Architects for any deviation from this schedule. All dimensions are to centerline.
 - 2. Pull Plate - 42"
 - 3. Push Plate - 42"
 - 4. Door Knob - 38"
 - 5. Deadlock - 60" - 56"
 - 6. Bottom Hinge - 10" from floor to bottom of hinge.
 - 7. Top Hinge - 5" from head to top of hinge.
 - 8. Center Hinge - equal distance between top and bottom hinge.
 - 9. Kickplates - 1/4" from door bottom to plate bottom.

2.5 HINGES

- A. Hinges shall be Ives of class and size shown in the hardware sets. All hinges, both regular weight and extra heavy, are to be of the oil impregnated ball bearing type. Hinge pins shall be of stainless steel. Hinges are to be of five knuckle construction. All hinges are to have nonremovable pins at exterior doors and security sets.

B. The following hinge manufacturers will be approved as equals, providing they meet the specifications.

1. Stanley
2. H. Soss

2.6 LOCKSETS

A. Locksets shall be Schlage L9000 series, Lever Style 06.

B. The following locksets will be approved as equals, providing they meet the specifications.:

1. Corbin-Russwin ML2000 Newport

2.7 DOOR CLOSERS

A. All door closers shall be of rack and pinion construction with cast iron cases, have key regulated valves, adjustable spring power, adjustable back check and adjustable closing and latching speeds. Concealed closers shall be LCN's 2030 2010 series. Surface closers shall be LCN's 4110- CUSH series, 4110 series, 4010 series, 4020 series, 4110-H-CUSH series as directed in the hardware sets. All door closers shall be of one manufacturer.

2.8 KICK PLATES

A. Shall be wrought ".050". Use 10" height by door width less 1-1/2" at single and less 1" at pairs of doors. Products from any nationally recognized trim or lock manufacturer are acceptable.

2.9 THRESHOLDS

A. Consult hardware sets for location and type. All thresholds shall be equal in length to full masonry opening and coped when frame is recessed. Cope all thresholds around door frame.

2.10 KEY CABINET

A. Furnish one complete key control wall cabinet Model SMTC-AWC-250-S manufactured by P.O. Moore, Inc., Glen Riddle, Pennsylvania. Finish applied manufacturer in standard neutra-tone gray color. Owner will designate location. Key cabinet shall have hook capacity to hold not less than 10% more keys than is required for the building.

2.11 KEYING

A. Establish a new master key system with construction keying. Individual key sets shall be as directed by the Architect and Owner.

3.1 FINISH HARDWARE SCHEDULE

HW SET: 01

1	EA	CONTINUOUS HINGE	SL11 HD	204R1	SEL
1	EA	ENTRANCE LOCKSET	LV9453 L06	626	SIM
1	EA	SURFACE CLOSER	SC71 SS	695	FAL
1	SET	WEATHER SEAL	BY FRAME SUPPLIER	AL	B/O
1	EA	DOOR SWEEP	C627BLK	AL	NGP
1	EA	THRESHOLD	425	AL	NGP

HW SET: 02

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080P L06	626	SCH
1	EA	SURFACE CLOSER	SC71 RW	689	FAL
1	EA	KICKPLATE	8400 10" X 34"	630	IVE
1	EA	WALL STOP	WS33	626	IVE

HW SET: 03

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	L9010 L06	626	SCH
1	EA	SURFACE CLOSER	SC71 RW	689	FAL
1	EA	KICK PLATE	8400 10" X 34"	630	IVE
1	EA	WALL STOP	WS33	626	IVE
1	SET	SEALS	2525B	BLK	NGP

HW SET: 04

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	INNER ENTRY LOCKSET	L9050 L06	626	SCH
1	EA	SURFACE CLOSER	SC71 HD	689	FAL
1	EA	KICK PLATE	8400 10" X 34"	630	IVE
1	EA	WALL STOP	WS33	626	IVE

HW SET: 05

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY SET	L9040 L06 L583-363	626	SCH
1	EA	SURFACE CLOSER	SC71 RW	689	FAL
1	EA	KICK PLATE	8400 10" X 34"	630	IVE
1	EA	WALL STOP	WS33	626	IVE

HW SET: 06

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	L9010 L06	626	SCH
1	EA	SURFACE CLOSER	SC71 SS	689	FAL

HW SET: 07

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ELECTRONIC LOCK	CO-100-MS-70-KP-SPA	626	SCH
1	EA	SURFACE CLOSER	SC71 HD	689	FAL
1	EA	KICK PLATE	8400 10" X 34"	630	IVE

HW SET: 08

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE LOCK	L9050P L06 L583-363	626	SCH
1	EA	WALL STOP	WS33	626	IVE

PART III - EXECUTION

4.1 INSTALLATION

- A. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Custom Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finished application. After completion of the finishes, re-install each item. Do not install surface-mounted items until finishes have been completed on the substrate.
- C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant.

4.2 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Lubricate moving parts with type lubrication recommended by manufacturer (graphite-type if not other recommended). Replace units which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of

hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

- D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass and glazing for wood doors, as scheduled in this Section, and as shown on the drawings.
 - 2. Glass and glazing for exterior aluminum thermal flush doors, exterior sliding aluminum-framed glass door and exterior overhead doors.
 - 3. Glass for toilet room mirrors is specified in Section 10 28 00 Toilet Accessories.
 - 4. Glass and glazing materials and installation requirements are included in this section for other sections referencing this section.

1.2 SYSTEM DESCRIPTION

- A. Glass Thickness: Provide thicknesses specified as a minimum or select minimum thickness in accordance with ASTM E1300 to resist specified design loads, if required.
- B. Structural Design: Design in accordance with 2009 Michigan Building Code for most critical combination of wind, snow, seismic, and dead loads.
- C. Exterior Glass Deflection: Maximum of 1/175 of glass edge length or 3/4 inch, which ever is less with full recovery of glazing materials.
- D. Interior Glass Deflection: Maximum differential deflection for two adjacent unsupported edges when 50 plf force is applied to one panel at any point up to 42 inches above finished floor less than thickness of glass.

1.3 SUBMITTALS

- A. Shop Drawings: Signed and sealed by professional engineer.
 - 1. Indicate sizes, layout, thicknesses, and loading conditions for glass.
- B. Product Data:
 - 1. Glass: Provide structural, physical, and thermal and solar optical performance characteristics, size limitations, special handling or installation requirements.
 - 2. Glazing Sealants, Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors where exposed.
- C. Design Data: Signed and sealed by professional engineer.
 - 1. Submit design calculations for glass thicknesses.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA Glazing Manual, GANA FGMA Sealant Manual, GANA Laminated Glass Design Guide for glazing installation methods.
- B. Perform Work in accordance with State of 2015 Michigan Building Code.

PART 2 PRODUCTS

2.1 FLOAT GLASS MATERIALS

- A. Annealed Glass: ASTM C1036, Type 1 transparent flat, Quality Q3, float glass.
 - 1. Furnish annealed glass except where heat strengthened or tempered glass is required to meet specified performance requirements.
- B. Heat Strengthened Glass: ASTM C1048, Type 1 transparent flat, Quality Q3, Kind HS heat strengthened, Condition A uncoated, float glass.
 - 1. Furnish heat strengthened glass where annealed glass cannot meet specified performance requirements.
- C. Tempered Glass: ASTM C1048, Type 1 transparent flat, Quality Q3, Kind FT fully tempered, Condition A uncoated, float glass with horizontal tempering.
 - 1. Furnish tempered glass where heat strengthened glass cannot meet specified performance requirements.
 - 2. Furnish tempered glass conforming to CPSC 16 CFR 1201 Category II at locations where safety glass is required by applicable code and as indicated on Drawings.

2.2 FLOAT GLASS PRODUCTS

- A. Float Glass Manufacturers:
 - 1. PPG Industries (Basis of Design): Solarban 67 Clear Low E (interior) + Vistacool Solargray tinted (exterior) at Insulating Glass Units.
 - 2. ACH Glass Operations (similar to PPG)
 - 3. AFG Industries, Inc. (similar to PPG)
 - 4. Guardian Industries Corp. (similar to PPG)
 - 5. Pilkington North America, Inc. (similar to PPG)
 - 6. Substitutions: Permitted.
- B. Clear Glass: Annealed, and Tempered float glass as specified; Class 1 clear.
 - 1. Clear annealed glass (FG-CA).
 - 2. Clear tempered glass (FG-CT).
 - 3. Minimum Thickness: ¼ unless otherwise indicated.
- C. Clear Low-E Glass: Annealed, and Tempered float glass as specified; Class 2.
 - 1. Low E annealed glass (FG-LEA).
 - 2. Low E tempered glass (FG-LET).
 - 3. Minimum Thickness: 1/4 inch unless otherwise indicated.

4. Product: 1/4 inch Solarban 67 manufactured by PPG Industries.
5. Tint: Solarban 67 - Clear.

2.3 INSULATING GLASS PRODUCTS

- A. Insulating Glass Manufacturers:
 1. PPG: Solarban 67 Clear (inboard) + Vistacool Solargray (outboard).
 2. Substitutions: Permitted.
- B. Insulating Glass: ASTM E2190 certified by Insulating Glass Certification Council and Insulating Glass Manufacturers Alliance; with glass elastomer edge seal; purge interpane space with dry hermetic air.
 1. Total Unit Thickness: 1 inch unless otherwise indicated.
 2. Insulating Glass Unit Edge Seal Construction: Aluminum, thermally broken, bent and soldered corners.
 3. Insulating Glass Unit Edge Seal Material: Black color.
- C. Double Pane Insulating Glass (IG-DP):
 1. Total Unit Thickness: 1 inch.
 2. Product: Solarban 67 (low E on #3 surface) + Vistacool Solargray manufactured by PPG.
 3. Inner Pane: Glass Type FG-LEA.
 4. Outer Pane: Glass Type FG-CA.
 5. U-Factor Winter: 0.29 maximum.
 6. U-Factor Summer: 0.27 maximum.
 7. Solar Heat Gain Coefficient: 0.23 maximum.
 8. Visible Light Transmittance: 21% minimum.
 9. Visible Light Reflectance Outside: 12% maximum.
- D. Double Pane Insulating Safety Glass (ISG-DP):
 1. Total Unit Thickness: 1 inch.
 2. Product: Solarban 67 + Vistacool Solargray manufactured by PPG.
 3. Outer Pane: Glass Type FG-LET.
 4. Inner Pane: Glass Type FG-CT.
 5. U-Factor Winter: 0.29 maximum.
 6. U-Factor Summer: 0.27 maximum.
 7. Solar Heat Gain Coefficient: 0.23 maximum.
 8. Visible Light Transmittance: 21% minimum.
 9. Visible Light Reflectance Outside: 12% maximum.

2.4 GLAZING SEALANTS

- A. Glazing Sealant, Gasket, Tapes, Compounds Manufacturers:
 1. Tremco.
 2. Pecora.
 3. Norton
 4. Substitutions: Permitted.

- B. Elastomeric Glazing Sealants: Materials compatible with adjacent materials including glass, laminated glass core, insulating glass seals, and glazing channels.
 - 1. Silicone Glazing Sealant: ASTM C920, Type S, Grade NS, Class and Use suitable for glazing application indicated; single component; chemical curing; capable of water immersion without loss of properties; non-bleeding, non-staining, cured Shore A hardness of 15 to 25.
 - a. Color: Black.
 - b. Structural Silicone: Furnish high-modulus structural silicone glazing materials where sealant bonds glass to substrate.
 - c. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
 - 2. Polyurethane Glazing Sealant: ASTM C920, Type S, Grade NS, Class and Use suitable for glazing application indicated; single component, chemical curing, non-staining, non-bleeding, Shore A Hardness Range 20 to 35.
 - a. Color: Black.
 - b. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
- C. Dense Gaskets: Resilient extruded shape to suit glazing channel retaining slot; black color.
 - 1. Neoprene: ASTM C864.
 - 2. EPDM: ASTM C864.
 - 3. Silicone: ASTM C1115.
- D. Soft Gaskets: ASTM C509 Type II; resilient extruded shape to suit glazing channel retaining slot; black color.
 - 1. Neoprene.
 - 2. EPDM.
 - 3. Silicone.
- E. Pre-Formed Glazing Tape: Size to suit application.
 - 1. Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.
 - a. Butyl Corner Sealant: ASTM C920 single component non-skinning butyl compatible with glazing tape; color to match tape.
 - b. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.

2.5 GLAZING ACCESSORIES

- A. Setting Blocks: Elastomeric material recommended by glass manufacturer, 80 to 90 Shore A durometer hardness.
- B. Spacer Shims: Elastomeric material recommended by glass manufacturer, 50 to 60 Shore A durometer hardness.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify openings for glazing are correctly sized, within tolerance, and glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.2 PREPARATION

- A. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- B. Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION

- A. Perform installation in accordance with GANA Glazing Manual.
 - 1. Glazing Sealants: Comply with ASTM C1193.
- B. Exterior Wet/Dry Method (Preformed Tape and Sealant) Installation:
 - 1. Cut glazing tape to length and set against permanent stops. Seal corners by butting tape and dabbing with compatible butyl sealant.
 - 2. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapor seal.
 - 3. Place setting blocks at 1/4 points.
 - 4. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.
 - 5. Install removable stops, with spacer strips inserted between glazing and applied stops, 1/4 inch below sight line. Place glazing tape on glazing pane or unit with tape 1/4 inch below sight line.
 - 6. Fill gap between glazing and stop with elastomeric glazing sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.
 - 7. Apply cap bead of elastomeric glazing sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.
- C. Exterior Wet Method (Sealant and Sealant) Installation:
 - 1. Place setting blocks at 1/4 points and install glazing pane or unit.
 - 2. Install removable stops with glazing centered in space by inserting spacer shims both sides at 24 inch intervals, 1/4 inch below sight line.
 - 3. Fill gaps between glazing and stops with elastomeric glazing sealant to depth of bite on glazing, but not more than 3/8 inch below sight line to ensure full contact with glazing and continue air and vapor seal.
 - 4. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.
- D. Interior Dry Method (Tape and Tape) Installation:
 - 1. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.

2. Place setting blocks at 1/4 points.
 3. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
 4. Place glazing tape on free perimeter of glazing in same manner described above.
 5. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
 6. Knife trim protruding tape.
- E. Interior Wet/Dry Method (Tape and Sealant) Installation:
1. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch above sight line.
 2. Place setting blocks at 1/4 points.
 3. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
 4. Install removable stops, spacer shims inserted between glazing and applied stops at 24 inch intervals, 1/4 inch below sight line.
 5. Fill gaps between pane and applied stop with elastomeric glazing sealant to depth equal to bite on glazing, to uniform and level line.
 6. Trim protruding tape edge.

3.4 CLEANING

- A. Remove glazing materials from finish surfaces.
- B. Remove manufacturer's labels after Work is complete.
- C. Clean fire labels of any paint, dirt, and dust.
- D. Clean glass and adjacent surfaces.

3.5 SCHEDULE

- A. Refer to Door Schedule on Drawing Sheet A-900.

END OF SECTION

SECTION 08 91 00

LOUVERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fixed louvers.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate louver layout plan and elevations; head, jamb and sill details; blade configuration, screens, and frames.
- B. Product Data: Submit data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with AMCA Certification for Water Penetration, Air Performance, and Wind Driven Rain, in compliance with AMCA 500-L. Attach AMCA seal to louvers.

PART 2 PRODUCTS

2.1 WALL LOUVERS - DRAINABLE STYLE

- A. Manufacturers:
 - 1. Ruskin: ELF375DX Drainable Stationary Louver.
 - 2. Airline Products Co.
 - 3. Arrow United Industries.
 - 4. Cesco Products.
 - 5. Construction Specialties Inc.
 - 6. Dowco Products Groups.
 - 7. Greenheck Corp.
 - 8. Industrial Louvers Inc.
 - 9. Substitutions: Not Permitted.
- B. Louver Construction: Aluminum, with 0.081 inch wall thickness.
- C. Louver Panel Thickness: 4 inches deep, face measurements as indicated on Drawings.
- D. Louver Blade Design: Sloped at 37.5 degrees; dual drain style.

- E. Louver: To permit passage of air at a velocity of 2000 ft / min without blade vibration or noise, with maximum static pressure loss of 0.9 inches measured at 2000 ft / min.
- F. Louver: To permit 54 percent free area.
- G. Water Penetration: Not more than 0.01 oz/sq ft of free area at minimum 873 ft / min face velocity.

2.2 COMPONENTS

- A. Aluminum: ASTM B221 6063T5 alloy & temper; extruded shape; prefinished with shop applied Medium Bronze Color Anodized finish in accordance with Aluminum Association AA-C22A44. Apply finish following chemical etching and pretreatment. Electrolytically deposited color anodized finish. 0.7 mils minimum thickness.
- B. Bird Screen: Interwoven wire mesh of aluminum, 0.051 inch diameter wire, 3/4 inch open weave, square design.

2.3 ACCESSORIES

- A. Fasteners and Anchors: Stainless steel type.
- B. Primer: Zinc chromate, alkyd type.
- C. Flashings: Of same material as louver frame.
- D. Sealants: Polyurethane type specified in Section 07 90 00.

2.4 FABRICATION

- A. Louver Blade Design: Slope and style as specified for each louver type; reinforced with intermediate stiffeners, material thickness of 0.081 inch minimum.
- B. Louver Frame: Channel shape, mechanically fastened corner joints, material thickness of 0.081 inch minimum. Form perimeter of frames with recessed channel to retain backer rod for sealant application.
- C. Head and Sill Flashings: Roll formed to required shape, single length in one piece for each location.
- D. Screens: Install screen mesh in shaped frame, reinforce corner construction.

2.5 FACTORY FINISHING

- A. Exterior and Interior Aluminum Surfaces: Color anodized finish of Medium Bronze color as selected to match aluminum windows and doors.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify prepared openings and flashings are ready to receive Work and opening dimensions are as indicated on shop drawings.

3.2 INSTALLATION

- A. Install louvers level and plumb.
- B. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- C. Secure louvers in opening framing with concealed fasteners.
- D. Install bird screen and frame to interior of louver.
- E. Install perimeter sealant and backing rod in accordance with Section 07 90 00.

3.3 SCHEDULE

- A. 40 inches x 40 inches Outside Air Intake Louver in Apparatus Room No. 136 for EF-1. 800 square inches free area minimum, 5,000 cfm. Motorized damper, Wall Collar, and Controls by mechanical contractor.
- B. See Mechanical drawings for soffit louvers of various sizes.

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes gypsum board with joint treatment; metal stud wall framing; metal channel ceiling framing.

1.2 SUBMITTALS

- A. Product Data: Submit data on metal framing, gypsum board, joint tape; acoustic accessories and accessories.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C840. GA-201 - Gypsum Board for Walls and Ceilings. GA-214 - Recommended Specification: Levels of Gypsum Board Finish. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board.
- B. Furnish framing materials in accordance with SSMA - Product Technical Information.
- C. Perform Work in accordance with the 2015 Michigan Building Code.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

- A. Manufacturers:
 - 1. National Gypsum Co.
 - 2. United States Gypsum Co.
 - 3. G-P Gypsum Corp.
 - 4. CertainTeed
 - 5. Substitutions: Permitted.

2.2 COMPONENTS

- A. Studs and Tracks: ASTM C645; GA-216 and GA-600; galvanized sheet steel, 0.036 inch thick (20 gauge), C shape, 3 5/8 inch width.
- B. Furring, Framing, and Accessories: ASTM C645, GA-216, and GA-600.
- C. Non-fire Rated Ceiling Suspension System: Chicago Metallic 640/660 Non-Fire Rated Drywall Grid System: Furring Runners; Cross Channels; Furring Tees; Cross Tees; Wall Track; Utility Angle; and 12 gauge hanger wire, as required.

- D. Gypsum Board Materials: ASTM C1396/C1396M.
 - 1. Standard Gypsum Board: 5/8 inch thick, maximum available length in place; ends square cut, tapered edges. Gold Bond Gypsum Wallboard, or approved equals.
 - 2. Interior Mold and Moisture Resistant Gypsum Board: 5/8 inch thick, maximum available length in place; ends square cut, tapered edges. Gold Bond eXP Interior Extreme Gypsum Panel, mold and moisture resistant. or approved equal.

2.3 ACCESSORIES

- A. Gypsum Board Accessories: ASTM C1047; metal; corner beads, edge trim, and expansion joints.
 - 1. Metal Accessories: Galvanized steel.
 - 2. Edge Trim: Type LC, L, or U bead.
- B. Joint Materials: ASTM C475, GA-201 and GA-216, reinforcing tape, joint compound, and water.
- C. Fasteners: ASTM C1002; Type S hardened screws and GA-216; length to suit application.
- D. Adhesive: ASTM C557 and GA-216.
 - 1. Interior Adhesives: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
- E. Gypsum Board Screws: ASTM C954 and ASTM C1002; length to suit application.
 - 1. Screws for Steel Framing: Type S.
 - 2. Screws for Wood Framing: Type W.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions are ready to receive work.

3.2 INSTALLATION

- A. Metal Studs:
 - 1. Install studs in accordance with ASTM C754, GA-216 and GA-600.
 - 2. Metal Stud Spacing: 16 inches or less oc.
 - 3. Partition Heights: 6 feet high and 3.5 feet high as indicated on drawings with un-braced tops. 20 gauge studs.
- B. Ceiling Framing:
 - 1. Install in accordance with ASTM C754 and GA-216.
 - 2. Coordinate location of hangers with other work. Install ceiling framing independent of walls, columns, and above ceiling work.

3. Reinforce openings in ceiling suspension system interrupting main carrying channels or furring channels, with lateral channel bracing.
 4. Laterally brace entire suspension system.
 5. Furring Runners to be installed at 48 inches on center maximum, with 12 gauge hanger wire spaced at 48 inches on center maximum, hung from structure above.
 6. Space Furring Tees at 16 inches on center maximum between Furring Runners. Use Wall tracks and Cross Tees as needed per manufacturer's instructions.
 7. Ceilings at the underside of the metal trusses to be fastened directly to the truss member.
- C. Gypsum Board:
1. Install gypsum board in accordance with GA-216 and GA-600.
 2. Fasten gypsum board to furring or framing with screws. Staples may not be used.
 3. Place control joints consistent with lines of building spaces as required and as directed by Architect/Engineer. 30 feet on center maximum spacing.
 4. Place corner beads at external corners and as indicated on Drawings. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
 5. Seal cut edges and holes in eXP gypsum board with sealant.
- D. Joint Treatment:
1. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 2. Feather coats onto adjoining surfaces so camber is maximum 1/32 inch.
 3. Taping, filling, and sanding is not required at surfaces above suspended ceilings at the underside of the trusses.
- E. Tolerances: Maximum Variation from Flat Surface: 1/8 inch in 10 feet in any direction.
- F. Schedule:
1. 5/8 inch eXP Gypsum Board on metal suspension system: Shower in Unisex Toilet/Shower, Shower in Female Locker Room No. 122, and Laundry No. 110.
 2. 5/8 inch Gypsum Wall Board: All areas indicated on interior elevations, schedules, and details on the drawings. Underside of all trusses, soffits at cabinets in Kitchen No. 131.
 3. 5/8 inch eXP Gypsum Board as backing for wall tile at the 3.5 feet high Pass Through/Bar wall in Kitchen No. 118.
 3. Metal Studs: Type as indicated on drawing details and schedules. 20 gauge steel studs for short unsupported walls in Kitchen No. 118 and 20 gauge steel studs for soffits above cabinets in Kitchen No. 131.
 4. Non-Fire Rated Ceiling Suspension System: Shower in Unisex Toilet/Shower and Shower in Female Locker Room No. 122.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes porcelain tile and base for interior floor and wall applications using the thin-set application method.

1.2 REFERENCES

- A. ANSI A108.1 – General Requirements.
- B. ANSI A108.5 – Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
- C. ANSI A108.10 – Installation of Grout in Tile work.
- D. ANSI A118.1 – Dry-Set Portland Cement Mortar.
- E. ANSI A118.4 – Latex-Portland Cement Mortar.
- F. ANSI A118.6 – Standard Cement Grouts for Tile Installation.
- G. ANSI A137.1 – Standard Specifications for Ceramic Tile.
- H. TCA (Tile Council of America) – Handbook for Ceramic Tile Installation.
- I. SCAQMD Rule 1168 – Adhesive and Sealant Applications.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate patterned applications and thresholds.
- B. Product Data: Submit instructions for using grouts and adhesives.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Samples: Submit mounted tile and grout, (2) samples, 36 x 36 inches in size on plywood panels illustrating pattern, color variations, and grout joint size variations.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit recommended cleaning methods, stain removal methods, and polishes and waxes.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with ANSI A137.1.
- B. Conform to TCA Handbook, ANSI A108.1.
- C. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- D. Installer: Company specializing in performing Work of this section approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of General Requirements.
- B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not install adhesives in unventilated environment.
- B. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during installation of mortar materials.

1.8 EXTRA MATERIALS

- A. Provide four square feet of each size, color, and surface finish of tile specified.

PART 2 PRODUCTS

2.1 TILE MANUFACTURERS

- A. Toilet Room Floor Tile-
 - 1. Main Floor tile: Virginia Tile- Crossville Ceramics –Series Color Blox 2.0– Sea Otter #CBX08; 12 inch x 24 inch.
 - 2. Shower floor Tile: Virginia Tile – Crossville Ceramics; Series Color Blox.
 - a. Sea Otter #CBX08; 3 inch x 3 inch
 - 3. Toilet Room Wall Tile and Shower Wall Tile: Virginia Tile – Crossville; Series Color Blox 2.0 – Slinky #CBX03; 12 inch x 24 inch.
- B. Substitutions: Not Permitted but final Owner/Architect approval is required before ordering materials.

2.2 COMPONENTS

- A. Main floor tile (Indicated as PFT-1 in Room Finish Schedule): ANSI A137.1, conforming to the following:
1. Moisture Absorption: 0 to 0.5 percent.
 2. Size: 12 x 24 x 3/8 inch.
 3. Shape: Rectangular.
 4. Edge: Square.
 5. Surface Finish: Unpolished, slip resistant.
 6. Color: Virginia Tile Crossville Inc.; Series - Color Blox 2.0, Color as selected.
- B. Shower Floor tile (Indicated as PFT-2 in Room Finish Schedule): ANSI A137.1, conforming to the following:
1. Moisture Absorption: 0 to 0.5 percent.
 2. Size: 12 x 12 x 1/4 inch.
 3. Shape: Square mosaic.
 4. Edge: Square.
 5. Surface Finish: Unpolished, slip resistant.
 6. Color/Style: Virginia Tile Crossville Inc.; Series - Color Blox 2.0, Color as selected.
- C. Shower wall tile (Indicated as PWT-1 in Room Finish Schedule): ANSI A137.1, conforming to the following:
1. Moisture Absorption: 0 to 0.5 percent.
 2. Size: 12 x 24 x 3/8 inch.
 3. Shape: Rectangular.
 4. Edge: Square.
 5. Surface Finish: Unpolished. Slip resistant.
 6. Color/style: Virginia Tile Crossville Inc.; Series – Color Blox 2.0, Color as selected.
- D. Mortar Materials:
1. Mortar Bond Coat Materials:
 - a. Latex-Portland Cement type: ANSI A118.4. ISO 13007 Classification C2EP1.
 - 1) MAPEI, Ultraflex 2
- E. Grout Materials:
1. Grout: ANSI A118.6 and A118.7. ISO 13007 Classification CG2WAF; Color: TEC – Color; Silhouette 935-use with PFT-1 and PFT-2. Owner approval required.
 - a. TEC, Power Grout.
 - b. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
- F. Grout Materials:
1. Grout: ANSI A118.6 and A118.7. ISO 13007 Classification CG2WAF; Color: TEC – Color; Mist 939-use with PFT-1 and PFT-2. Owner approval required.
 - a. TEC, Power Grout.

- b. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
- G. Trim: Schluter Systems – Brushed Stainless Steel, profile to match tile thickness.
 - 1. Schluter Systems, L.P., 194 Pleasant Ridge Road, Plattsburgh, NY 12901-5841. Tel: (800) 472-4588. Fax (800) 477-9783. E-mail: info@schluter.com. Internet: www.schluter.com.
 - 2. Schluter®-RONDEC: Edge Protection Profile for wall at Kitchen Pass Through Counter between Kitchen and Dining Room.
 - a. Description: bullnose-type profile with symmetrically rounded visible surface with 1/4 inch (6 mm) radius, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
 - b. Material and Finish: EB - Brushed Stainless Steel Type 304 = V2A

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify substrate under provisions of General Requirements.
- B. Verify surfaces are ready to receive work.

3.2 PREPARATION

- A. Protect surrounding work from damage or disfiguration.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler.

3.3 INSTALLATION – THIN-SET METHOD

- A. Floors: Install adhesive, tile, and grout in accordance with applicable requirements of ANSI A108.1 through A108.10, and TCA Handbook, No. F113-07 as scheduled
- B. Base and Wall Tile on Gypsum Board: Install adhesive, tile, and grout in accordance with applicable requirements of ANSI A108.1 through A108.10, and TCA Handbook, No. W243-07 as scheduled.
- C. Base and Wall Tile on Concrete Masonry Units: Install adhesive, tile, and grout in accordance with applicable requirements of ANSI A108.1 through A108.10, and TCA Handbook, No. W202-07 as scheduled.
- D. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor, and base joints.

- E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Provide 3/16 inch grout joints. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
- F. Sound tile after setting. Replace hollow sounding units.
- G. Allow tile to set for a minimum of 48 hours prior to grouting.
- H. Grout tile joints.
- I. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.4 CLEANING

- A. Clean work under provisions of General Requirements.
- B. Clean tile and grout surfaces.

3.5 PROTECTION OF FINISHED WORK

- A. Protect finished work under provisions of General Requirements.
- B. Do not permit traffic over finished floor surface for 4 days after installation.

3.6 SCHEDULE (refer to Room Finish Schedule on drawing sheet A-901 and Floor Finish Plan on drawing sheet A-511.)

- A. Floors: (Where PFT-1 and PFT-2 is indicated on Drawings.)
 - 1. Over interior concrete substrates, install in accordance with TCA Handbook Method F113-07, dry-set or latex-portland cement bond coat, with standard grout.
- B. Wall Tile (Where PWT-1 is indicated on Drawings)
 - 1. Over gypsum wallboard on studs install in accordance with TCA Handbook Method W243-07, thin-set with dry-set or latex-portland cement bond coat, with standard grout.
- C. Trim: Schluter RONDEC where the wall tile meets a masonry wall at the pass through counter between the Kitchen and Dining Room.

END OF SECTION

SECTION 09 51 13
ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes suspended metal grid ceiling system and perimeter trim.
- B. Acoustical tile.

1.2 REFERENCES

- A. ASTM C635 – Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- B. ASTM C636 – Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
- C. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. ASTM E1264 – Classification of Acoustical Ceiling Products.
- E. CISCA – Acoustical Ceilings: Use and Practice.
- F. UL – Fire Resistance Directory and Building Material Directory.
- G. GS 11 – Green Seal Standards & Certification: Paints.

1.3 SYSTEM DESCRIPTION

- A. Provide system capable of supporting imposed loads with deflection limited to 1: 360.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data on metal grid system components and acoustical units.
- B. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- C. Samples: Submit ceiling tile and suspension system.

1.5 QUALITY ASSURANCE

- A. Conform to CISCA requirements.

SECTION 09 51 13

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PART 1 GENERAL

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- B. Acoustical tile.

1.2 REFERENCES

- A. ASTM C635 – Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- B. ASTM C636 – Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
- C. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. ASTM E1264 – Classification of Acoustical Ceiling Products.
- E. CISCA – Acoustical Ceilings: Use and Practice.
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1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data on metal grid system components and acoustical units.
- B. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- C. Samples: Submit ceiling tile and suspension system.

1.5 QUALITY ASSURANCE

- A. Conform to CISCA requirements.

- B. Acoustic Panels (ACT-1): ASTM E1264 conforming to the following:
 - 1. Nominal Size: 24 x 24 inches (600 x 600 mm) as indicated on sheet A-510.
 - 2. Thickness: 5/8 inches.
 - 3. Composition: Mineral fiber with acoustically transparent membrane.
 - 4. Light Reflectance: 0.80
 - 5. NRC: 0.65.
 - 6. CAC Minimum: 35.
 - 7. Recyclable Content: 44%
 - 8. Surface Color: White.
 - 9. Surface Finish: acoustically transparent membrane with factory-applied latex paint.
 - 10. Edge: Beveled tegular lay-in.
 - 11. Fire Hazard Classification: Class A (UL), Fireguard.
 - 12. Anti Mold and Mildew Treatment.

- C. Acoustic Panels (ACT-2): ASTM E1264 conforming to the following:
 - 1. Nominal Size: 24 x 24 inches (600 x 600 mm) as indicated on sheet A-510.
 - 2. Thickness: 5/8 inches.
 - 3. Composition: Wet-formed ceramic and mineral fiber composite
 - 4. Light Reflectance: 0.86
 - 5. NRC: 0.55.
 - 6. CAC Minimum: 40.
 - 7. Recyclable Content: 41%
 - 8. Surface Color: White.
 - 9. Surface Finish: Factory-applied plastic paint finish.
 - 10. Edge: Square lay-in.
 - 11. Fire Hazard Classification: Class A (UL).
 - 12. Anti-Mold /Mildew treatment.

2.4 ACCESSORIES

- A. Touch-up Paint: Type and color to match acoustic and grid units.
 - 1. Interior Flat and Non-Flat Paints: Maximum volatile organic compound content in accordance with GS-11.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions.
- B. Verify layout of hangers does not interfere with other work.

3.2 INSTALLATION

- A. Suspension System:
 - 1. Install system in accordance with ASTM C636 and as supplemented in this section.

2. Install system capable of supporting imposed loads to a deflection of 1:360 maximum.
3. Locate system on room axis according to reflected plan on sheet A-610.
4. Coordinate location of hangers with other work. Where components prevent regular spacing of hangers, reinforce system to span extra distance.
5. Install hanger clips. Provide additional hangers and inserts as required.
6. Hang system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
7. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
8. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.
9. Do no eccentrically load system, or produce rotation or runners.
10. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.

B. Acoustic Units:

1. Install acoustical units in accordance with manufacturer's instructions.
2. Install acoustic units level, free from damage, twist, warp or dents.
3. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
4. Fit border trim neatly against abutting surfaces.
5. Cut panels to fit irregular grid and perimeter edge trim.

C. Tolerances:

1. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
2. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.3 SCHEDULE

- A. Ceilings indicated on sheet A-510 and materials scheduled on sheet A-901.

END OF SECTION

SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes resilient tile flooring and base.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data.
- B. Samples:
 - 1. Submit manufacturer's complete set of color samples for initial selection.
 - 2. Submit two samples, 4 x 4 inch in size illustrating color and pattern for each resilient flooring product specified.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit maintenance instruction and data.

1.4 QUALITY ASSURANCE

- A. Surface Burning Characteristics:
 - 1. Floor Finishes: Class II, minimum 0.22 watts/sq cm when tested in accordance with NFPA 253.
 - 2. Base Material: Class II, minimum 0.22 watts/sq cm when tested in accordance with NFPA 253.
- B. Perform Work in accordance with 2015 Michigan Building Code.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (32 degrees C).
- B. Store materials for not less than 48 hours prior to installation in area of installation at temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.1 PVC INTERLOCKING FLOOR TILES

- A. Manufacturers:

1. Armor-Tuff “ Made in the USA”; www.armortufftile.com
 2. Substitutions: not permitted.
- B. Furnish materials in accordance with 2015 Michigan Building Code.
- C. Products:
1. Tuff Tiles, Super-Heavy-Duty (TT-1, TT-2, TT-3)
 - a. Size: 20.5” x 20.5”
 - b. Thickness: 7mm or ¼” thick
 - c. Joint: T-Joint
 - d. Hardness: 92
 - e. Abrasion: 17
 - f. Wear Resistance: 90.6
 - g. Flame Spread: Class 1
 - h. Fire Resistance: Class 1
 - i. Color(s) as selected by Architect.
 2. LVT Decorative Design Series, Stone Creek Collection (LVT-1) and Deadwood Collection (LVT-2)
 - a. Size: 20” x 20”
 - b. Thickness: 5mm or ¼” thick
 - c. Joint: Hidden joint interlocking
 - d. Hardness: 92
 - e. Abrasion: 17
 - f. Wear Resistance: 90.6
 - g. Flame Spread: Class 1
 - h. Fire Resistance: Class 1
 - i. Color as selected by Architect.
 3. Edging
 - a. Provide interlocking edging with sloping transition at bi-fold garage doors in apparatus room. Edging color to match the corresponding tile.
 4. Adhesives
 - a. Two part epoxy adhesive as recommended by manufacturer for Super-Heavy-Duty Tuff Tiles and LVT Decorative Design Series. Apply per manufacturer’s instructions.

2.2 RESILIENT BASE

- A. Manufacturers:
1. Johnsonite.
 2. Armstrong.
 3. Mannington.
 4. Substitutions: Permitted.
- B. Furnish materials in accordance with the 2015 Michigan Building Code.
- C. Base: ASTM F1861 Vinyl; top set coved:
1. Height: 4 inch.

2. Thickness: 0.125 inch thick.
3. Finish: Satin.
4. Length: Roll.
5. Accessories: Premolded external corners, internal corners, and end stops.

2.3 ACCESSORIES

- A. Subfloor Filler: Cementitious or Premix latex; type recommended by floor material manufacturer.
- B. Primers and Adhesives: Waterproof, types recommended by floor material manufacturer.
 1. Interior Adhesives: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
- C. Moldings and Edge Strips: Same material as flooring.
- D. Sealer and Wax: Types recommended by floor material manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify concrete floors are dry to maximum moisture content of 7 percent, as recommended by manufacturer, and exhibit negative alkalinity, carbonization, and dusting.

3.2 PREPARATION

- A. Clean substrate.
- B. Fill minor low spots and other defects with sub-floor filler.
- C. Apply primer as required to prevent "bleed-thru" or interference with adhesion by substances that cannot be removed.

3.3 INSTALLATION

- A. Spread adhesive and set flooring in place. Press tile flooring to attain full adhesion.
- B. Install tile flooring with joints and seams parallel to building lines. Allow minimum 1/2 full size tile width at room or area perimeter.
- C. Scribe flooring to produce tight joints at items penetrating flooring.
- D. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

- E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated. Secure resilient strips by adhesive.
- F. Adhere base tight to wall and floor surfaces.
- G. Fit joints tightly and make vertical. Miter internal corners. At external corners, use premolded units.

3.4 CLEANING

- A. Remove excess adhesive from surfaces without damage.
- B. Apply Sealer and Wax in accordance with Manufacturer's Installation Instructions

3.5 SCHEDULE

- A. See Room Finish Schedule on Drawing Sheet A-901.

END OF SECTION

SECTION 09 68 00

CARPETING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Carpet Tiles direct-glued to substrate.
 - 2. Coordinated Broadloom Carpet Base.

- B. Final approval of Colors & Styles is required by Owner prior to ordering materials.

1.2 SUBMITTALS

- A. Samples: Submit two carpet tile samples full size, illustrating color and pattern for each carpet tile material specified.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit maintenance and cleaning instructions.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Materials:
 - 1. Furnish 4 full tiles of each type, color, and pattern specified.

1.5 QUALITY ASSURANCE

- A. Surface Burning Characteristics:
 - 1. Floor Finishes: Comply with one of the following:
 - a. Class II, minimum 0.22 watts/sq cm when tested in accordance with NFPA 253.
 - b. CPSC 16 CFR 1630.

- B. Texture Appearance Retention Rating: Rating classifications as determined by CRI Model Specifications for Commercial Carpets.
 - 1. Greater than or equal to 3.0 TARR for Heavy Traffic Level Classification.

- C. Perform Work in accordance with the 2015 Michigan Building Code.

1.6 AMBIENT CONDITIONS

- A. Store materials in area of installation of 48 hours prior to installation.

- B. Maintain minimum 70 degrees F (21 degrees C) ambient temperature 3 days prior to, during and 24 hours after installation.

C. Ventilate installation area during installation and for 3 days after installation.

1.7 WARRANTY

A. Furnish manufacturer's standard Lifetime Limited Modular warranty for carpet tiles integrity, wear, and colorfastness.

PART 2 PRODUCTS

2.1 CARPET TILES

A. Manufacturer and Product List:

1. Carpet tiles CPT-1: Shaw Contract Group, Diffuse + Disperse Collection, Style Number 59575, in color as selected, as basis of design.
2. No substitutions permitted but Owner approval required prior to ordering material.

2.2 COMPONENTS

A. Carpet Tile CPT-1:

1. Tile Size: 24 x 24 inches.
2. Construction: Multi-level pattern loop
3. Style: Diffuse Tile 59575.
4. Gauge: 1/12" (47 rows per 10 cm.)
5. Dye Method: 100% Solution Dyed.
6. Fiber Type: Eco Solution Q100 Nylon.
7. Protective Treatment: SSP Shaw Soil Protection.
8. Primary Backing Material: Synthetic.
9. Secondary Backing Material: Ecoworx Tile.
10. Installation Method: Quarter Turn
11. Flammability: ASTM E 648 Class 1 (Glue Down).
12. Smoke Density: ASTM E 662 Less than 450.
13. Static Propensity: AATCC-134 Under 3.5 KV.
14. Color: As Selected by Architect
15. Tufted Weight: 16
16. Stitches per Inch: 8.5
17. Finished Pile Thickness: 0.092 inch
18. Total Thickness: 0.23 inch

2.3 ACCESSORIES

- A. Sub-Floor Filler: Cementitious Type recommended by flooring material manufacturer.
- B. Base Cap: 3/4 inch nylon strip, color to match base carpet. Wrap around exposed edge and sew to top edge of carpet.
- C. Moldings and Edge Strips: Rubber color as selected.

- D. Contact Adhesive: Compatible with carpet tile material and recommended by carpet tile manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify floor surfaces are smooth and flat within tolerances specified in Section 03 30 00 and are ready to receive work.
- B. Verify concrete floors for glue-down installation are ready for carpet tile installation by testing for moisture emission rate and alkalinity. Obtain instructions when test results are not within specified limits.

3.2 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
- B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- C. Vacuum clean substrate.

3.3 INSTALLATION

- A. Install carpet tiles in accordance with CRI Carpet Installation Standard.
- B. Verify carpet tiles match before cutting to ensure minimal variation between dye lots.
- C. Lay out carpet tiles and locate joints in accordance with shop drawings:
 - 1. Locate change of color or pattern between rooms under door centerline.
- D. Install carpet tiles by direct glue-down method.
- E. Install broadloom carpet as base finish up vertical surfaces to form base. Terminate top of base with cap strip.
- F. Complete installation of edge strips, concealing exposed edges. Bind cut edges where not concealed by edge strips.
- G. Cleaning:
 - 1. Remove excess adhesive from floor, base, and wall surfaces without damage.
 - 2. Clean and vacuum sheet carpet surfaces.

3.4 SCHEDULE: (Refer to Drawing Sheet A-901.)

- A. CPT-1 where indicated on drawings..

END OF SECTION

SECTION 09 90 00
PAINTING AND COATING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and field application of paints, and other coatings.

1.2 REFERENCES

- A. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 RELATED SECTIONS

- A. 09 81 00 – Epoxy Flooring: Epoxy Floor Coating for areas scheduled to receive Epoxy Floor System.

1.4 SUBMITTALS

- A. Product Data: Submit data on all finishing products
- B. Samples: Submit two paper chip samples illustrating range of colors available for each surface finishing product scheduled.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit maintenance and cleaning instructions.

1.6 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of project.
- B. Installer: Company specializing in performing work of the section with minimum three years documented experience.
- C. Surface Burning Characteristics:
 - 1. Fire Retardant Finishes: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Store and apply materials in environmental conditions required by manufacturer's instructions.

PART 2 PRODUCTS

2.1 PAINTS AND COATINGS

- A. Manufacturers:
 1. Sonneborn Building Products.
 2. Sherwin-Williams.
 3. Devoe and Reynolds.
 4. Glidden Coatings.
 5. Benjamin Moore and Co.
 6. Pittsburgh Paints.
 7. Pratt and Lambert
 8. Substitutions: Not Permitted.

2.2 COMPONENTS

- A. Coatings: Ready mixed except field catalyzed coatings of good flow and brushing properties, capable of drying or curing free of streaks or sags.
 1. Interior Flat and Non-Flat Paints: Maximum volatile organic compound content in accordance with GS-11.
 2. Interior Anti-Corrosive Paints: Maximum volatile organic compound content in accordance with GC-03.
- B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials required to achieve finishes specified.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify substrate conditions are ready to receive Work.
- B. Measure moisture content of porous surfaces using electronic moisture meter. Do not apply finishes unless moisture content is less than 12 percent.

3.2 PREPARATION

- A. Correct minor defects and clean surfaces affecting work of this section.
- B. Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or applying finishes.

- C. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- D. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- E. Gypsum Board and Plaster Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- F. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- G. Concrete Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove foreign matter. Remove oil and grease with solution of tri-sodium phosphate, rinse well and allow to dry.
- H. Uncoated Steel and Iron Surfaces: Remove scale by wire brushing, sandblasting, clean by washing with solvent. Apply treatment of phosphoric acid solution. Prime paint after repairs.
- I. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Clean surfaces with solvent. Prime bare steel surfaces.
- J. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- K. Do not paint over door and frame fire labels! Painting contractor is responsible for masking of fire labels, removing paint from labels or paying for replacement of labels.

3.3 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry.
- C. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
- D. Allow applied coat to dry before next coat is applied.
- E. Apply each coat to uniform finish.
- F. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- G. Sand wood and metal surfaces lightly between coats to achieve required finish.
- H. Where clear finishes are required, tint fillers to match wood.

- I. Prime concealed surfaces of interior woodwork with primer paint.
- J. Finishing Mechanical And Electrical Equipment:
 - 1. Paint shop primed equipment exposed to view in finished spaces.
 - 2. Remove unfinished louvers, grilles, covers, and access panels and paint separately.
 - 3. Prime and paint insulated and exposed pipes hangers, brackets, collars and supports (in finished spaces), except where items are prefinished.
 - 4. Paint exposed conduit and electrical equipment occurring in finished areas.
 - 5. Paint both sides and edges of plywood backboards.
 - 6. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
 - 7. Paint ductwork exposed in areas without ceilings.
- K. Cleaning: As work proceeds, promptly remove finishes where spilled, splashed, or spattered.

3.4 SCHEDULE - SHOP PRIMED ITEMS FOR SITE FINISHING

- A. Division 08 - Openings: Hollow metal door and borrowed light frames.

3.5 SCHEDULE - EXTERIOR SURFACES

- A. Steel - Shop Primed or Galvanized (Steel Channel Overhead Door Frames; and Exposed surfaces of Steel Lintels):
 - 1. Touch-up with acrylic primer: Sherwin-Williams Pro-Cryl Universal Acrylic Primer, B66-310 Series. (Shop Primed Items)
 - 2. Touch-up with latex primer: Sherwin-Williams All Surface Enamel Latex Primer, A41W210. (Galvanized items)
 - 3. Two coats of enamel: Sherwin-Williams SherCryl HPA High Performance Acrylic, B66-350 Series.
- B. Exterior Concrete Masonry Units: (Interior walls of dumpster enclosure.)
 - 1. One Coat Latex Block Filler: Sherwin-Williams PrepRite Block Filler.
 - 2. Two Coats of Acrylic Enamel: Sherwin-Williams A-100 Exterior Latex, Satin finish.
- C. Wood (dumpster enclosure):
 - 1. One coat of Oil Wood Primer: Sherwin-Williams A-100 Exterior Oil Wood Primer.
 - 2. Two coats of Solid Color Stain: Sherwin-Williams ProMar Exterior Solid Color Acrylic Latex Stain.

3.6 SCHEDULE - INTERIOR SURFACES

- A. Concrete Floors (indicated as sealed concrete or SC in Room Finish Schedule):
 - 1. Concrete Hardening, Sealing, and Dustproofing: Kure-N-Harden by Sonneborn Building Products/BASF. Clear sealer, hardener, and dustproofing compound. 150 to 200 square foot per gallon coverage.

- B. Concrete Block Walls (indicated as CMU-P in Room Finish Schedule):
 - 1. One coat block filler: Sherwin-Williams Loxon Block Surfacer, A24W200.
 - 2. Two coats latex enamel: Sherwin-Williams Harmony Low Odor Interior Latex Eg-Shel, B9 Series.

- C. Concrete Block Walls Epoxy (indicated as CMU-EP in Room Finish Schedule):
 - 1. One coat block filler: Sherwin-Williams Heavy Duty Block Filler.
 - 2. Two coats Semi-Gloss Epoxy: Sherwin-Williams Waterbased Tile-Clad Epoxy, 2 component system, B73-100/B73V100.

- D. Steel – Primed (Hollow Metal Doors & Frames):
 - 1. One Coat Primer: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer.
 - 2. Two coats of Semi-gloss Epoxy: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, single component, K46-150.

- E. Galvanized (miscellaneous exposed metals):
 - 1. Touch-up with latex primer: Sherwin-Williams All Surface Enamel Latex Primer, A41W210.
 - 2. Two coats of latex enamel: Sherwin-Williams Harmony Low Odor Interior Latex Eg-Shel, B9 Series.

- F. Copper (Miscellaneous exposed piping):
 - 1. One coat of latex primer: Sherwin-Williams DTM Wash Primer, B71Y1.
 - 2. Two coats of latex enamel: Sherwin-Williams Harmony Low Odor Interior Latex Eg-Shel, B9 Series.

- G. PVC (Miscellaneous exposed piping):
 - 1. One coat of latex primer: Sherwin-Williams All Surface Enamel Latex Primer, A41W210.
 - 2. Two coats of latex enamel: Sherwin-Williams Harmony Low Odor Interior Latex Eg-Shel, B9 Series.

- H. Wood – Painted (Partition Wall Cap in Bunkroom):
 - 1. One coat of Oil stain: Sherwin-Williams Wood Classics, Interior Oil Stain-250, A_49-800.
 - 2. Two coats latex enamel: Sherwin-Williams Wood Classics, Polyurethane Clear, Stain, A67FL.

- I. Gypsum Board (Gypsum board partitions, soffits and ceilings typical unless otherwise noted. Indicated as GB-P in Room Finish Schedule):
 - 1. One coat of latex primer sealer: Sherwin-Williams Harmony Low Odor Interior Latex Primer, B11W900.
 - 2. Two coats latex enamel: Sherwin-Williams Harmony Low Odor Interior Latex Eg-Shel, B9 Series.

- J. Gypsum Board Epoxy System (Gypsum board ceilings in , toilet rooms, laundry room, locker rooms, shower rooms, apparatus room and support spaces. Indicated GP-EP in Room Finish Schedule.):
 - 1. One coat of latex primer: Sherwin-Williams ProMar 200 Latex Primer.

2. Two coats Semi-Gloss Epoxy: Sherwin-Williams Waterbased Tile-Clad Epoxy, 2 component system, B73-100/B73V100.

3.7 SCHEDULE – COLORS

- A. Colors to be chosen by Owner and Architect from manufacturer's standard colors.

END OF SECTION

SECTION 10 21 13

TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal toilet compartments, floor mounted, head rail braced, Baked Enamel or Powder Coat finish.

1.02 RELATED SECTIONS

- A. Section 10 28 00 - Toilet Accessories.

1.03 REFERENCES

- A. ANSI A117.1 - Safety Standards for the Handicapped.
- B. ASTM A167 - Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- C. ASTM A526 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
- D. FS RR-P-1352 - Partitions, Toilet, Complete.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 00 00.
- B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall & floor, supports, door swings.
- C. Product Data: Provide data on panel construction, hardware, and accessories.
- D. Samples: Submit two samples of partition panels, illustrating panel finish, color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.05 REGULATORY REQUIREMENTS

- A. Conform to ANSI A117.1 code for access for the handicapped.

1.06 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

1.07 COORDINATION

- A. Coordinate the work with placement of support framing and anchors in wall.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. ASI Accurate Partitions: Powder coated.
- B. Bradley-Mills: Series 400 Sentinel overhead braced, baked enamel.
- C. Metpar Corporation: Overhead braced, baked enamel.
- E. Substitutions: Permitted.

2.02 MATERIALS

- A. Steel Sheet: ASTM A526, with G90 zinc coating.

2.03 ACCESSORIES

- A. Pilaster Shoe: Formed chromed steel with polished finish, 3 inch high, with adjustable screw jack.
- B. Head Rails: Hollow steel anodized aluminum tube, 1 x 1-5/8 inch size, with anti-grip strips and cast socket wall brackets.
- C. Attachments, Screws, and Bolts: Stainless steel; tamper proof type, heavy duty extruded aluminum brackets.
- D. Hardware: Chrome plated non-ferrous cast metal
 - 1. Pivot hinges, gravity type, adjustable for door close positioning.
 - 2. Nylon bearings.
 - 3. Thumb turn door latch with exterior emergency access feature.
 - 4. Door strike and keeper with rubber bumper.
 - 5. Door pull for outswinging doors.

2.04 FABRICATION

- A. Fabricate partitions in accordance with FS RR-P-1352.
- B. Fabricate components of steel sheet as follows:
 - 1. Panel and Door Faces: 20 gage panel & 22 gage door.
 - 2. Pilaster Faces: 20 gage.
 - 3. Reinforcement: 12 gage.
- C. Doors and Panels:
 - 1. Thickness: 1 inch
 - 2. Door Width: 24 inch
 - 4. Height: 58 inch.
- D. Pilasters: 1-1/4 inch (32 mm) thick, of sizes required to suit cubicle width and spacing.

- E. Door, Panel, and Pilaster Construction: Sheet steel face, pressure bonded to sound deadening core, form and close edges, miter and weld corners, grind smooth.
- F. Internal Reinforcement: Provide in areas of attached hardware and fittings. Mark locations of reinforcement for partition mounted washroom accessories.

2.05 FINISHING

- A. Clean, degrease, and neutralize panels.
- B. Follow immediately with a phosphatizing treatment, prime coat and two finish coats baked enamel.
- C. Single Color: color as selected.
- D. Exposed Steel Surfaces: Polished chrome plated.
- D. Aluminum: Anodized to clear color.
- E. Non-ferrous Surfaces: Polished chrome plated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify site conditions.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attached panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets with tamper proof through bolts and nuts. Locate head rail joints at pilaster center lines.
- E. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster. Conceal floor fastenings with pilaster shoes.
- F. Equip each door with two hinges, one door latch.
- G. Install door strike and keeper with door bumper on each pilaster in alignment with door latch.
- H. Field touch-up of scratches or damaged enamel finish will not be permitted.

- I. Replace damaged or scratched materials with new materials.

3.03 ERECTION TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch.
- B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

- A. Adjust work.
- B. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- C. Adjust hinges to position doors in partial opening position when unlatched. Return out swinging doors to closed position.
- D. Adjust adjacent components for consistency of line or plane.

3.05 SCHEDULES

- A. As indicated on Contract Drawings and as follows:
 - 1. Female Locker Room No. 122: Partitions around two standard water closets.
 - 2. Male Locker Room No. 129: Partitions around two standard water closets.

END OF SECTION

SECTION 10 28 00

TOILET ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Toilet, and locker room accessories.
- B. Grab bars.
- C. Attachment hardware.

1.2 RELATED SECTIONS

- A. Section 06 10 00 – Rough Carpentry: Blocking in walls for accessories.

1.3 REFERENCES

- A. ANSI A117.1 - Safety Standards for the Handicapped.
- B. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- D. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- E. ASTM A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
- F. ASTM B456 - Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

1.4 SUBMITTALS

- A. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.
- B. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.5 REGULATORY REQUIREMENTS

- A. Conform to ANSI A117.1 and ADA code for access for the handicapped.

1.6 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on product data.

1.7 COORDINATION

- A. Coordinate work with other trades for required blocking in walls.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. American Specialties, Inc. - Product: As scheduled.
- B. Other acceptable manufacturers offering equivalent products.
 - 1. Bobrick - equal.
 - 2. Bradley - equal.
 - 3. McKiney/Parker - equal.
- C. Substitutions: Permitted.

2.2 MATERIALS

- A. Sheet Steel: ASTM A366.
- B. Stainless Steel Sheet: ASTM A167, Type 304.
- C. Tubing: ASTM A269, stainless steel.
- D. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof, and security type.
- E. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.3 FABRICATION

- A. Weld and grind joints of fabricated components, smooth.
- B. Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion. Maintain surfaces without scratches or dents.
- C. Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges. Form bar with 1-1/2 inches clear of wall surface.
- D. Shop assemble components and package complete with anchors and fittings.
- E. Provide steel anchor plates, adapters, and anchor components for installation.

2.4 KEYING

- A. Supply 2 keys for each accessory to Owner.
- B. Master key all accessories.

2.5 FINISHES

- A. Galvanizing: ASTM A123 to 1.25 oz/sq yd. Galvanize ferrous metal and fastening devices.
- B. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- C. Chrome/Nickel Plating: ASTM B456, Type SC 2 polished finish.
- D. Stainless Steel: No. 4 satin luster finish.
- E. Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions.
- B. Verify that site conditions are ready to receive work and dimensions are as indicated on shop drawings.
- C. Verify exact location of accessories for installation.

3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions and ANSI A117.1.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Items indicated as OFCI are Owner Furnished Contractor Installed.

3.4 SCHEDULE

- A. See Drawings (plans and interior elevations) for toilet accessory locations indicated in keynotes, including: Grab bars, mirrors, robe hooks, shower curtain, shower curtain hooks, shower curtain rod, towel bar, soap dispenser, combination paper towel dispenser and waste receptacle, toilet tissue holder, and sanitary disposal units.
- B. Grab Bars: 1 ½ inch diameter Grab Bars with Snap-on Flange Covers. American Specialties Inc. Model No. 3801, Type-01. Stainless steel. Mounting Height to top of horizontal Grab Bar = 33 to 36 inches; and bottom of vertical Grab Bars = 39 to 41 inches. Locations: Unisex Toilet 104 and Unisex Toilet/Shower 112, Lengths 18 inches; 36 inches; and 42 inches.
- C. Wall Mounted Soap Dispenser: Automatic Foam Soap Dispenser. American Specialties Inc. Model No. 20363. Stainless steel. Mounting height = 44 inches maximum to push button or dispensing opening. Locations: Female Locker Room 122; Unisex Toilet 112; Male Locker Room 129; and Unisex Toilet 104. Size 5 ½ inch wide x 10 ¾ inch high x 4 inch deep.
- D. Double Roll Toilet Paper Dispenser: Surface Mounted Dual Roll Toilet Paper Holder with Hood. American Specialties Inc. Model No. 74022-HSM. Satin Finish Stainless steel. Mounting height = 15 inches minimum AFF to bottom of unit below Grab Bars; or 12 inches minimum to bottom of unit above Grab Bars; and 7 to 9 inches to centerline from front of Water Closet. Locations: Unisex Toilet 104, Unisex Toilet/Shower 112, Female Locker Room 122 and Male Locker Room 129; Size 5 ½ inches W x 10 ¾ inches H x 4 inches D.
- E. Combination Paper Towel Dispenser and Waste Receptacle: Semi-recessed Paper Towel Dispenser and Waste Receptacle. American Specialties Inc. Model No. 0469-2. Satin Stainless steel; 800 standard multi-fold or 600 standard C-fold paper towel capacity; 12 Gallon Waste Capacity tumbler lock, 2 inch wall recess. Mounting height = 48 inches maximum to towel dispensing opening. Locations: Unisex Toilet 104, Unisex Toilet/Shower 112, Female Locker Room 122 and Male Locker Room 129; Size 17 ¼ inches W x 56 inches H x 4 inches D.

- F. Double Robe Hook: Surface Mounted Double Robe Hook. American Specialties Inc. Model No. 7345. Satin Stainless Steel; Mounting height = 48 inches maximum in barrier free locations: Located on walls as indicated on drawings.
- G. Mirror: Channel Frame Mirror: American Specialties Inc. Model No. 0620-A. Satin Stainless steel frame; ¼ inch thick Plate glass with No. 1 quality polished, silver coated and hermetically sealed with a uniform coating of electrolytic copper plating. Mounting height = 40 inches maximum to bottom edge of mirror over a lavatory. . Locations: Unisex Toilet 104, Unisex Toilet/Shower 112, Female Locker Room 122 and Male Locker Room 129; Size 24 and 48 inches W x 36 inches H x 5/8 inches D.
- H. Sanitary Disposal: Surface Mounted Sanitary Napkin Disposal. American Specialties Inc. Model No. 0852. Satin Stainless steel. Mounting Height to top of disposal door = 24 to 34 inches. Locations: In each water closet stall in Female Locker Room 122. Size 7 1/2 inches W x 9 1/2 inches H x 4 inches D.
- I. Towel Bar: Heavy Duty Stainless Steel Towel Bar. American Specialties Inc. Model No. 0755-SS18. Satin Stainless Steel; Mounting height = 48 inches: Located in Unisex Toilet/Shower 112, Female Locker Room 122 and Male Locker Room 129 , one for each shower at location shown on drawings. 18 inches long.
- J. Shower Rod: Heavy Duty Shower Curtain Rod. American Specialties Inc. Model No. 1214. Satin Stainless Steel; Mounting height = 74 1/2 inches: Located in Unisex Toilet/Shower 112, Female Locker Room 122 and Male Locker Room 129, one for each shower at location shown on drawings. 1 inch diameter; 36 inches long – field verified.
- K. Shower Curtain: Vinyl Shower Curtain. American Specialties Inc. Model No. 1200-V. 0.008 thick vinyl treated with Macrobiotic KV-33 anti-bacterial, anti-fungal, anti-mildew agent, and flame retardant agents; Located in Unisex Toilet/Shower 112, Female Locker Room 122 and Male Locker Room 129, one for each shower at location shown on drawings. 36 inch opening – 42 inch curtain x 72 inch height.
- L. Shower Curtain Hooks: Stainless Steel Shower Curtain Hooks. American Specialties Inc. Model No. 1200-SHU. Satin Stainless Steel; Located in Unisex Toilet/Shower 112, Female Locker Room 122 and Male Locker Room 129, 7 hooks for each shower curtain.

END OF SECTION



AMERICAN SPECIALTIES, INC.

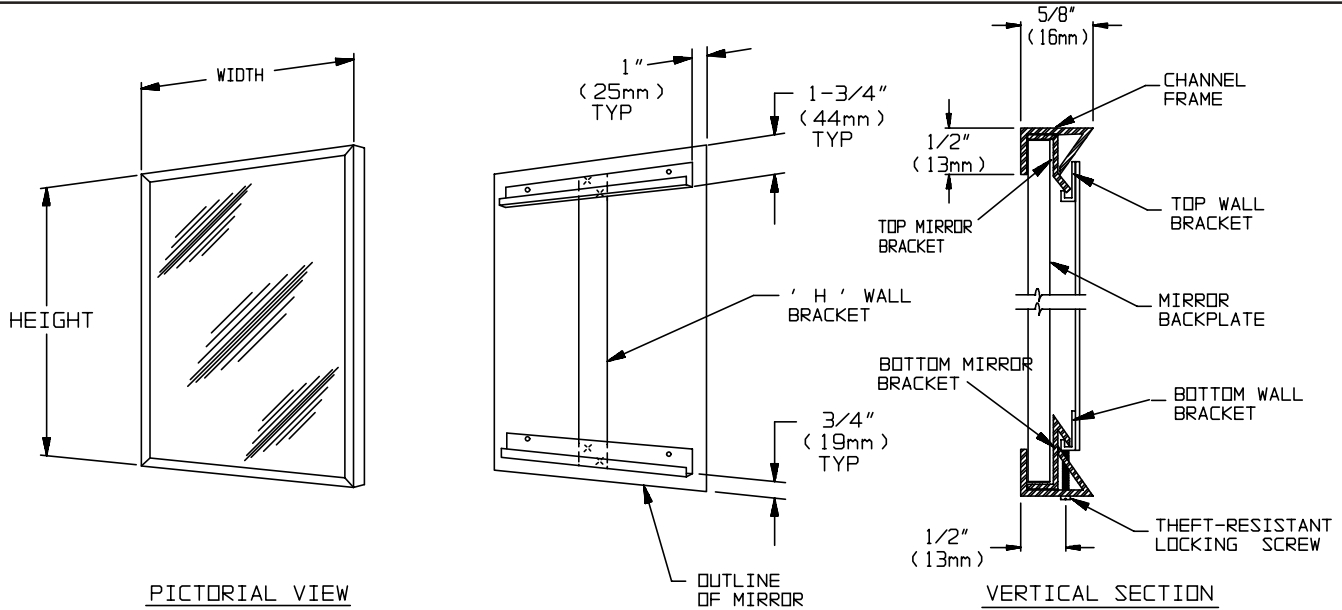
441 Saw Mill River Road, Yonkers, NY 10701 (914) 476-9000
www.americanspecialties.com

MODEL No: 0620

ISSUED: 1-87

REVISED: 4-06

CHANNEL FRAME MIRROR



SPECIFICATION

Channel Frame Mirror shall have frame fabricated of alloy 18-8 stainless steel, type 304, 20 gauge with mitered corners. Mirror glazing shall be ____ (insert glazing option) and shall be warranted for 15 years against silver spoilage. All edges of mirror shall be protected by friction and chafe absorbing fillers. Back of mirror shall be protected by full size shock-absorbing water-resistant filler and full size one piece 20 gauge corrosion protected steel. Top and bottom wall mounting brackets shall be fabricated of 20 gauge corrosion protected steel and shall be spot welded into "H" hanger. Mirror shall be secured to lower bracket with a Philips Pan Head locking screw.

Channel Frame Mirror shall be Model N° 0620-__ (insert glazing option)-__ (note size, W x H) as manufactured by American Specialties, Inc., 441 Saw Mill River Road, Yonkers, New York 10701-4913

MATERIALS

Frame 18-8, type 304, 20 gauge (.036" <91mm> thick) stainless steel. Unitized all roll-formed one-piece construction. Exposed surfaces have N° 4 satin finish. Edges and corners are burr free.

Glass: Standard glazing is N° 1 quality, 1/4" (6.4mm) thick plate/float glass, silver coated and hermetically sealed with uniform copper plating, and warranted against silver spoilage for 15 years. Mirrors meet Federal Specification DD-M-411C, ASTM C1036-91.

Filler: Expanded polyethylene microcell foam sheet material, abrasion resistant and shock absorbing, water resistant, 1/8" inch (3.2mm) total layer thickness.

FABRICATION NOTE FOR SPECIFICATION

Mirrors larger than 21sq. Ft. (1.95m²) are fabricated in two (2) or more sections to provide installation and handling ease.

INSTALLATION

Install "H" wall brackets level and plumb per diagram location using **ONLY** N° 8 or N° 10 Pan Head screws (by others). Hang mirror on brackets and tighten locking screw (N° 6-32F x 3/4" Philips Pan Head, supplied separately taped to mirror back) at bottom (note: this screw should be started prior to hanging mirror on wall bracket). For compliance with ADA Accessibility Guidelines, bottom edge of reflecting surface should be no higher than 40" (1016mm) above finished floor.

GLAZING OPTIONS

Units are supplied with 1/4" (6.4mm) thick plate glass. Other glazing options are available. For a complete description of any other available glazing, see the **MIRROR GLAZING OPTIONS** chart.

Accessory Specialties

AMERICAN DISPENSER

Desert Ray Products

WATROUS inc.



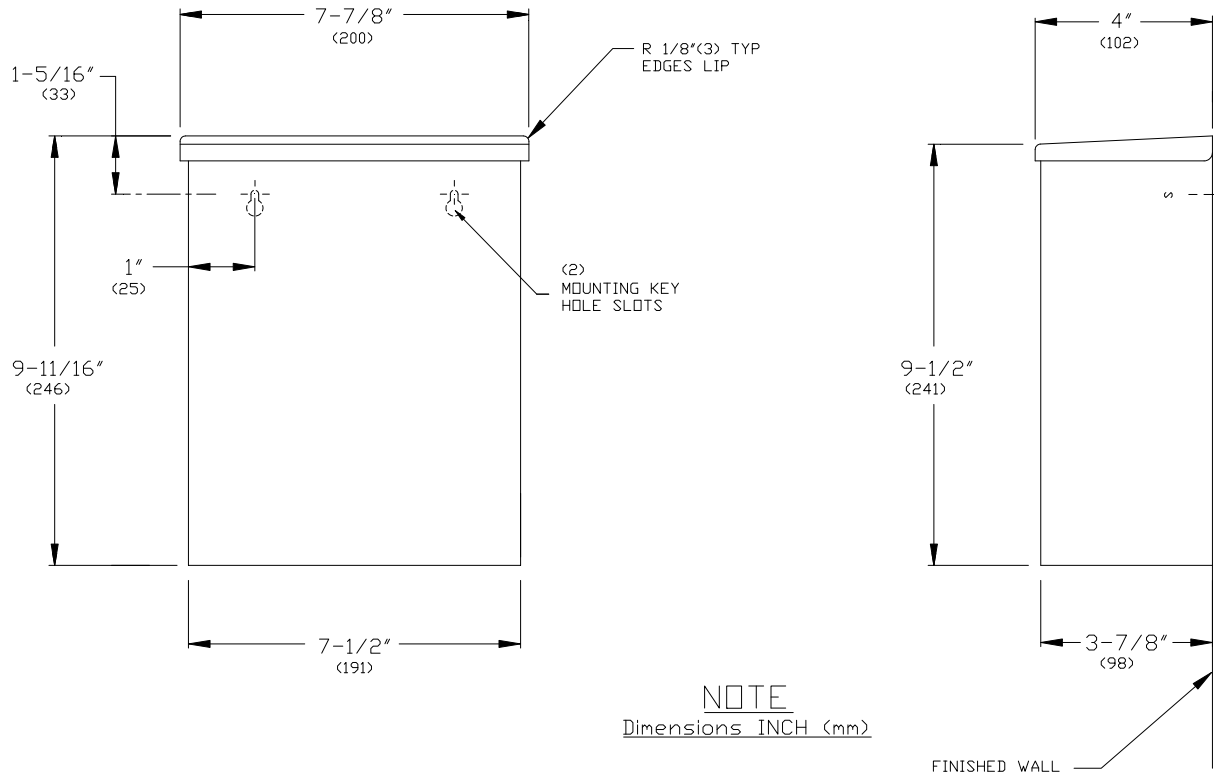
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MODEL №: 0852

ISSUED: 01/87

REVISED: 03/12

SURFACE MOUNTED SANITARY NAPKIN DISPOSAL



NOTE
 Dimensions INCH (mm)

SPECIFICATION

Surface Mounted Sanitary Napkin Disposal shall have top cover door and cabinet of 22 gauge type 304 stainless steel alloy 18-8. All exposed surfaces shall be satin finish and be protected during shipment with PVC film easily removable after installation. Capacity shall be 1.2 gal (4.5L). Top cover is attached to cabinet with a full length 3/16" diameter (Ø4.8) stainless steel multi-staked piano hinge. Structural assembly of body and door components shall be of welded construction.

Surface Mounted Sanitary Napkin Disposal shall be Model № 0852 of American Specialties Inc., 441 Saw Mill River Road, Yonkers, New York 10701-4913

INSTALLATION

Surface mount unit on wall or partition using № 10 self tapping screws (by others). Two (2) mounting holes through back are keyhole slots for ease in hanging unit on pre-installed screws. For compliance with 2010 ADA Accessibility Standards, install unit so that top cover is 44" (1118) MAX above finished floor.

OPERATION

User lifts lid to deposit waste material. Maintenance schedule determines trash removal cycle. Unit is emptied by opening top door and removing wax paper collection bag. Waxed paper liner bags are furnished by others.



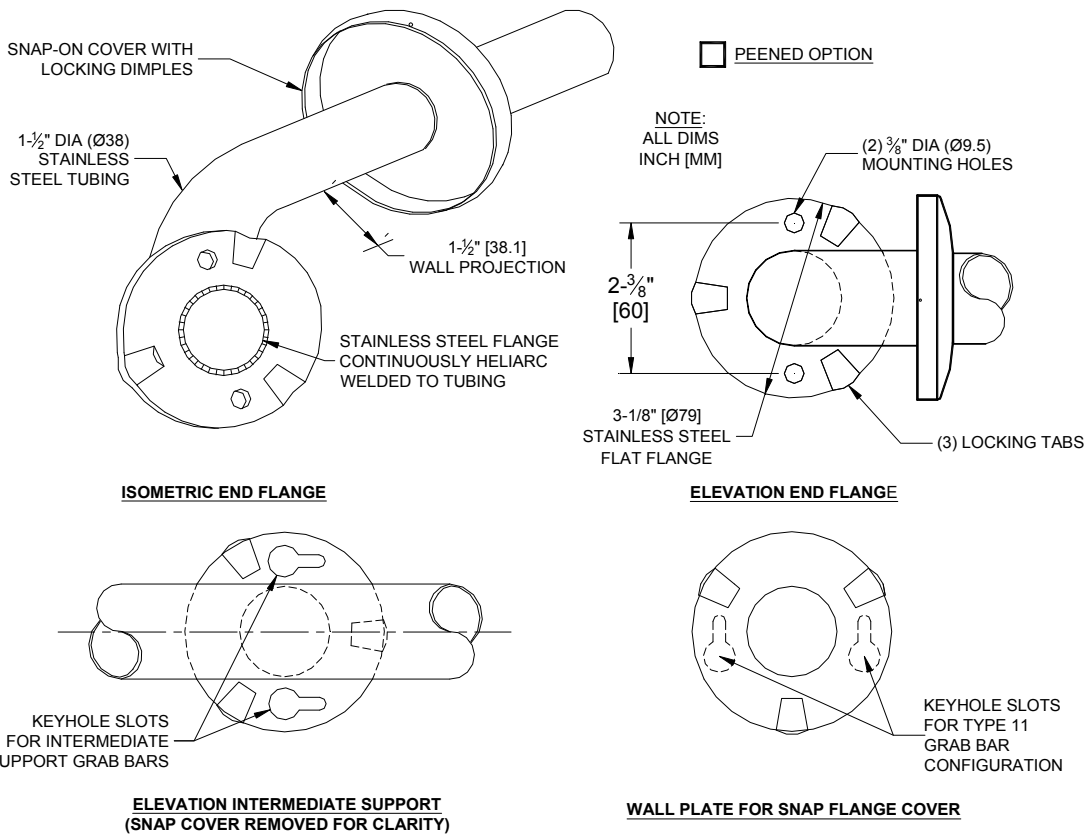
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MODEL №: 3800

ISSUED: 01/87

REVISED: 07 Nov 2012

1-1/2" DIA (Ø38) GRAB BAR SERIES WITH SNAP-ON FLANGE COVERS



SPECIFICATION

Grab Bar with Snap-On Flange Covers for concealed mounting shall be type 304 stainless steel alloy 18-8. Tubing shall be 1-1/2" diameter (Ø38) x 18 gauge [0.048"] (1.2). Snap-on cover shall be 22 gauge [0.03"] (0.8). Flange shall be 1/8" (3) thick and shall be Heliarc welded to tubing with a continuous concealed bead. End flanges shall have two (2) 3/8" diameter (Ø9.5) mounting holes. Center posts (if any) shall have (2) keyhole slots to ease installation access. All exposed surfaces shall have a satin finish and shall be protected during shipment with a plastic bag. For optional non-slip surface add suffix – P (peened).

1-1/2" Diameter (Ø38) Grab bar with Snap-On Flange Covers shall be Series № 3800 of American Specialties, Inc., 441 Saw Mill River Road, Yonkers, New York 10701- 4913

STRENGTH

ASI Grab Bars are designed to meet and exceed ADA requirements as published in CABO/ANSI A117.1 and 2010 ADA Accessibility Standards. Mounting to the wall is a critical part of the system to meet this requirement. To withstand the shear, tension or pullout, and torsion loads generated by the maximum loading, the fastener system must be adequately sized.

INSTALLATION

Use grab bar as template to mark mounting holes locations and pre-drill holes. Install bar using two (2) № 10 self-tapping pan head screws and flat washers (by others) or other fastener system (by others) to suit conditions for each flange. Appropriate anchoring and backing must be provided in accordance with local building codes or as specified on Architects Plans prior to wall finishing. For compliance with 2010 ADA Accessibility Standards install unit so that the top of the grab bar is 33" (840) minimum above finished floor (AFF) to 36" (915) maximum AFF. Anchors are available from ASI and must be specified separately for each grab bar style scheduled (see 3900 series).



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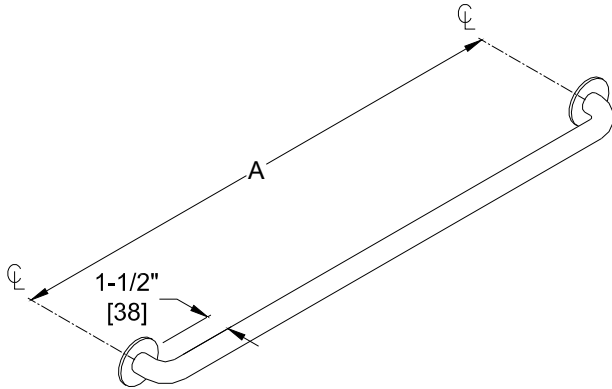
MODEL №: GRABBAR CONFIG

ISSUED: 09/96

REVISED: 03/11

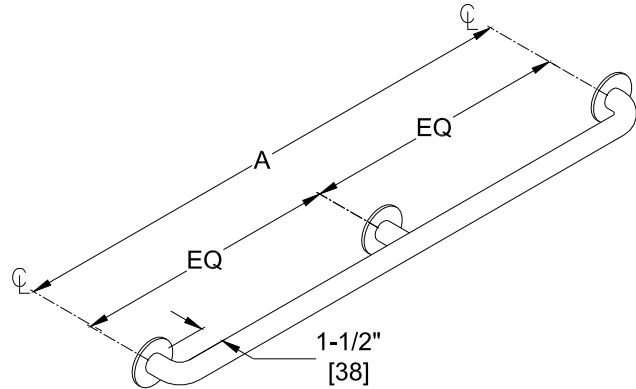
GRAB BAR CONFIGURATIONS (PG 1 OF 3)

TYPE -01



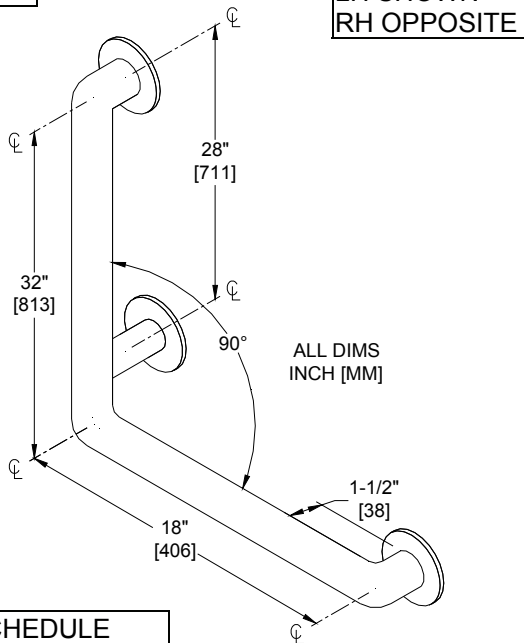
SCHEDULE			
QTY.	DIM. A	QTY.	DIM. A
	12" [305]		36" [914]
	18" [457]		42" [1067]
	24" [610]		48" [1219]
	30" [762]		

TYPE -02



SCHEDULE	
QTY.	DIM. A
	52" [1321]
	54" [1372]
	60" [1524]
	72" [1829]

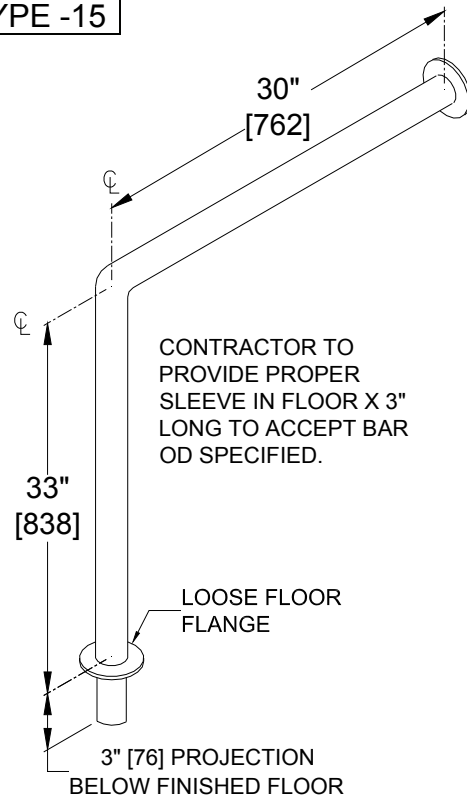
TYPE -04



SCHEDULE	
QTY.	HAND
	LH
	RH

MODEL № MUST SPECIFY
 -LH OR -RH

TYPE -15





AMERICAN SPECIALTIES, INC.

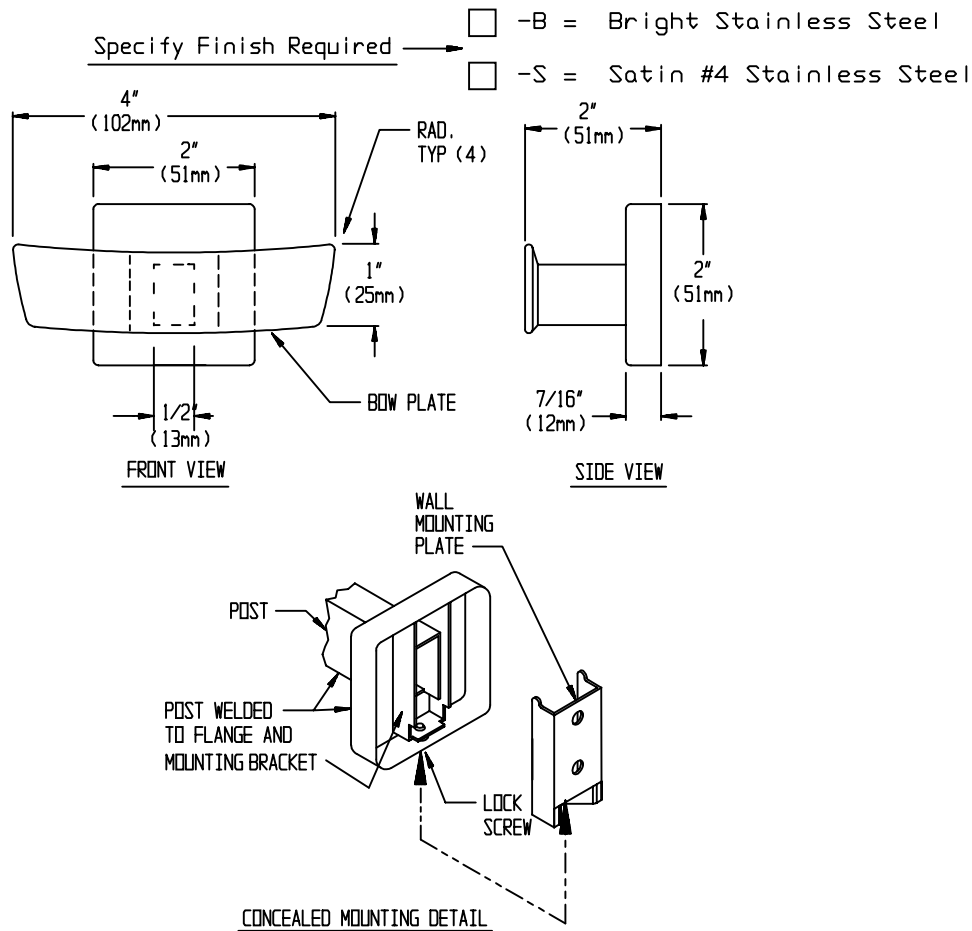
441 Saw Mill River Road, Yonkers, NY 10701 (914) 476-9000
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MODEL No: 7345

ISSUED: 1-87

REVISED: 1-06

DOUBLE ROBE HOOK



SPECIFICATION

Double Robe Hook shall be fabricated of stainless steel alloy 18-8, type 304. Post shall be 1/2" x 1" (13mm x 25mm) rectangular tubing with formed mounting flange and bracket welded on end. Bow plate shall be 14 gauge, 4" x 1" (102mm x 25mm) with radiused corners and internally welded to outer end. Mounting plate shall be included and shall be 18 gauge. A stainless steel setscrew shall be provided on bottom perimeter of flange to lock unit to mounting plate. Surface finish shall be bright or satin as chosen by option and indicated by code suffix.

Double Robe Hook shall be Model N° 7345-B or N° 7345-S of American Specialties, Inc., 441 Saw Mill River Road, Yonkers, New York 10701-4913

INSTALLATION

Surface mount unit on door back or wall using N° 10 self tapping screws (by others) through holes provided in mounting plate into suitable prepared mountings (by others) or other suitable mounting hardware (by others) to suit door or wall conditions. Hang post and flange assembly on mounting plate and tighten setscrew to lock unit to plate. For compliance with ICC/ANSI A-117.1-2003 and ADA Accessibility Guidelines install unit with top of hook 48" (1219mm) maximum above finished floor (MAX AFF) if clear floor forward reach or if clear floor side reach access only is provided or 46" (1168mm) MAX AFF if side reach access over an obstruction (e.g. vanity) with reach depth greater than 10" (254mm) and less than 25" (635mm) is only provided or 44" (1118mm) MAX AFF if forward reach over an obstruction with reach depth greater than 20" (508mm) and less than 25" (635mm) is only provided. For general utility install hook with centerline of mounting plate 68" (1727mm) AFF.

OPERATION

Hook is suitable for robes or clothing and small carry bags.

Accessory Specialties

AMERICAN DISPENSER

Desert Ray Products

WATROUS inc.



AMERICAN SPECIALTIES, INC.

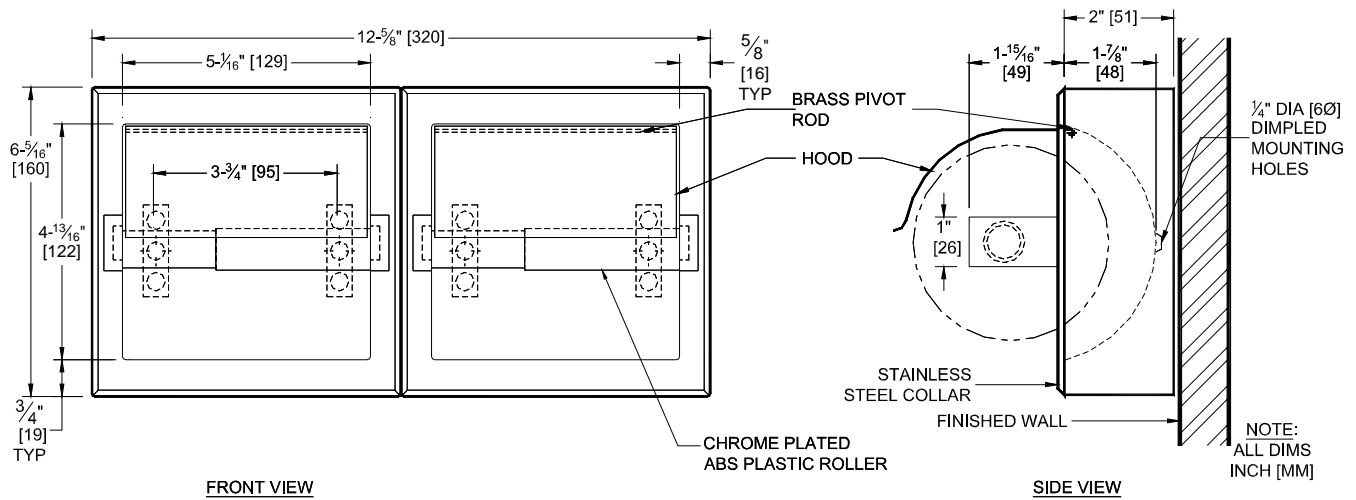
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MODEL No: 74022-HSM

ISSUED: 01-87

REVISED: 12-06

SURFACE MOUNTED DUAL ROLL TOILET PAPER HOLDER WITH HOOD



SPECIFICATION

Surface Mounted Dual Roll Toilet Paper Holder with Hood shall hold and dispense all standard core roll tissue up to 6" diameter (Ø152) roll and shall be fabricated of stainless steel type 304 alloy 18-8. Each outer shell shall have two (2) dimpled holes for dry wall installation. Hoods shall be attached to top of unit with full-length brass pivot rods. Rollers shall be chrome plated high impact resistant ABS plastic and shall be spring-loaded. All exposed surfaces shall be satin or bright finish as chosen by option and indicated by code suffix.

Surface Mounted Dual Roll Toilet Paper Holder with Hood shall be Model N^o 74022-HBSM (or N^o 74022-HSSM) of American Specialties, Inc., 441 Saw Mill River Road, Yonkers, New York 10701-4913

INSTALLATION

For Standard Dry Wall Mounting: Locate unit and transfer hole positions to wall. Drill four (4) 7/32" diameter (Ø5.6) clearance holes through tile and/or wallboard only. Use four (4) N^o 10 stainless steel Philips flat or oval head self-tapping or wood screws (by others) of suitable length to penetrate blocking in wall by approximately 1/2" (13). Tighten screws to hold unit tight against finished wall face.

Optional Method for Dry Wall Mounting: Locate unit and transfer hole positions to wall. Drill four (4) holes appropriate for expansion anchors into masonry substrate. Tap proper expansion anchors (provided by others to suit wall conditions) into wall to be flush with wall face. Use four (4) stainless steel Philips flat or oval head N^o 10AB self-tapping screws (provided by others to suit wall conditions) through dimpled holes at back of shell. Tighten screws to hold unit tight against finished wall face.

For compliance with ADA Accessibility Guidelines install unit with centerline of roller 19" (483) min AFF to 42" (1067) max AFF and 7" (178) min to 9" (229) max from front of commode to centerline of dispenser.

OPTIONS

Optional finish must be specified as either Bright or Satin. Specify finish by adding code suffixes to model number (i.e. 74022-HBSM or 74022-HSSM).

Option	B		S	
Specifies	Bright Finish		Satin Finish	



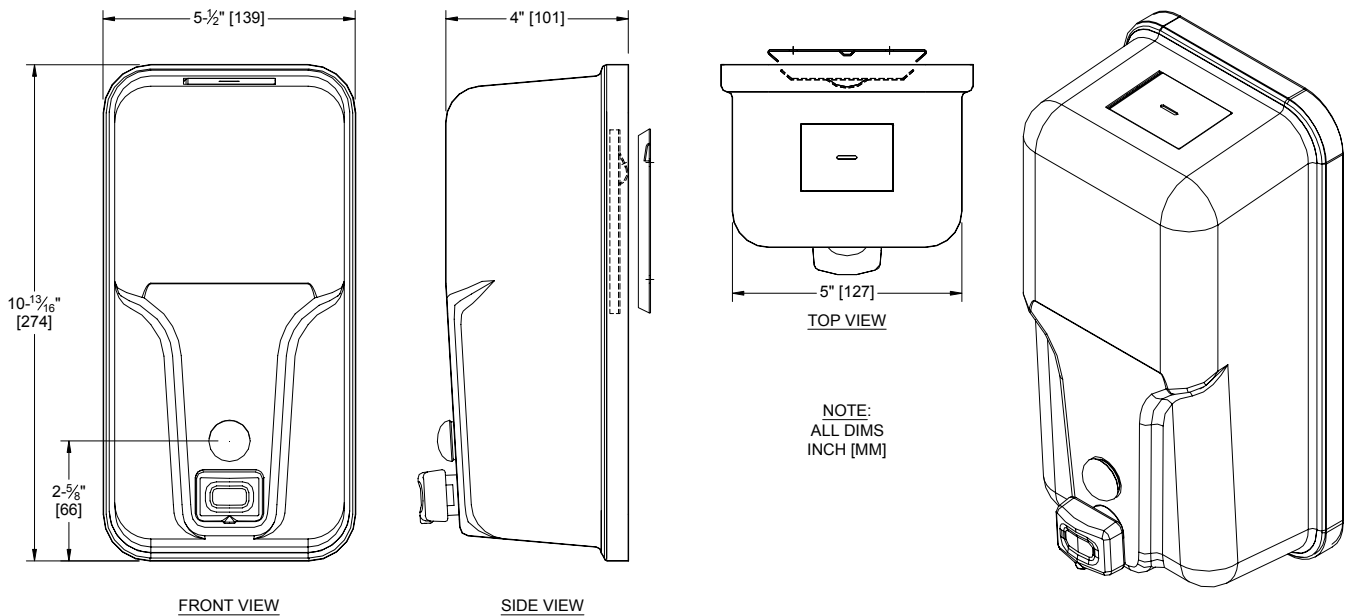
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MODEL №: 20363

ISSUED: 03/10

REVISED:

SURFACE MOUNTED VERTICAL SOAP DISPENSER



SPECIFICATION

Surface Mounted Vertical Soap Dispenser shall hold 57 oz (1.7 liter) of soaps, synthetic detergents and antibacterial soaps containing PCMX and/or Triclosan within the viscosity range of 1 – 5500 cP (MPa•s). Valve shall be constructed of a plastic valve body and push button with stainless steel and plastic internal parts. Valve operation shall comply with ADA Accessibility Guidelines by requiring no more than 5 lbs_f (22.2 Newtons) pressure to actuate and require no grasping or twisting by operator. Unit shall have a hinged stainless steel refill door on top of unit, which is opened with special key provided. Unit shall be fabricated of 22 gage type 304 stainless steel alloy 18-8 (.031" [0.8] thick) with a uniform satin finish over all exposed surfaces.

Surface Mounted Vertical Soap Dispenser shall be Model № 20363 of American Specialties, Inc., 441 Saw Mill River Road, Yonkers, NY 10701-4913

INSTALLATION

Secure concealed mounting plate (supplied) to wall or partition with three (3) self-tapping screws № 8 x 3/4" (M4.5 x 20) pan head (by others) through mounting holes provided in plate into plastic wall anchors or other suitable mounting system (provided by others). Unit is secured to interlocking wedge bracket and locked in place by a locking screw (supplied) installed through hinged refill door. Recommended installation for general utility is 42" (1066) AFF or 6" (152) minimum above washbasin. Fill tank with appropriate viscosity soap to correct level and lock door. Locking door protects soap from inadvertent introduction of contaminants. Retain key provided for future access.

OPERATION

Push button to dispense soap. Unit is refilled through hinged door at top requiring special key (supplied) to open. Soap tank will continue to feed properly until soap level is below valve intake port. Tank supply is replenished manually on cycle determined by maintenance needs.



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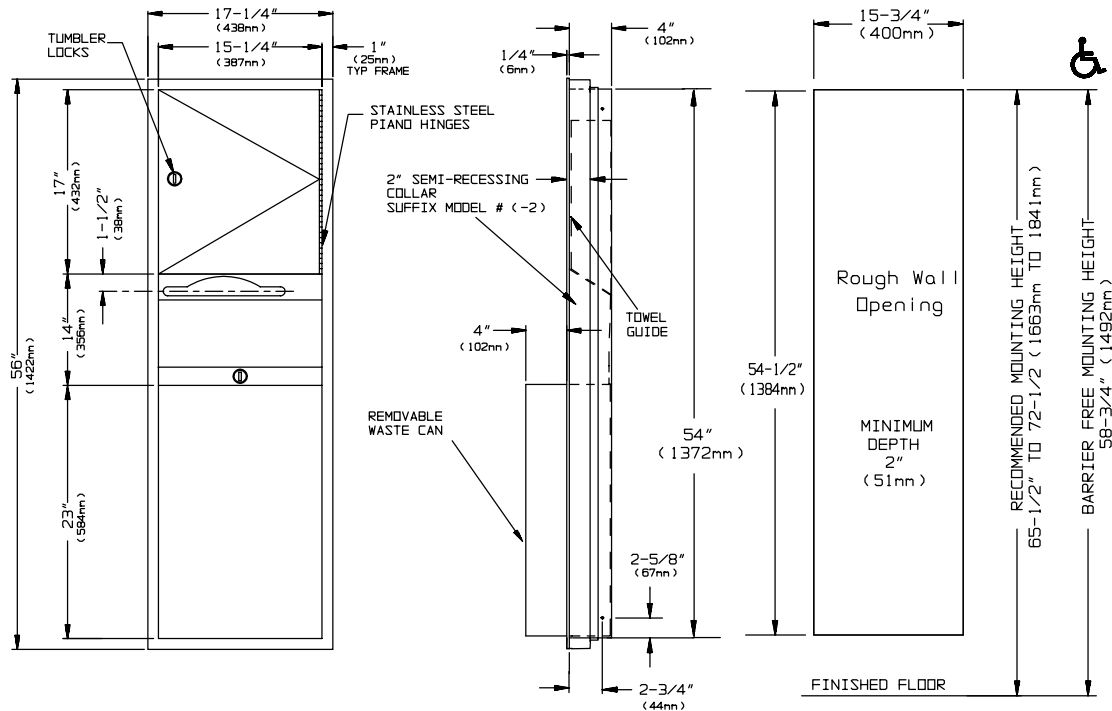
441 Saw Mill River Road, Yonkers, NY 10701 (914) 476-9000

MODEL No: 0469-2

ISSUED: 1-87

REVISED: 9-04

SEMI-RECESSED PAPER TOWEL DISPENSER AND WASTE RECEPTACLE



SPECIFICATION

Semi-Recessed Paper Towel Dispenser and Waste Receptacle shall hold and dispense 800 standard multi-fold or 600 standard C-fold paper towels and shall have a waste capacity of 12 gal (46 litres). Towel dispenser door, frame, waste container and cabinet shall be fabricated of alloy 18-8 stainless steel, type 304, 22 gauge. All exposed surfaces shall be N° 4 satin finish and be protected during shipment with a PVC film easily removable after installation. Towel dispensing slot shall have a fully hemmed-in rolled edge for snag-free dispensing and user safety. Door shall be fabricated in double-pan construction with fiberboard filler and shall be attached to cabinet at side with a full length 3/16" dia. stainless steel multi-staked piano hinge and be held closed with a tumbler lock keyed alike to other ASI washroom equipment. Waste container shall have hemmed edges for safety and shall be retained by a tumbler lock keyed alike. Face trim shall be 1" (25.4mm) wide formed from one piece with no miters, welding or open seams and have 1/4" (6.35mm) square return to wall. Structural assembly of all components shall be of welded construction. Cabinet shall have no exposed fastening devices or spot welded seams. Unit shall be supplied with SR collar to convert to semi-recessed mounting.

Semi-Recessed Paper Towel Dispenser and Waste Receptacle shall be Model N° 0469-2 as manufactured by American Specialties, Inc., 441 Saw Mill River Road, Yonkers, New York 10701-4913

INSTALLATION

Unit is semi-recessed in wall using four (4) N° 10 self tapping screws (by others) through concealed mounting holes provided. For compliance with ADA Accessibility Guidelines, unit should be installed so that towel dispenser slot is 54" (1372mm) maximum above finished floor (AFF) if clear floor side reach access is provided or 48" (1219mm) maximum AFF if clear floor forward reach access only is provided. Note that top of RWO is 3/4" (19mm) below top of unit. SR collar is installed on cabinet prior to mounting in wall recess following procedure described on SR Collar Data Sheet.

Rough Wall Opening (RWO) required is..... 15-3/4"W x 54-1/2"H x 2"D minimum (400mm x 1384mm x 51mm)

OPERATION

Towels are self-feeding until supply is depleted. Unit may be reloaded with a partial load in-place and will continue to feed properly. Waste container is emptied manually on cycle determined by maintenance needs. Locked compartment prevents unauthorized access.

Accessory Specialties

AMERICAN DISPENSER

Desert Ray Products

WATROUS INC.



AMERICAN SPECIALTIES, INC.

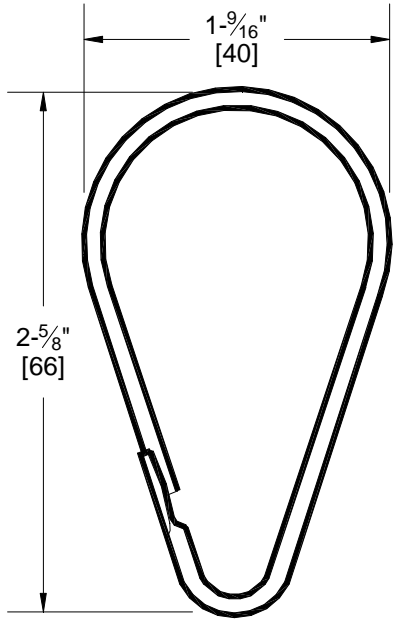
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MODEL No: 1200-SHU

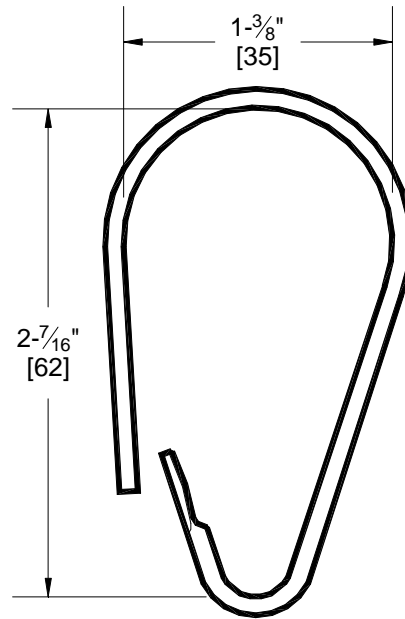
ISSUED: 01-87

REVISED: 01-08

STAINLESS STEEL SHOWER CURTAIN HOOK



HOOK IN CLOSED POSITION



HOOK IN OPEN POSITION

NOTE: ALL DIM'S
ARE INCH [MM]

SPECIFICATION

Shower Curtain Hook shall be fabricated of type 304 stainless steel alloy 18-8. Solid formed wire shall be .098" diameter (Ø2.5) with a bright finish. Hook shall have a formed retainer to hold free end closed and shall accommodate 1" to 1-1/4" diameter (Ø25 to Ø32) curtain rods.

Stainless Steel Shower Curtain Hook shall be Model N° 1200-SHU of American Specialties, Inc., Yonkers, NY 10701-4913

INSTALLATION

Open hook and slip over shower curtain rod (specified separately). Hang shower curtain (specified separately) on small hook. Close hook free end into retainer on hook end.

OPERATION

Grasping hook in both hands, use the thumb of one hand to push the hanger hook in and to one side. Release thumb pressure allowing top hook to bypass and extend over the bottom hook. Slip the hook over the shower curtain rod (specified separately). After hanging shower curtain (specified separately) use thumb pressure to replace the free leg of the hook onto the bottom hook leg-retainer.



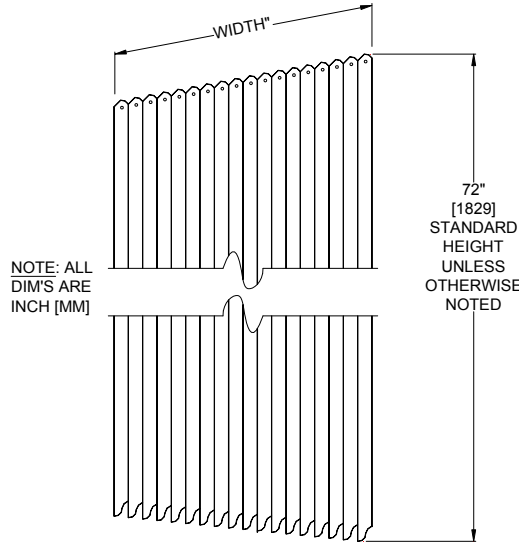
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MODEL №: 1200-V

ISSUED: 01/87

REVISED: 16 Oct 12

VINYL SHOWER CURTAIN



SPECIFICATION

Shower Curtain shall be fabricated of .008" (0,203) thick vinyl treated with Macrobiotic KV-33 anti-bacterial, anti-fungal and anti-mildew agent, and flame retardant agents. Protection agents shall remain in effect after repeated low-temperature mild soap washing and air-drying cycles. Top hem shall be 1-1/2" (38) wide, backing reinforced and heat-sealed above and below grommet row. Bottom hem and vertical edges shall be plain edge. Clear anodized aluminum grommets with 3/8" inside diameter (Ø9.5) shall be machined into top hem at 6-1/2" ± 1/2" (165 ± 13) intervals on centers starting at 1-1/4" ± 1/4" (32 ± 6) from edges. Color shall be white. Pattern is San Suede Pebble Emboss № SS9700. Vinyl curtain shall conform to Federal Specification L-C-780-A, L-C-780-A amendment 2, ASTM G-21-96 for fungal and mildew resistance and CID A-A-2398B.

Vinyl Shower Curtain shall be Model № 1200-Vxx (specify size per chart) of American Specialties, Inc., Yonkers, NY 10701-4913

INSTALLATION

For openings up to 36" (914) wide curtains should be specified an additional 6" (152) wider than opening and 12" (305) wider for openings exceeding 36" (914). Shower curtain should be attached with hooks (not provided, order separately) to rod (not provided, order separately). Curtain hooks Model № 1200-SHU are recommended.

<u>SIZE SPECIFICATION</u>					
OPENING	XX	OPENING	XX	OPENING	XX
36" (914)	42" (1067)	48" (1219)	60" (1524)	72" (1829)	84" (2134)
42" (1067)	60" (1524)	60" (1524)	72" (1829)		

<u>HOOKS COUNT (1200-SHU SUGGESTED) REQUIRED</u>					
CURTAIN WIDTH	HOOK COUNT	CURTAIN WIDTH	HOOK COUNT	CURTAIN WIDTH	HOOK COUNT
42" (1067)	7	60" (1524)	10	84" (2134)	14
		72" (1829)	12		



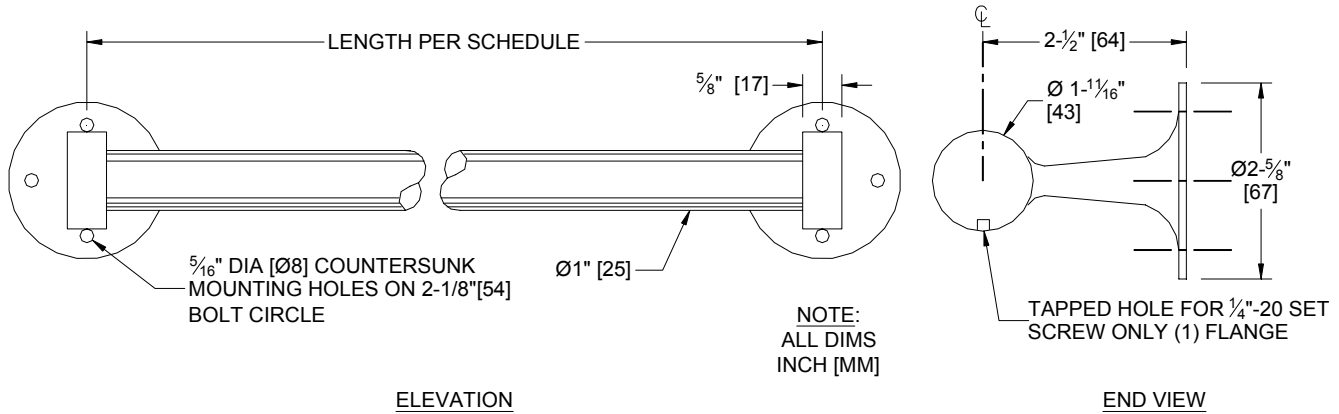
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MODEL №: 0755-SS

ISSUED: 01/87

REVISED: 07/09

HEAVY DUTY STAINLESS STEEL ROUND TOWEL BAR



SCHEDULE OF AVAILABILITY		
Model №:	Length	Quantity
0755-SS18	18" [457]	
0755-SS24	24" [610]	
0755-SS30	30" [762]	

SPECIFICATION

Heavy Duty Stainless Steel Round Towel Bar shall have bar fabricated of alloy 18-8 stainless steel, type 304, 1" diameter (Ø25) x 20 gauge. Support posts shall be fabricated of heavy solid cast brass. Bar and support posts shall have satin finish. Bar tubing shall not turn when set screw (supplied) is engaged in support post and tube.

Surface Mounted Towel Ring shall be Model N^o 0755-SS of American Specialties, Inc., 441 Saw Mill River Road, Yonkers, New York 10701-4913

INSTALLATION

For compliance with ADA Accessibility Guidelines, install unit so that centerline of bar is 48" (1219) above finished floor if clear floor forward reach access is provided or 46" (1168) MAX AFF is side reach over obstruction is only provided (i.e. vanity). Surface mount each support post to wall with three (3) 1/4" diameter (Ø6) oval, pan or round head fasteners of length and type to suit wall conditions (supplied by installer) through mounting holes in posts. To mount on stud walls, provide concealed backing at screw points, secured to studs. Backing must comply with local building codes. If concealed backing is not provided, secure with toggle bolts. To mount on solid walls, use plastic or fiber type (Rawl®) plugs or expansion bolts.



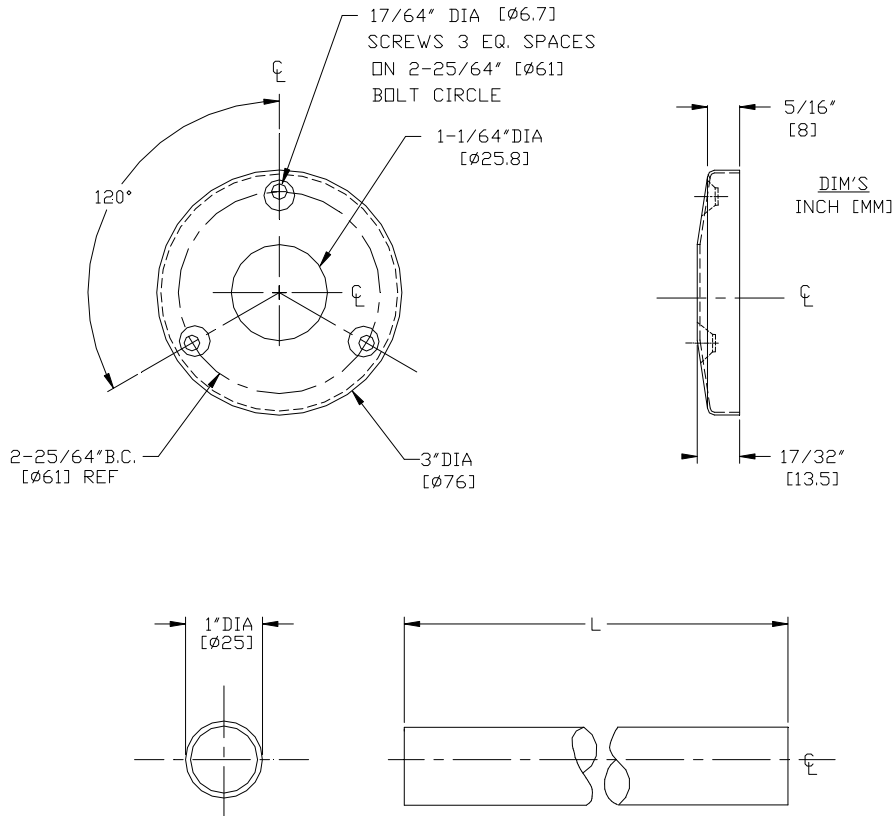
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MODEL №: 1214

ISSUED: 1-87

REVISED: 05 Nov 2013

HEAVY-DUTY SHOWER CURTAIN ROD



SPECIFICATION

Heavy-Duty Shower Curtain Rod with flanges shall be fabricated of type 304 stainless steel alloy 18-8 and shall be protected during shipment with a plastic bag. Tubing shall be 1" diameter (Ø25) x 20 gauge with a satin finish and shall be protected during shipment with a plastic sleeve. Length shall be as specified. Flanges shall have three (3) dimpled 17/64" diameter (Ø6.7) holes to accept either Ø1/4 (M6) or № 10 (M5) oval head screws (provided by others).

Heavy-Duty Shower Curtain Rod with Exposed Mounting Flanges shall be Model No 1214-XXX of American Specialties, Inc., 441 Saw Mill River Road, Yonkers, New York 10701-4913

ORDERING NOTE

Select rod length in inches (e.g. 048, 060, 120) to create Part Spec Order Number (i.e. 1214-060).

INSTALLATION

Install rod in straight section between two (2) mounting flanges with no more than 1/4" (6) total wall clearance. Rods longer than 72" (1829) require ceiling hanger Model № 1224-C18. For use with standard shower curtain model №'s 1200 or 1200-V having 72" (1829) length and standard hooks (Model № 1200-SHU) install unit with rod centerline 74-1/2" (1892) maximum above finished floor (MAX AFF) or 67" (1702) above tub rim to obtain 6" (152) bottom overlap. Seal screw holes in walls under flange to prevent any sprayed water from possibly infiltrating the wall structure.

OPERATION

Rod is held captive by flanges when installed properly. Rod may rotate in flanges if turned by hand. Correctly installed rod and flanges will support specified shower curtain(s) hung on hooks 1200-SHU or others (by others). Rod will bend and pull from flanges if significant body weight is suspended.

SECTION 10 44 00

FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Cabinets.
- C. Accessories.

1.02 RELATED SECTIONS

- A. Section 04 27 00 – Multi & Single Wythe Masonry Assemblies: Roughed-in wall openings.

1.03 REFERENCES

- A. ANSI/NFPA 10 - Portable Fire Extinguishers.
- B. ANSI/UL 711 - Rating and Fire Testing of Fire Extinguishers.
- C. UL 299 - Dry Chemical Fire Extinguishers.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, & location.
- B. Product Data: Provide extinguisher operational features, color and finish, & anchorage details.
- C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.05 OPERATION AND MAINTENANCE DATA

- A. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.06 QUALITY ASSURANCE

- A. Provide units conforming with ANSI/UL 711.

1.07 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 10 for requirements for extinguishers.
- B. Conform to ADA accessibility Guidelines.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Larsens: Architectural Series SS-2409-R3 Cabinet and MP5 Fire Extinguisher.
- B. Potter-Roemer: Equal product.
- C. JL Industries: Equal product
- D. Substitutions: Permitted.

2.02 EXTINGUISHERS

- A. Dry Chemical Type: UL 299, Cast steel tank, with pressure gage; Class 2A-10B: C

2.03 CABINETS

- A. Metal: Formed sheet steel, galvanized; 18 gage thick base metal.
- B. Configuration: Semi-recessed type, size as scheduled.
- C. Trim Type: Stainless steel, rolled edge, returned to wall surface, with 2 1/2 inch projection.
- D. Door: 18 gage thick, reinforced for flatness and rigidity; Stainless steel. Full flush door. ADA approved pull handle.
- E. Cabinet Mounting Hardware: Appropriate to cabinet.

2.04 ACCESSORIES

- A. Cabinet Graphics: Red Die Cut Vertical Letters.

2.05 FABRICATION

- A. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.
- B. Pre-drill for anchors.

- C. Hinge doors for 180 degree opening with two butt continuous piano hinge. Provide roller type catch.
- D. Weld, fill, and grind components smooth.

2.06 FINISHES

- A. Extinguisher: Steel, enamel to red color.
- B. Cabinet Exterior Trim and Door: Stainless steel door and trim.
- C. Cabinet Interior: White baked enamel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, 48 inches from finished floor to handle of cabinet, maximum.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets.

3.03 SCHEDULES

- A. Locations as indicated on drawings.
 1. Larsens SS-2409-R3 Architectural Series Cabinet, Semi-recessed, 2 1/2" projection, stainless steel door with red vertical letters.
 2. Larsens MP5 Fire Extinguisher, 5 lb. capacity, UL rating: 2A-10B:C.

END OF SECTION

SECTION 10 51 13

METAL LOCKERS

1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION

- A. Work Included
 - 1) Furnish all labor, material and equipment required to furnish and install all new metal lockers and benches complete with all accessories, incidentals, fasteners, etc. in accordance with the Drawings, and these Specifications.
- B. Related Work Described Elsewhere
 - 1) Rough carpentry for bases - Section 06 10 00
 - 2) Turn-out lockers - Section 10 99 90

1.03 QUALITY ASSURANCE

- A. Field Measurements
 - 1) Take field measurements to verify or supplement dimensions indicated and be responsible for accurate fit of specified work.
- B. Uniformity
 - 1) Provide each type of metal locker as produced by a single manufacturer, including necessary mounting accessories, fittings, and fastenings.

1.01 SUBMITTALS

- A. Product Data
 - 1) Submit manufacturer's technical data and installation and maintenance instruction for metal locker units.
- B. Samples
 - 1) Submit color samples on squares of same metal to be used for fabrication of lockers.
- C. Shop Drawings
 - 1) Submit shop drawings for metal lockers, verifying dimensions affecting locker installations for each location shown and indicated on drawings. Show lockers in detail, method of installation, fillers, trim, and accessories. Show all interface requirements of adjacent materials. Include locker numbering sequence information.

2 PRODUCTS

2.01 METAL LOCKERS

A. Manufacturers

- 1) Design of new lockers is based on Republic Storage Systems Company, Inc. "Quiet Lockers" for lockers. All lockers shall be specified or an equal approved in advance by the Architect. Lockers proposal shall be accompanied by manufacturers descriptive literature to fully describe the locker proposed with proposed locker clearly noted.

B. Single Tier Lockers in Firefighter Locker Rooms

- 1) Single tier lockers shall be in numbers and dimensions as noted on the Drawing, without legs, and with flat bottoms for sitting on new built-up base. Lockers shall have two (2) interior hat shelves, recessed handle and latch to receive padlock furnished by Owner. Built-in lockers, lockers which abut walls or with ends not exposed to view shall be supplied with manufacturer's standard gauge and panels as required. Free standing exposed to view locker ends shall be supplied with 16 gauge end finishing panels with no exposed bolt heads. Lockers shall have two single prong hooks along side walls and one double prong hook along the back wall.
- 2) Lockers shall be 24" x 21" x 72", free standing, single door.

C. Ventilation

- 1) Ventilation for all doors shall be achieved by manufacturer's standard ventilation without perforations or louvers.

D. Locker Groups

- 1) Lockers shall be arranged in runs or groups as indicated on the Drawings, complete with top and front fillers at corners.

2.02 MATERIALS AND FABRICATION

A. Materials

- 1) Fabricate lockers from cold rolled, steel enameling stock free from buckles, scale and other imperfections and defects capable of taking a high grade enamel finish. Use stretcher leveled steel sheets for doors and panels.
- 2) Use minimum 16 gauge structural steel shapes for reinforcement, securely welded or riveted in place.
- 3) All bolts, nuts, fasteners shall be cadmium plated, chrome plated, galvanized or otherwise metallically rustproofed steel.
- 4) Provide locker units in colors(s) as selected by Architect from manufacturer's standards. Unless otherwise indicated, concealed parts may be manufacturer's standard neutral color.
- 5) Provide one (1) quart of each color paint used for touch-up.

B. Fabrication

- 1) Locker construction
 - a). Fabricate tops, backs, bottoms, of not less than 24 gauge sheet steel with flanges as required. Fabricate each run of lockers as a group, except that each group shall not exceed five lockers wide. Reinforce locker side panels at exposed ends of

locker groups. Seam edges of vertical sheets to provide double thickness of metal at connections. Flange top and bottom edges of lockers on four sides, flange backs on two sides.

- b). Frame and reinforce door frames with formed steel channels at each side having flanged edge to form door stops, formed from minimum 16 gauge steel sheet for hallway lockers, rigidly welded at corners, and with formed channel cross members. Side of frames shall form a continuous door strike.
- c). Fabricate doors from a single sheet of steel, 16 gauge minimum thickness with both vertical edges formed into channel shaped reinforcements, and right angle flange on top and bottom edges.
- d). Fabricate shelves of minimum 24 gauge sheet steel, at lockers, of full width and depth of lockers. Flange back and side edges and form front edge in a channel shape.

2) Fillers and Trim

Fabricate fillers and trim of not less than 18 gauge sheet steel. Provide filler strips at top, bottom and sides. Secure strips to locker body and building construction with continuous strips. Provide fillers or closures at exposed ends of sloping tops. Provide corner fillers as required.

3) Hardware

- a). Hinges shall be not less than 2" high, 5 knuckle, of full-loop, tight-pin style, securely welded to frame and riveted to door.
- b). Hinge leaves shall project into locker interior. Hinges and hinge pins shall be non-removable from exterior. Doors for lockers shall have three (3) hinges for doors over 42" high, at least two (2) hinges for each door 42" high or less.
- c). Recessed Handle and Latch: Manufacturer's standard design consisting of housing to form recess for latch lifter and locking devices; non-protruding latch lifter containing strike; and automatic, prelocking, pry-resistant latch mechanism with latching action as follows:
 - i) Single-tier lockers: Not less than 3-point latching.
- d). Padlocks will be furnished by the Owner.

4) Accessories

- a). Coat hooks shall be of cadmium plated steel with ball points, free of sharp edges and corners, attached with not less than two (2) bolts each.
- b). Each locker shall have a number plate attached near the top of the door. Plates shall be of polished chrome, nickel or aluminum, with bright background and etches, embossed or stamped black numerals not less than 1/2" high. Number lockers as directed.
- c). Provide continuous sloping tops, where noted, not less than 20 gauge sheet steel, approximately 25° pitch, in lengths as long as practicable but not less than four (4) lockers. Provide closures at ends. Finish to match lockers.
- d). Provide filler panels as required, of not less than 18 gauge steel sheet, factory-fabricated and finished to match locker units.

5) Finish

- a). All metal parts and surfaces, except bright metal hooks and number plates, shall be bonderized and given a factory applied baked-on enamel finish. Finish must

withstand a rigid hammer test without flaking or chipping. Colors of finish shall be as selected by the Architect from manufacturer's standard color range.

2.03 LOCKER BENCHES (IN MEN'S, WOMEN'S LOCKER ROOMS AND UNISEX TOILET/SHOWER ROOM 112)

- A. Locker benches shall be as manufactured by Republic Storage Systems Co., Inc. or an equal approved in advance by the Architect.
- B. Locker benches shall be 9-1/2" wide by full 1-1/4" thick laminated maple hardwood with all corners rounded and sanded, of lengths as noted, with two coats of manufacturers clear finish on tops and edges, and one coat on bottom. Mount tops on pedestals consisting of 1-1/4" o.d. steel tubing with 10 gauge steel flanges welded to each end. Overall height of bench shall be 17-1/2" Space bases not more than 6'-0" apart. Finish bases same color as lockers.

3 EXECUTION

3.01 INSPECTION

- A. Examine all work in place on which specified work is in anyway dependent to assure that conditions are satisfactory for the installation of specified work. Report defects which may influence satisfactory completion of specified work. Absence of such notification will be construed as acceptance of work in place.

3.02 PREPARATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication of special components, when possible, to ensure proper fittings of work. However, allow for adjustment and fitting of trim and filler panels wherever taking of field measurements before fabrication might delay work.

3.03 INSTALLATION

- A. General
 - 1). Install metal lockers at locations shown in accordance with manufacturer's instructions for plumb, level, rigid, and flush installation.
- B. Metal Lockers
 - 1). Secure rigidly to the base and wall. Bolt lockers securely to the wood base or wood sleeper in concrete base. Bolt adjacent locker sections together. Space fastenings about 12" o.c. to secure each locker to base and apply through back-up reinforcing plates where necessary to avoid metal distortion. Conceal fasteners insofar as possible.
 - 2). Install formed metal trim to close off ends of lockers, to close joints between groups of lockers at internal corners, to close joints between ends of locker runs and abutting walls, and to close top space between adjacent lockers at internal corners. Install trim, metal base, sloping top units, and metal filler panels where indicated, using concealed fasteners to provide flush, hairline joints against adjacent surfaces.

- 3). At completion, adjust all doors to operate freely without sticking or binding, and to close tightly. All mechanisms shall be in good operating condition.
- 4). Touch-up marred finishes, but replace units which cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

C. Locker Benches

- 1). Anchor and bolt locker benches securely to concrete floors, plumb and level.

3.04 CLEANING UP

- A. Wash and clean all exposed surfaces as required to remove all surface contamination. Touch up all areas of damaged paint finish to match adjacent surfaces.

END OF SECTION

SECTION 10 99 90

MISCELLANEOUS SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes Flag Pole, Ceiling Access Panels; Turn Out Gear Lockers; Dedication Plaque, Knox box and Barrier Free Parking Signs.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate component locations, dimensions, details of blocking and attachment, and anchors.
- B. Product Data: Submit data on Product, and accessories.

1.3 CLOSEOUT SUBMITTALS

- A. Operating and Maintenance Data.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with the 2015 Michigan Building Code.

PART 2 PRODUCTS

2.1 MISCELLANEOUS SPECIALTIES

- A. Manufacturers:
 - 1. Provide product specified in individual components specification.
 - 2. Substitutions: Permitted.

2.2 FLAG POLE

- A. Furnish and install one (1) flagpole in the location shown on Drawings. Flagpole shall be manufactured by Concord Industries, Inc., American Flagpole Equipment Company, Poletch Co., Inc. or approved equal. Flagpole shall be ground set, continuous or cone tapered seamless aluminum flagpoles 40' high above the ground, having minimum diameters of 6" at butt, 3½" at top, and minimum wall thickness of .188". Provide a 6" diameter aluminum ball at top, revolving aluminum truck with double sheaves, two aluminum cleats, two (2) sets of 5/16" No. 10 nylon braided rope halyards having bronze center and two (2) chrome swivel snaps for flags. Provide standard aluminum base at bottom of poles. Finish all exposed aluminum surfaces with a fine satin bronze colored aluminum finish.

- B. Furnish metal foundation tubes and copper ground rods to Concrete Trade for setting. Set the poles in the foundation tubes, center with fixed metal wedges at bottom and align plumb with loose metal wedges at top. Fill the space between the pole and the tube with sand, packed in place, fill the top portion with waterproof cement mortar, and seal with caulking compound.

2.3 CEILING ACCESS PANELS

- A. Furnish and install access panels in ceiling where noted, Milcor "Style M Flush Panel Door", fabricated of factory prime painted steel, equipped with screw driver operated locks, 20 inch x 30 inch size.

2.4 TURN OUT GEAR LOCKERS

- A. Provide and install wall mounted turnout gear lockers as shown on drawings and as manufactured by Geargrid Storage Systems, Division of Mid-Minnesota Wire and Manufacturing. Inc. Phone: 1-888-643-6694 or 1-612-464-4468. Contact: Robert Foht.
- B. Wall mounted lockers shall be 20 inch wide x 20 inch deep x 72 inch tall, with adjustable wire shelves (3 inch increments), with electrostatic TGIC powder coating, in manufacturer's standard color, as selected by Architect/Owner.
- C. Frames shall be heavy duty 1 ¼ inch steel tubing, with ¼ inch cold rolled wire side and back grids at 3 inch on center. Shelves shall be ¼ inch cold rolled wide, with 20 gauge cold rolled metal name plate.
- D. Provide 3 apparel hooks for each locker, personalized name plate. Horizontal hanging rod, and coat drying hanger; for each locker.
- E. Securely mount units to concrete block walls at 12 inches minimum clear above floor.
- F. Substitutions: Permitted.

2.5 BUILDING DEDICATION PLAQUE

- A. Provide 24" x 36" cast bronze plaque with leatherette texture oxidized background with polished letters. Plaque shall be beveled edge and shall have thereon the following:
 - Township Board Members
 - Fire Department Chief and Deputy Chief
 - Architects
 - Contractor
 - Date
 - Building Name
- B. Manufacturer: Ark Ramos Signage System, Border 515 with #3 mounting.

2.6 KNOX BOX

- A. Provide (1) one commercial, surface mounted KnoxBox.

- B. Model 3261, color to be Dark Bronze.
- C. Install knock box within three feet of the principle main entrance door.

2.7 BARRIER FREE PARKING SIGNS

- A. Provide and install Barrier Free Parking signs where indicated on drawings, all in accordance with the 2015 Michigan Building Code, Americans with disabilities Act – Accessibility Guidelines, and ANSI – A117.1-2003 – Accessible and Usable Buildings and Facilities. Signs shall be complete with concrete foundation, steel post, symbol of compliance, and “Van Accessible” indication.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify surfaces and internal wall blocking are ready to receive work and opening dimensions are as indicated on shop drawings or instructed by manufacturer.

3.2 INSTALLATION

- A. Secure units level and plumb.

END OF SECTION

SECTION 11 00 00

EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section describes miscellaneous equipment items, as shown on the equipment and furnishing plans.
- B. Only items with a specification in Division 11 are included in this contract.

1.2 RELATED SECTIONS

- A. Section 11 31 00 – Appliances are included in this contract.

1.3 SUBMITTALS

- A. Product Data: Owner shall submit data on equipment, and accessories, or provide access to these items, if electrical characteristics or exact dimensions are required.

PRODUCTS

1.4 EQUIPMENT

- A. Manufacturers:
 - 1. As indicated in each component specification
 - 2. Substitutions: Not permitted

1.5 COMPONENTS

- A. Self-Contained Breathing Apparatus System: MAKO Stationary Fill Station Model SCFS3, 38 inch width, 66 inch height and 23 ½ inch depth, 15 hp, 3 phase with Breathing Air Module Model BAM07H, 4 stage 6,000 psi, 50” width, 65 ¼ inch height and 31” depth and 6,000 psi DOT/UN Cascade System with cylinders, wall mounting brackets, connector & filler hoses and self-venting regulator option. Local representative is Breathing Air systems, 8855 E. Broad St., Reynoldsburg, OH 43068. Phone: 800-937-2479.

EXECUTION

1.6 INSTALLATION

- A. Set and adjust units level and plumb, connect to utilities and make units operational.
- B. Activate units to confirm correct operation.

END OF SECTION

SECTION 11 31 00

APPLIANCES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes a Washer-Extractor, Dishwasher, Gas Range, Vented Range Hood, Refrigerators, and Washer/Dryer.
- B. Section includes set-up and installation of appliances supplied by Owner, designated as OFCI (Owner Furnished Contractor Installed), in the specification.
- C. Final Owner approval of specified appliances is required, prior to ordering.

1.2 SYSTEM DESCRIPTION

- A. Equipment: Conform to applicable code for UL approval.

1.3 SUBMITTALS

- A. Product Data: Submit data on equipment, and accessories.
- B. Manufacturer's Installation Instructions: Submit manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit relevant instructions.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with the 2015 Michigan Building Code.

PART 2 PRODUCTS

2.1 RESIDENTIAL EQUIPMENT

- A. Manufacturers:
 - 1. As indicated in each component specification.
 - 2. Substitutions: Permitted unless otherwise noted in description.
 - 3. Local representative for kitchen appliances is Bill & Rod's Appliance, Inc., 15870 Middlebelt Road, Livonia, MI. Phone: 734-425-5040 ext. 6221.

2.2 COMPONENTS

- A. Washer-Extractor: Located in Laundry/Work Room No. 127. Furnish and install a Washer-Extractor as shown on drawings. Washer-Extractor shall be as manufactured by UniMac-

Alliance Laundry Systems, two-speed, 480/277 volt, 60 cycle, 3 phase. Local representative is Universal Laundry Machinery, 38700 Webb Drive, Westland, MI 48185. Phone: 800-825-7787.

- B. Dishwasher: Model KitchenAid KDFE204KPS, 24 inch, Stainless Steel Dishwasher with PrintShield Finish, Eco Series. 39 Decibel Level; Stainless Steel Tub; 23 7/8 inch width; 33 5/8 height; 24 1/2 inch depth; 120 volt; 60 Hz; 15 or 20 amp fused electrical supply.
- C. Gas Range: Model RISE JGRP536HL with Chrome Infused Griddle. Stainless steel with JennAir Culinary Center feature and CustomClean with automatic lock. Electronic Ignition and 18,000 BTU dual-stacked PowerBurner. 36 inch width; 38 3/4 height; 24 inch depth
- D. Vented Range Hood: Model Broan E60000 Series, Brushed type 430 Stainless Steel, 24 inch depth, 48 inch width, 1200 cfm blower, 3 -50 watt GU10 Halogen lights, 3 speed rotary control, type 304 stainless steel baffle filters, removable grease tray, Heat Sentry automatically adjusted blower speed, UL listed for damp locations when installed on a GFCI circuit; Vented, wall exhaust with Wall Extension, Stainless Steel; Stainless steel flue cover.
- E. Three (3) Refrigerators in Kitchen No. 131 and one (1) Refrigerator in Kitchenette No. 105: GE Energy Star 27.7 Cu. Ft. fingerprint resistant stainless steel French-Door Refrigerator. Model No. GFE28GYNFS. In-door ice maker for cubed/crushed ice, external controls with temperature display, child lock and door alarm. 35 3/4 inch width; 70 1/2 inch height; 36 1/4 inch depth.
- F. One (1) Refrigerator in Training Room No. 114: GE 21.9 Cu. Ft. fingerprint resistant stainless steel Top-Freezer Refrigerator. Model No. GTS22KYNRFS. Upfront temperature controls. 15.25 Cu. Ft. fresh food capacity and 6.68 Cu. Ft. frozen food capacity. 32 3/4 inch width; 66 3/8 inch height; 34 1/2 inch depth.
- G. Residential Washer and Dryer (OFCI) in Laundry Room No. 110: Furnished by Owner and installed by Contractor.
- H. Residential Stack Washer/Dryer in Laundry/Work Room No. 127: Speed Queen Model LTEE5ASP175TW01 and LTGE5ASP115TW01. Energy Star Qualified with Electronic Homestyle Controls. Stacked 26.875 inch width; 78.7 inch height; 27.73 inch depth.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify openings and utility services are ready to receive work and opening dimensions are as indicated on shop drawings and instructed by manufacturer.

3.2 INSTALLATION

- A. Set and adjust units level and plumb, connect to utilities and make units operational. Activate units to confirm correct operation.

END OF SECTION

SECTION 12 00 00

FURNISHINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section describes miscellaneous furnishings, as shown on the First Floor Plan and Enlarged Floor Plan.
- B. All furnishings shown on the First Floor Furnishings Plan, are not-in-contract unless noted otherwise and will be provided by Owner.
- C. Only items with a specification in Division 12 are included in this contract.
- D. Other furnishings that may not be shown on the drawings, are not-in-contract.

1.2 RELATED SECTIONS

- A. Section 12 20 00 – Window Treatments.
- B. Section 12 35 30 – Manufactured Casework

1.3 SUBMITTALS

- A. Product Data: Owner shall submit data or provide access to all furnishing requiring coordination with work of this contract.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 12 20 00
WINDOW TREATMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes manual roller shade and operating hardware.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate method of attachment and anchorage. Indicate locations for operating controls.
- B. Product Data: Submit data indicating physical and dimensional characteristics, operating features, and color.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with three years documented experience.

PART 2 PRODUCTS

2.1 ROLLING SHADES

- A. Manufacturers:
 - 1. Hunter Douglas: RB 500+ Manual Roller Shade (Basis of Design).
 - 2. Levelor Contract: www.levelorcontract.com.
 - 3. Bali: Equivalent product.
 - 4. Substitutions: Permitted.

2.2 COMPONENTS

- A. FABRIC
 - 1. PVC-coated fiberglass fabric color to be selected by architect.
- B. Control Systems:
 - 1. Clutch Operated: Chain-driven operator capable of lifting up to 20 pounds of weight with a maximum allowable pull force of 10 pounds.
 - 2. Chain anchor devices to be complaint with WCMA safety standards A100.1.1-2010 and must prevent the clutch system from moving the roller shade through lowering and raising if not properly installed as specified in ANSI Standard Section 6.5.2.
 - 3. Components to be maintenance-free from adjustments or lubrication for trouble -free lifetime operation.

- C. Bottom Bar: Industry standard sealed hembar with weight sewn into pocket providing for tracking adjustments and uniform look of hanging fabric panel; RB500 Bottom Bar – color to be selected by architect.
- D. Mounting Hardware
 - 1. Manufacturer's standard duty brackets constructed of hardened 1/8" thick steel to support full weight of shade with bracket and screw holes covers to provide uniform look. Locking mechanism on bracket adapter provides for a secure installation and removal of the shade.
- E. Fascia
 - 1. L-Shaped removable aluminum extrusion valance that attaches to brackets and conceals roller shade. Fascia at the bottom enclosure must allow a maximum 1" gap to allow fabric to come through. Exposure underneath greater than 1" is not to be accepted.
- F. Blockout system
 - 1. Extruded aluminum side channel with concealed mounting brackets. Bottom bar with Nylon wood pile to prevent light leakage.

2.3 FABRICATION

- A. Fabricate blinds to fit within openings with uniform edge clearance of 1/8 inch.
- B. At openings requiring multiple blind units, furnish separate blind assemblies with space of 1/4 inch between assemblies, occurring at window mullion centers.
- C. Determine sizes by field verification.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive the Work.
- B. Ensure that structural blocking and supports are correctly placed.

3.2 INSTALLATION

- A. Installation shall comply with manufacturer's specifications, standards and procedures.
- B. Adequate clearances shall be provided to permit unencumbered operation of shade and hardware.
- C. Secure in place with concealed fasteners.

D. Adjust blinds for smooth operation.

3.3 SCHEDULE:

A. Exterior windows:

1. Window in Captain's Office 121.
2. Windows in Training Room 114.
3. Windows in Kitchen 131 and Dining/Day Room 130.
4. Windows in Deputy Chief's 109 and Chief's Office 107.
5. Windows in Kitchenette 105.
6. Windows (3) in Reception 102.
7. Windows in Office 115, 116, 117, 118, 119 and 120.

END OF SECTION

SECTION 12 35 30

MANUFACTURED CASEWORK

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes shop fabricated manufactured cabinet units with counter tops as specified 06 61 00 Solid Surface Fabrications.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate casework locations, scale plans, elevations, and clearances required.
- B. Product Data: Submit data on component profiles, sizes, assembly methods, and schedule of finishes.
- C. Samples: Submit two panels, 4 x 4 inch in size illustrating cabinet and counter top finish.
- D. Samples: Submit hardware samples.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with KCMA (Directory of Certified Cabinet Manufacturers) - Certification Program.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Install after interior temperature and humidity are controlled and stabilized.

PART 2 PRODUCTS

2.1 MANUFACTURED CASEWORK

- A. Manufacturers:
 - 1. Merillat Essentials: Classic Collection, Maple, color - Sable as selected by Architect.
 - 2. American Woodmark
 - 3. Aristokraft Cabinets
 - 4. Kraftmaid Cabinetry Inc.
 - 5. Triangle Pacific Corp.
 - 6. Substitutions: Permitted.

2.2 COMPONENTS

- A. Hardware: Manufacturer's standard.
- B. Shelf Standards and Rests: Manufacturers Standard.
- C. Drawer and Door Pulls: Antique Brass or required to match existing, as approved by Owner and Architect.
- D. Catches: Manufacturers Standard.
- E. Hinges: Manufacturers Standard Offset pin.

2.3 FACTORY FINISHING

- A. Exposed To View Surfaces: Seal and varnish.
- B. Interior Surfaces: Plastic Laminate of color and pattern as selected.
- C. Counter Tops: Solid Surface Fabrications as indicated on drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify adequacy of backing and location of mechanical and electrical outlets.

3.2 PREPARATION

- A. Install supplementary support framing.

3.3 INSTALLATION

- A. Set and secure casework in place rigid, plumb, and level.
- B. Provide openings for plumbing fixtures, appliances, and other fixtures and fittings.
- C. Use fixture attachments at concealed locations for wall mounted components.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units and counter tops.
- E. Carefully scribe casework against other building materials, leaving gaps of 1/32 inch maximum. Use filler strips not additional overlay trim for this purpose.
- F. Secure cabinet and counter bases to floor using appropriate anchorage.
- G. Adjust moving or operating parts to function smoothly and correctly.

3.4 SCHEDULE:

- A. Copier /Printer 103: Base Cabinets, Wall Cabinets, as indicated on drawings, sheet A-400 and A-401.
- B. Kitchenette 105: Base Cabinets, Wall Cabinets, as indicated on drawings, sheet A4-00 and A-401.
- C. Male Locker Room 129: Vanity Base Cabinets, as indicated on drawings, sheet A-400 and A-401.
- D. Female Locker Room 122: Vanity Base Cabinets, as indicated on drawings, sheet A-400 and A-401.
- E. Kitchen 131: Base Cabinets, Wall Cabinets, Full Height Cabinets, as indicated on drawings, sheet A-400 and A-401.
- F. Training Room 114: Base Cabinets as indicated on drawings, sheet A-400 and A-401.

END OF SECTION

SECTION 01 56 39

TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1. SUMMARY OF WORK

- A. Section includes:
 - 1. Protective measures for tree and roots
 - 2. Grading and filling around trees
 - 3. Excavation around trees
 - 4. Repair and replacement of trees

- B. Related Sections:
 - 1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
 - 2. Section 31 10 00 - Site Clearing
 - 3. Section 31 20 00 - Earthmoving
 - 4. Section 31 25 00 - Erosion and Sedimentation Controls
 - 5. Section 33 11 00 - Water Utility Distribution Piping
 - 6. Section 33 30 00 - Sanitary Sewerage Utilities
 - 7. Section 33 40 00 - Storm Drainage Utilities

1.2. Referenced Standards

- A. All work under this section shall be completed in general conformance with construction plan details, all Local Municipality / County standards; or per applicable Michigan Department of Transportation's (MDOT) standard specifications for construction, standard plans, construction manual, quality assurance procedures manual (current editions), and as specified herein.

1.3. DEFINITIONS

- A. Protective Barrier: A temporary device installed during the full period of construction to protect existing vegetation from damage or disturbance.

- B. Damage: Physical change to the site or its vegetation caused by equipment, materials, labor or grading operations, which has occurred after on site work operations, have commenced.

- C. Drip Line: The outer perimeter of the plant canopy projected on the ground plane.

- D. Existing Vegetation: Any existing tree, shrub, or ground cover presently on site.

- E. Protection: Means of protecting existing site vegetation from trespass, damage, or disturbance by use of barriers or other means necessary to prevent trespass, damage, or disturbance.

1.4. QUALITY ASSURANCE

- A. Arborist Qualifications: If necessary, engage a qualified arborist to advise on the following work:
 - 1. Remove branches from trees that are to remain if required.
 - 2. Recommend procedures to compensate for loss of roots and perform initial pruning of branches and stimulation of root growth where removed to accommodate new construction.
 - 3. Recommend procedures for excavation and grading work where adjacent to established plants.
 - 4. Perform tree repair work for damage incurred by new construction.

5. Replace damaged plant materials on an equal basis as determined by landscape architect and arborist.

1.5. PROJECT CONDITIONS

- A. Temporary Protection: Provide temporary fencing, barricades or other suitable guards located outside dripline to protect trees and other plants that are to remain from damage.
- B. Root Systems: Do not store construction materials, debris or excavated material within drip line of trees to remain. Do not operate, park, or permit vehicles within the protected drip line of trees to be saved. Restrict foot traffic to prevent excessive compaction of soil over root systems within drip line.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Barriers: Wood and wire snow fence, plastic construction barrier fence, or chain link fence fabric minimum 4'-0" high; in accordance with municipality standards / details.
 1. Support barriers with 6'-0" steel fence posts spaced not more than 8'-0" on center.
- B. Tree Pruning Compound: Waterproof, antiseptic, elastic and free of kerosene, coal tar, creosote, and other substances harmful to plants.
- C. Drainage Fill: Selected stone or gravel, graded to pass a 3-inch sieve and retained on a 1-inch sieve.
- D. Topsoil: Approved stripped clean, non-toxic, organic topsoil (refer to section 32 91 19.13 for requirements.)

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Do not commence clearing operations prior to installing protective barriers.
- B. Protect tree root systems from damage due to noxious materials caused by run-off or spillage during mixing, placement, or storage of construction materials. Protect root systems from flooding, eroding or excessive wet conditions resulting from dewatering operations.
- C. Do not allow fires under or adjacent to trees or other plants that are to remain.
- D. Remove only branches from trees that are to remain, to clear new construction.
 1. Where directed by the Owner's Representative, extend pruning operation to restore natural shape of entire tree.
 2. Cut branches and roots with sharp pruning instruments. Make three cuts per branch for branches over 2" diameter-remove end of branch, undercut branch to prevent ripping and finally make clean cut.

3.2 EXCAVATION AROUND TREES

- A. Excavate within proximity of trees only where directed and approved. Do not machine excavate within dripline.

- B. Where excavating for new construction is required within drip line of trees, hand excavate to minimize damage to root systems. Provide sheeting at excavations if required. Use narrow tine spading forks and comb soil to exposed roots.
 - 1. Relocate roots in backfill areas wherever possible. If large, main lateral roots are encountered, expose beyond excavation limits as required to bend and relocate without breaking. If encountered immediately adjacent to location of new construction and relocation is not practical, cut roots approximately 3 inches back from new construction.
- C. Do not allow exposed roots to dry out before permanent backfill is placed; provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in moist condition and temporarily support and protect from damage until permanently relocated and covered with earth.
- D. Where trenching for utilities is required within drip line, tunnel under or around roots by hand digging. Do not trench and/or cut main lateral roots or tap roots; cut only smaller roots that interfere with installation of new work. Cut roots with sharp pruning instruments; do not break or chop.
- E. Prune branches to balance loss to root system caused by damage or cutting of root system.

3.3 GRADING AND FILLING AROUND TREES

- A. Maintain existing grade within dripline of trees unless otherwise approved or directed by the Owner's Representative. Filling and compaction over root areas may cause loss of tree.
- B. Lowering Grades: Where existing grade is above new finish grade shown around trees, gradually slope grade away from trees as recommended by arborist. Do not lower grade within dripline.
 - 1. Prune branches to stimulate root growth and to compensate for loss of roots. Provide subsequent maintenance during the Contract period as recommended by arborist. Provide Owner's Representative with typed instruction for recommended long-range maintenance procedures to be followed after completion of construction operations.
- C. Raising Grades:
 - 1. Minor Fills: Where existing grade is 6 inches or less below elevation of finish grade shown, use topsoil fill material specified. Place in single layer and do not compact; hand grade to proposed finish grade elevations.
 - 2. Moderate Fills: Where existing grade is more than 6 inches, but less than 12 inches below finish grade elevation, place a layer of drainage fill on existing grade before placing topsoil. Carefully place against trunk of tree approximately 2 inches above finish grade elevation and extend not less than 18 inches from tree trunk on all sides. For balance of area within drip line perimeter, place drainage fill to an elevation 6 inches below grade and completely fill with a layer of topsoil to finish grade elevation. Do not compact drainage fill or topsoil layers; hand grade to required elevations.

3.4 REPAIR AND REPLACEMENT OF TREES

- A. Repair trees damaged by construction operations promptly after damaged occurs to prevent progressive deterioration of damaged trees. Repairs are to be made in the best approved standard practice.
- B. Remove and replace dead and damaged trees incapable of restoration to normal growth pattern.

1. Provide replacement trees of same size and species as those damaged. Install and maintain as acceptable to landscape architect.
- C. Maintain trees including fertilizing and watering for one month after installation to establish growth cycle. Turn over to owner for extended maintenance.
- D. Trees within the construction area are to be warranted for 1 year after project completion at which time they will be examined for condition and vigor. Deterioration of plant materials determined to be weakened by construction are subject to replacement to the Owner's satisfaction.

DISPOSAL

- A. Burning removed trees and branches is not permitted on site.
- B. Remove excess excavation, displaced trees and trimmings and dispose of off Owner's property.

END OF SECTION 01 56 39

SECTION 02 00 00

EXISTING CONDITIONS - GENERAL INFORMATION/SITE CONSTRUCTION

PART 1 – GENERAL

1.01 REQUIREMENTS, CODES

- A. The GENERAL CONDITIONS and GENERAL REQUIREMENTS are made part of the Section.
- B. Rules, regulations, or laws of any controlling Governmental Agency shall govern, when they are more stringent than the requirements of this Section.

1.02 DEFINITIONS

- A. **Contractor.** The Terms Contractor, Construction Manager and/or General Contractor shall be interchangeable and shall mean the Person, Firm, or Corporation entering into the Contract with the Owner to construct and install the Work covered by the Contract Documents.
- B. **Soils Engineer.** A licensed Soil Engineer retained for interpreting and making recommendations on geotechnical testing, quality control and aspects of the Work.
- C. **Engineer.** Shall mean Nowak & Fraus Engineers through its Project Representatives.

1.03 SUBSURFACE CONDITIONS

- A. A subsurface investigation may have been made by the Owner. If so, that information is bound herein, or available for review at the office of the Owner. The Owner makes no representation of subsurface conditions that may be encountered. Contractor is cautioned that he is responsible for any consequences of relying on subsurface data provided.

1.04 QUALITY ASSURANCE

- A. The Owner may select and pay for the services of a Soils Engineer to perform tests to verify compliance with the Plans and Specifications. The Contractor shall cooperate with the Soils Engineer to facilitate the testing in a safe and timely manner.
- B. Work within street or highway rights-of-way shall meet requirements of the Governing Agency and shall not begin without a permit and/or authorization from the owner.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Noise producing activities shall be held to a minimum. The Contractor shall comply with all applicable noise abatement ordinances.
- B. All areas within the construction site shall be kept sufficiently dampened to prevent dust. The Contractor shall comply with all applicable anti-pollution ordinances.
- C. The Contractor shall assure that trucks leaving the site shall do so in such a manner that mud, and earth will not be deposited on adjacent streets. Any mud or earth deposited on streets shall be promptly removed by the Contractor.

- D. Pursue the Work to prevent soil erosion, and the transport of soils off-site. Perform the Work and take preventative measures in compliance with applicable laws. Obtain all permits necessary for conducting the Work.
- E. Fuel tanks located on-site by the Contractor shall be arranged so that spilled fuel will not enter a sewer or stream in case of an accident or vandalism.

1.06 TEMPORARY SUSPENSION OF THE WORK

- A. The Contractor shall have the authority to suspend the Work entirely or in part for such period or periods of time as he may deem necessary:
 - 1. Due to unsuitable weather or such other conditions that are considered unfavorable for the satisfactory execution of the Work.
 - 2. Due to unsafe working conditions as outlined in General Conditions
- B. Such suspension of Work shall not relieve the Contractor of his responsibility to complete the project within the Contract period. If it should become necessary to stop work for some period, the Contractor shall take every precaution to prevent damage or deterioration of the Work already performed.
- C. If the Contractor stops Work due to unsafe work environment, he shall take immediate steps to correct the situation and return the Work area to a safe environment.

1.07 JOB CONDITIONS

- A. Survey: The owner has provided a survey for use by the engineer for design purposes. The contractor shall field verify this survey to determine if all information is correct or if any conflicts exist. The contractor shall immediately alert the owner, surveyor & engineer of any discrepancies.
- B. Utilities: Certain utility lines may be indicated within the Contract limit lines; others may exist within these lines and may be found upon inspection the Site. It is the Contractor's responsibility to contact all Utility Companies or Authorities which may be reasonably expected to have utilities in the area. He shall locate exactly any and all utilities and maintain in operating condition all active utilities, sewers, and drains encountered during construction. The Contractor shall repair to the satisfaction of the Utility Owner any improvement damaged during the course of the Work. Active utilities shall be removed and relocated only as directed by the Utility Owner or Authorities having jurisdiction. Existing utilities that are indicated to be removed shall be coordinated with the Utility Owner prior to the removal of said utilities. The Contractor shall report to the Utility Owner any existing damage prior to commencing Work.
- C. Existing Facilities: The Contractor shall protect all existing facilities and all-natural features that are not shown to be disturbed. The Contractor shall restore to their present condition any utility easement or public right-of-way that is disturbed by the Work under these Specifications to the satisfaction of the Governmental Agency that has jurisdiction.
- D. Permits, Inspection and Codes: The Contractor shall secure, comply with, and pay for all permits required by Ordinance or Law and for all inspections as required. No extra charges will be allowed for any changes necessary for code compliance regardless of the method of installation shown on the Drawings and indicated in the Specifications.

1.08 PROTECTION AND SHORING

- A. The Contractor shall protect all existing facilities within the Site, and shall provide and install sheeting, shoring, and bracing and take all necessary precautions to maintain support for structures, utilities, and appurtenances.
- B. The Contractor shall repair promptly any damage resulting from his operation to the satisfaction of the Owner, at no expense to the Owner. The Contractor shall report to the Owner any existing damage before beginning Work.
- C. The Contractor shall provide and maintain temporary pedestrian and vehicular traffic routes. Provide lights, barricades, pavement markings, guard rails, signs, and other protective devices necessary for safe operation. Remove after permanent facilities are completed.

PART 2 – PRODUCTS – Not Applicable

PART 3 – EXECUTION

3.01 SITE INSPECTION

- A. Site Visit: The Contractor shall visit the Site to become thoroughly familiar with the existing Site Conditions. A full understanding by the Contractor of the facilities, difficulties and restrictions attending execution of the Work is mandatory. The Contractor shall verify the location of all pertinent items. No additional compensation will be allowed for failure of the Contractor to be so informed.
- B. Monuments: The Contractor shall locate and maintain all permanent benchmarks, monuments, and other reference points. If destroyed or disturbed by the Contractor, they shall be replaced as directed by the applicable Local Authority at no expense to the Owner.

3.02 LAYOUT AND GRADE CONTROL

- A. Staking and Checking: The Contractor shall establish and maintain site control, both horizontal and vertical. Where required by law, he shall obtain the services of a Registered Land Surveyor to provide direct supervision of the surveying Work, including staking for construction. The Contractor shall carefully and thoroughly review the Plans and the field staking and shall immediately notify the Engineer of any errors or inconsistencies.

3.03 MAINTENANCE OF DRAINAGE

- A. Drain Operations: Contractor shall maintain existing drainage systems and prevent flooding of the site and adjacent properties due to his operations. The Contractor shall stage work to assure proper drainage to and from the Site during construction and shall avoid draining the Site to areas used by pedestrians or vehicular traffic.

END OF SECTION 02 00 00

SECTION 02 41 00

SITE DEMOLITION

GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Demolition of structures, site pavement, and site utilities.
 - 2. Filling voids created as a result of removals or demolition.
 - 3. Removal or capping off existing utilities, underground structures, septic tanks, disposal fields, etc.
 - 4. Removal from site and disposal of all excess and unusable material.
- B. Related Sections
 - 1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
 - 2. Section 31 14 13 - Topsoil Stripping and Stockpiling
 - 3. Section 31 10 00 - Site Clearing
 - 4. Section 31 20 00 - Earthmoving

1.2 REFERENCED STANDARDS

- A. All work under this section shall be completed in general conformance with construction plan details, all Local Municipality / County standards; or per applicable Michigan Department of Transportation's (MDOT) standard specifications for construction, standard plans, quality assurance procedures manual (current editions), and as specified herein.

1.3 QUALITY ASSURANCE

- A. The Contractor shall visit the Site so that a full understanding of the difficulties and restrictions affecting execution of the Contract are made. Verify the location of all pertinent items. No additional compensation will be allowed for failure to be so informed.
- B. The Contractor shall coordinate selective demolition work with the Owner prior to commencing work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable State and local codes for demolition of structures, safety of adjacent structures, dust control, and runoff control.
- B. Obtain required permits and licenses from appropriate authorities. Pay associated fees including disposal charges.
- C. Notify affected utility companies before starting work and comply with their requirements.
- D. Do not close or obstruct public or private roadways, sidewalks, or fire hydrants without appropriate permits or written authorization.
- E. Conform to applicable regulatory procedures when hazardous or contaminated materials are discovered.

- F. Test soils around buried tanks for contamination.

1.5 SUBMITTALS

- A. Project Record Documents: Accurately record actual locations of capped utilities and subsurface obstructions that will remain after demolition. Submit record as part of closeout submittals.

1.6 PROJECT CONDITIONS

- A. Existing structures, utilities, drives, walks, etc., have been shown on the Plans in their approximate location, others may exist and may be found upon visiting the Site. It shall be the responsibility of the Contractor to accurately locate all facilities and to determine their extent. If such facilities obstruct the progress of the Work and are not indicated to be removed or relocated, they shall be removed or relocated only as directed by the Owner.
- B. Structures to be demolished will be discontinued in use and vacated prior to start of work.
- C. Owner assumes no responsibility for condition of structures to be demolished.
- D. Contractor shall investigate the possibility of existing septic tanks and drain fields near the location of existing foundations, prior to demolition. In the event that any possible septic tanks exist, this Contractor shall make further investigations, as necessary, to locate the septic tank and drain fields. Any septic tank and drain field found to exist shall be removed in accordance with the requirements of State and Local Health Departments.
- E. Conditions existing at time of inspection for bidding purposes will be maintained by Owner as reasonably practical. Variations within structures may occur by Owner's removal and salvage operations prior to start of demolition work.
- F. Unless otherwise indicated in Contract Documents or specified by the Owner, items of salvageable value to Contractor shall be removed from site and structures. Storage or sale of removed items on site will not be permitted and shall not interfere with other work specified.
- G. Natural features which are not subject to changes by reason of the Drawings and Specifications shall not be defaced or injured in any manner.
- H. Restore to their present conditions any pavement or public right-of-way that is disturbed by the Work under this Section. All pavement restoration work in public rights-of-way shall be performed to the proper satisfaction of the governmental agencies having jurisdiction thereover.
- I. When the premises adjacent to areas of selective demolition will be occupied during construction, conduct selective demolition work in a manner that will minimize disruption of normal business operations. Provide 72 hours advance written notice to the Owner of activities that will affect normal business operations.
- J. Damages: Promptly repair damages caused to adjacent facilities by demolition Work.
- K. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways as required by governing regulations.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

- A. Fill material shall be suitable aggregate fill materials as specified in Section 31 20 00.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Provide, erect, and maintain erosion control devices, temporary barriers, and security devices at locations indicated on Construction Drawings.
- B. Protect existing landscaping materials, appurtenances, and structures, which are not to be demolished. Repair damage to existing items to remain caused by demolition operations.
- C. Prevent movement or settlement of adjacent structures. Provide bracing and shoring, as necessary.
- D. Mark location of utilities. Protect and maintain in safe and operable condition utilities that are to remain. Prevent interruption of existing utility service to occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities as acceptable to governing authorities and Owner.

3.2 GENERAL DEMOLITION REQUIREMENTS

- A. Conduct demolition to minimize interference with adjacent structures or pavements to remain.
- B. Cease operations immediately if adjacent structures appear to be in danger. Notify authority having jurisdiction. Do not resume operations until directed by authority.
- C. Conduct operations with minimum of interference to public or private access. Maintain ingress and egress at all times.
- D. Sprinkle work with water to minimize dust. Provide hoses and water connections for this purpose.
- E. Comply with governing regulations pertaining to environmental protection.
- F. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.

3.3 DEMOLITION

- A. Perform demolition Work in a systematic manner. Use such methods as required to complete Work indicated on Drawings in accordance with demolition schedule and governing regulations.
 - 1. Saw cut asphalt pavement at limits indicated for removal to a minimum depth of 3".
 - 2. Concrete pavement shall be removed to the joint nearest the indicated removal limit or saw cut where specifically directed.
 - 3. Where piping is to be bulk-headed, provide a permanent, water-tight plug consisting of brick and concrete mortar, one foot thick or prefabricated plugs intended for this purpose.
 - 4. Check with the Sewer Department, Water Company and Gas Company to assure that all utilities and services are inoperative prior to their removal.

5. Maintain in operating conditions all active utilities, sewers and drains encountered.
 6. The Contractor shall use extreme caution in removing any structures and utilities above and below grade to prevent damage to existing utilities which are to remain in service. Any existing utilities which are in any way damaged shall be replaced at no additional cost to the Owner.
- B. Demolish site improvements designated to be removed as shown on the drawings. Site improvements shall include but not be limited to structures, retaining walls, foundations, pavements, curbs and gutters, drainage structures, utilities, signage, or landscaping.
 - C. Disconnect and cap or remove utilities to be abandoned as shown on the drawings.
 - D. Fill or remove underground tanks, piping, and appurtenances as shown.
 - E. Demolish buildings completely and remove from site using methods as required to complete work within limitations of governing regulations. Small structures may be removed intact when acceptable to Owner and authorities having jurisdiction.
 - F. Locate demolition equipment and remove materials to prevent excessive loading to supporting walls, floors, or framing.
 - G. Demolish concrete and masonry in small sections. Break up concrete slabs-on-grade that are 2-feet or more below proposed subgrade to permit moisture drainage. Remove slabs-on-grade and below grade construction within 2-feet of proposed subgrade.
 - H. Where existing utilities are to be demolished, they shall be removed and capped or closed, as appropriate, at the nearest manhole, junction box, or main as directed by the Contracting Officer's Representative.
 - I. For Water main abandonment, all valves, tee, blocking, and/or appurtenances associated with the main being removed shall be removed and the connection replaced with suitable couplings and replacement pipe. No valves, tees, blocking, or other appurtenances will be permitted to remain at any main abandonment sites.
 - J. The contractor shall be responsible for furnishing an as-built drawing of the demolition site showing the location point where each utility shall be terminated. Existing underground utilities under the footprint of the new Administrative Building and the Parking Structure shall be removed within 10-feet from the footprint of the buildings. All other locations where the abandoned existing utilities are not in conflict with the new construction can be cut and plugged and abandoned in place. Existing abandoned utilities shall be filled with flowable fill or pressure grouted to limits of abandonment.

3.4 FILLING BASEMENTS AND VOIDS

- A. Completely fill below grade areas and voids resulting from demolition or removal of structures, underground fuel storage tanks, wells, cisterns, etc., using aggregate fill materials consisting of stone, gravel, or sand free from debris, trash, frozen materials, roots, and other organic matter.
- B. Areas to be filled shall be free of standing water, frost, frozen or unsuitable material, trash, and debris prior to fill placement.
- C. Place fill materials in accordance with Section 31 20 00 unless subsequent excavation for new work is required.

- D. Grade surface to match adjacent grades and to provide flow of surface drainage after fill placement and compaction.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove from site debris, rubbish, and other materials resulting from demolition operations. Leave areas of work in clean condition.
- B. No burning of any material, debris, or trash on-site or off-site will be allowed except when allowed by appropriate governing authority and Owner. If allowed as stated above, burning shall be performed in manner prescribed by governing authority. Attend burning materials until fires have burned out and have been completely extinguished.
- C. The contractor shall be responsible to the removal and proper disposal of all materials associated with any demolition to a site off of the Installation in accordance with all federal, state, and local regulations.

END OF SECTION 02 41 00

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Cleaning site of debris, grass, trees, and other plant life in preparation for site improvement and/or building improvement for subsequent earthwork operations.
 - 2. Protection of existing structures, trees, or vegetation indicated on the Construction Drawings to remain.

- B. Related Sections
 - 1. Section 31 14 13 - Topsoil Stripping and Stockpiling
 - 2. Section 02 41 00 - Demolition
 - 3. Section 01 56 39 - Tree and Plant Protection
 - 4. Section 31 20 00 - Earthmoving
 - 5. Section 31 25 00 - Erosion and Sedimentation Controls

1.2 REFERENCED STANDARDS

- A. All work under this section shall be completed in general conformance with construction plan details, all Local Municipality / County standards, or per applicable Michigan Department of Transportation's (MDOT) standard specifications for construction, standard plans, construction manual, quality assurance procedures manual (current editions), and as specified herein.

1.3 ENVIRONMENTAL REQUIREMENTS

- A. Construct temporary erosion control systems as shown on Construction Drawings or as directed by the "Storm Water Pollution Prevention Plan" (SWPPP) and/or the Engineer to protect adjacent properties and water resources from erosion and sedimentation.

- B. In event that site work on this project will disturb 5 or more acres; the Contractor shall not begin construction without "National Pollution Discharge Elimination System" (NPDES) permit governing discharge of storm water from site for entire construction period. NPDES permit requires SWPPP to be in place during construction if required based upon site conditions.

- C. Contractor shall conduct storm water management practices in accordance with NPDES permit and shall enforce action taken or imposed by Federal or State agencies, including cost of fines, construction delays, and remedial actions resulting from Contractor's failure to comply with provisions of NPDES permit.

1.4 PROJECT CONDITIONS

- A. Conditions existing at time of inspection for bidding purposes will be maintained by Owner as reasonably practical.

- B. Prior to commencement of site clearing, inspect areas in which work will be performed. Photograph existing conditions at above-grade improvements and surrounding properties; file with Owner/Owner's Representative/General Contractor/Construction Manager prior to the start of work.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PREPARATION

- A. Identify existing plant life that is to remain and verify clearing limits are clearly tagged, identified, and marked in such manner as to ensure their protection throughout construction operations.
- B. Prior to commencement of site clearing, inspect areas in which work will be performed. Photograph existing conditions at above-grade improvements and surrounding properties; file with Owner/Owner's Representative/General Contractor/Construction Manager prior to the start of work.

3.2 PROTECTION

- A. Provide protection necessary to prevent damage to existing improvements indicated to remain in place.
- B. Protect improvements on adjoining properties and on Owner's property.
- C. Verify utility locations with Owner and utility companies and protect existing utilities that are to remain.
- D. Restore damaged improvements to their original condition as acceptable to parties having jurisdiction.
- E. Protect existing trees and vegetation indicated to remain in place, against unnecessary cutting, breaking, or skinning or roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to remain.
- F. Water trees and other vegetation to remain within limits of Contract work as required to maintain health during course of construction activities.
- G. Provide protection for roots over 1-1/2 inch diameter cut during construction activities. Coat cut faces with emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissue. Temporarily cover exposed roots with wet burlap to prevent roots from drying out, cover with earth as soon as possible.
- H. Repair or replace trees and vegetation indicated to remain, which are damaged by construction activities, in manner acceptable to Owner/Architect/Engineer/Landscape Architect.
- I. Conduct operations with minimum interference to public or private accesses and facilities. Maintain ingress and egress at all times and clean or sweep roadways daily as required by SWPPP or governing authority. Dust control shall be provided with sprinkling systems or equipment provided by Contractor.

- J. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by a licensed land surveyor and replaced, as necessary, in kind.
- K. Provide traffic control as required, in accordance with the "Michigan Manual on Uniform Traffic Control Devices" and applicable Michigan Department of Transportation or governing authority requirements.

3.3 EQUIPMENT

- A. Material shall be transported to and from the project site using well-maintained and operating vehicles. Transporting vehicles operating on site shall stay on designated haul roads and shall not endanger improvements by rutting, overloading, or pumping.

3.4 CLEARING

- A. General: Remove trees, shrubs, grass and other vegetation, improvements or obstructions as required to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Removal includes digging out and off-site disposal of stumps and roots.
- B. Cut minor roots and branches of trees indicated to remain in a clean and careful manner, where such roots and branches obstruct installation of new construction. Refer to Section 02235.
- C. Stake and label new locations as directed by Owner/Owner's Representative/Architect/ General Contractor/Construction Manager/Landscape Architect.
- D. Use approved hand or machine relocation methods.
- E. Comply with all applicable requirements specified herein and with the American Association of Nurserymen's "American Standard for Nursery Stock".
- F. Topsoil: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material.
- G. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material.
- H. Remove heavy growth of grass from areas before stripping.
- I. Where existing trees are indicated to remain, leave existing topsoil in place within drip lines to prevent damage to root system.
- J. Stockpile topsoil in storage piles where directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, if required, to prevent wind blown dust.
- K. Dispose of unsuitable topsoil same as specified for disposal of waste material.
- L. Clearing and Grubbing: Clear site of trees, shrubs and other vegetation where specifically indicated and as directed by Owner/Architect/Engineer/Landscape Architect.
- M. Completely remove stumps, roots and other debris protruding through ground surface.

- N. Use only hand methods for grubbing inside drip line of trees to remain.
- O. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
- P. Refer to Section 31 0 00 for material, placement, compaction, and grading requirements.

3.5 DISPOSAL OF WASTE MATERIALS

- A. Burning is not permitted on Owner's property.
- B. The contractor is responsible for the removal and proper disposal of all materials associated with this work to a site off the Installation in accordance with all federal, state, and local regulations.

END OF SECTION 31 10 00

SECTION 31 14 13

TOPSOIL STRIPPING AND STOCKPILING

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes:

1. Topsoil removal and stockpiling as indicated or required per the Construction Documents.

B. Related sections:

1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
2. Section 31 10 00 - Site Clearing
3. Section 31 20 00 - Earthmoving

PART 2 – PRODUCTS

2.1 MATERIALS

A. Topsoil: Topsoil shall be relatively free from roots, sticks, weeds, brush, or stones large than 1-inch in diameter or other litter or waste products. It shall be a loamy mixture having at least 90 percent passing a No. 10 sieve. A sample, free from extraneous materials, shall comply to the following requirements.

1. Organic Matter: Topsoil shall contain not less than 10 percent organic matter as determined by the test for organic matter, AASHTO T 194.
2. Clay: The topsoil shall contain not less than 12 percent clay or more than 50 percent as determined in accordance with AASHTO T 88.
3. Sand: The sand content shall not exceed 55 percent as determined in accordance with AASHTO T 88.
4. pH: The pH of the sample shall not be less than 5.0 nor higher than 8.0. The pH shall be determined with an acceptable pH meter, on that portion of the sample passing a No. 10 sieve, in accordance with ASTM D-4972, pH of soils.

B. If sufficient topsoil is not available at the Site or the Contractor elects the option to secure topsoil elsewhere, the Contractor must receive the Owner's approval of material in writing prior to securing topsoil. All topsoil secured off Site must meet other requirements of this Section.

PART 3 – EXECUTION

3.1 TOPSOIL REMOVAL

A. Excavate or strip topsoil in all cut-and-fill areas and stockpile for later use in connection with finish grading. Excavate topsoil to the depths directed by Soil Engineer, as required to remove all organic material from subgrade, but not less than 2-in. Transport and deposit topsoil in stockpiles at designated locations in a manner convenient for spreading and finish grading.

Removal of topsoil includes removal all roots, debris, vegetation and stones 3-in. or larger and other undesirable material prior to stockpiling. (This removal does not include grass or grass roots in the topsoil.)

3.2 STOCKPILING

- A. Stockpile excavated topsoil, separate from other excavated materials for later use. Stockpile area shall be cleared and grubbed prior to placing any topsoil. Keep stockpile free of all undesirable materials. Make stockpiles neatly shaped, and free to drain. Place stockpiles at locations shown on Drawings or as directed by Owner. Cover storage piles, as required, to prevent wind blown dust.

END OF SECTION 31 14 13

SECTION 31 20 00

EARTHMOVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavation, filling, and backfilling for structures, pavement, and out parcels.
 - 2. Trenching and backfilling for utilities.
 - 3. Dewatering.
 - 4. Boring under crossings.

- B. Related Sections
 - 1. Section 02 00 00 - General Information/Site Construction
 - 2. Section 31 10 00 - Site Clearing
 - 3. Section 01 56 39 - Tree and Plant Protection
 - 4. Section 31 25 00 - Erosion and Sedimentation Controls
 - 5. Section 33 11 00 - Water Utility Distribution Piping
 - 6. Section 33 30 00 - Sanitary Sewerage Utilities
 - 7. Section 33 40 00 - Storm Drainage Utilities
 - 8. Section 32 12 16 - Asphalt Paving
 - 9. Section 32 13 13 - Concrete Paving
 - 10. Section 32 16 13.13 - Concrete Curbs and Gutters

1.2 REFERENCED STANDARDS

- A. All work under this section shall be completed in general conformance with construction plan details, all Local Municipality / County standards, or per applicable Michigan Department of Transportation's (MDOT) standard specifications for construction, standard plans, construction manual, quality assurance procedures manual (current editions), and as specified herein.

- B. ASTM International (ASTM)
 - 1. ASTM D 422 - Standard Test Method for Particle Size Analysis of Soil
 - 2. ASTM D 698 - Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN.m/m³))
 - 3. ASTM D 1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 Kn.m/m³))
 - 4. ASTM D 2922 - Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
 - 5. ASTM D 4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils

- C. American Association of State Highway and Transportation Officials (AASHTO)
 - 1. AASHTO T 88 - Particle Size Analysis of Soils

- D. National Fire Protection Association (NFPA)
 - 1. NFPA 70 - National Electrical Code

- E. American Water Works Association (AWWA)
 1. AWWA C200 - Standard for Steel Water Pipe - 6 In. (150 Mm) And Larger
 2. AWWA C206 - Field Welding of Steel Water Pipe

1.3 QUALITY ASSURANCE

- A. A Soil Engineer or Testing Laboratory (TL), selected and paid for by the Contractor, will be retained to perform all necessary construction testing service on site for planned improvements.
 1. The Soil Engineer or TL shall prepare test reports that indicate test location, elevation data, and test results. The Owner, Engineer, and Contractor shall be provided with copies of reports within 96 hours of time that test was performed. In event that test performed fails to meet Specifications, the Soil Engineer or TL shall notify Contractor immediately.
 2. Quality assurance testing will be conducted in accordance with Paragraph "Quality Assurance Testing and Inspection" in Part 3 hereinafter.

1.4 DEFINITIONS

- A. Satisfactory Materials: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, SM, ML, CL, or a combination of these group symbols.
 1. Fill material shall further conform to the plasticity index and liquid limits (PI and LL) specified in Paragraph FILLING hereinafter.
 2. Satisfactory materials shall be free of rock or gravel larger than allowed for fill or backfill material as specified hereinafter or as shown on the drawings.
 3. Satisfactory materials shall contain no debris, waste, frozen materials, vegetation, and other deleterious matter.
 4. Unless specifically stated otherwise in "Foundation Subsurface Preparation" on the Drawings, the following table stipulates maximum allowable values for plasticity index (PI) and liquid limit (LL) of satisfactory materials to be used as fill in specified areas:

<u>Location</u>	<u>PI</u>	<u>LL</u>
Building area (below upper four feet)	20	50
Building area (upper four feet)	12	40
All other areas outside the building pad (below upper two feet)	20	50
(upper two feet, except for depth to receive topsoil)	15	40

(References to depth are to the proposed sub-grade elevations)

- B. Unsatisfactory Materials: Materials which do not comply with the requirements for satisfactory materials are unsatisfactory.
 1. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory materials which contains root and other organic matter or frozen material. The TL shall be notified of any contaminated materials.
 2. Unsatisfactory materials also include satisfactory materials not maintained within 2 percent of optimum moisture content at time of compaction.

1.5 SUBMITTALS

- A. Test Reports: The Soil Engineer or Testing Laboratory shall submit the following reports directly to the Contractor for testing services, with copy to the Owner's Representative / Engineer and/or General Contractor/Construction Manager as selected for this project.
 - 1. Report and certification of drainage fill and pipe bedding materials.
 - 2. Test reports on borrow material.
 - 3. Field reports for in-place soil density tests.
 - 4. One optimum moisture-maximum density curve for each type soil encountered.
 - 5. Report of actual unconfined compressive strength and/or results of bearing tests for each stratum tested.
 - 6. Field Reports: Observation of proof rolling, noting areas exhibiting excessive pumping or yielding.
- B. If geo-textile fabrics or geo-grids are to be used, design shall be submitted for approval by Contractor / Soil Engineer.
- C. Shop drawings or details pertaining to excavating and filling are not required unless otherwise shown on the Drawings or if contrary procedures to Construction Documents are proposed.
- D. Shop drawings or details pertaining to site utilities are not required unless required by regulatory authorities or unless uses of materials, methods, equipment, or procedures that are contrary to The Drawings or Specifications are proposed. Do not perform work until required shop drawings are approved.

1.6 PROJECT CONDITIONS

- A. Site Information: Data in subsurface geo-technical investigation reports was used for the basis of the design and are provided in this project manual for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner will not be responsible for interpretations or conclusions drawn from this data by the Contractor.
 - 1. The Contractor may perform additional test borings and other exploratory operations, at the Contractor's option; however, no change in the contract Sum will be authorized for such additional exploration. Procure Architect's / Engineer's approval prior to testing.
 - 2. Refer to "Geo-technical Inspection Report" included in this project manual.
- B. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.
 - 1. Should uncharted, or incorrectly charted piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility Owner.
 - 2. DO NOT interrupt existing utilities serving facilities occupied by the Owner, except when permitted in writing by the Owner. Include acceptable temporary utility services if required.
 - a. Provide minimum 72-hour notice.
- C. Protection of Persons and Property:
 - 1. Barricade open excavation occurring as part of this work and post with warning lights.
 - 2. Operate warning lights as recommended if required by authorities having jurisdiction.

3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, erosion, and other hazards created by earthwork operations.
4. Perform excavation by hand within drip line of large trees to remain. Protect root systems from damage or dry out to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

PART 2 - PRODUCTS

2.1 SOIL AND ROCK MATERIALS

- A. Fill and Backfill. Satisfactory materials excavated from the site as approved by Soil Engineer.
- B. Imported Fill Material: Satisfactory material(s) provided from offsite borrow areas when sufficient satisfactory materials are not available from required excavations.
- C. Trench Backfill: ASTM D 2321 unless otherwise specified or shown on the drawings.
- D. Building Subbase Material: Subbase for building and appurtenances slabs on ground is specified in Section 03 30 00 as applicable.
- E. Bedding: Aggregate Type as indicated on the plans or naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No.200 sieve.
- F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- G. Backfill and Fill Materials: "Satisfactory" soil materials free of clay, rock, or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
 1. Granular Backfill: Clean, natural, coarse bank run sand, conforming to requirements for MDOT Class II or ASTM C 33, materials.
 2. Aggregate Backfill: Crushed limestone conforming to MDOT aggregate 21AA or 22AA.
- H. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- I. Impervious Fill: Clayey mixture without granular materials capable of compacting to a dense composite as acceptable to Testing and Inspecting Agency.
- J. Coarse Aggregate: As indicated on drawings.
- K. Aggregate Surfaces and Shoulders: Surfaces on which no bituminous or concrete pavement is to be placed; crushed stone or gravel conforming to MDOT aggregate 21AA, 22AA, 22A or 23A.
- L. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2- inch sieve and 0 to 5 percent passing a No.8 sieve.

- M. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No.4 sieve.
- N. Topsoil: Topsoil shall consist of stripping material excavated from the site. Topsoil shall consist of organic surficial soil found in depth of not more than 6-inches. Topsoil shall be as further defined in Section 02919 – “Topsoil”.

2.2 APPURTENANT MATERIALS

- A. Stabilization geo-textile fabrics and/or geo-grids: As specified in Section 31 32 19 if required per construction plan, site conditions, or as directed by Soil Engineer based upon site conditions.
- B. Filter and drainage fabrics: As specified in Section 31 32 19 if required on plan or site conditions.
- C. Steel Casing Pipe: Comply with AWWA C200 minimum grade B, size, and wall thickness as indicated on The Drawings.
- D. Trench Utility Locator Tape: Heavy duty 6" wide underground warning tape. Tape shall be made from polyethylene material, 3.5 mils thick, with a minimum tensile strength of 1,750 psi. Place the tape at one-half the minimum depth of cover for the utility line or a maximum of 3 feet, which ever is the less, but never above the top of subgrade. Color of tape shall be determined by as follows:
 - 1. Natural Gas or Propane - Yellow
 - 2. Electric - Red
 - 3. Telephone - Orange
 - 4. Water - Blue
 - 5. Sanitary Sewer - Green

2.3 EQUIPMENT

- A. Transport off-site materials to project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

2.4 SOURCE QUALITY CONTROL

- A. In areas to receive pavement, California Bearing Ratio (CBR) or Limerock Bearing Ratio (LBR) tests shall be performed for each type of material that is imported from off-site. CBR or LBR value shall be equal to or above pavement design subgrade CBR or LBR value indicated on Construction Drawings, or within the geotechnical report.
- B. Following tests shall be performed on each type of on-site or imported soil material used as compacted fill:
 - 1. Moisture and Density Relationship: ASTM D 698 or ASTM D 1557.
 - 2. Mechanical Analysis: AASHTO T 88 or ASTM D422.
 - 3. Plasticity Index: ASTM D 4318

PART 3 - EXECUTION

3.1 PREPARATION

- A. Identify required lines, levels, contours, datum, elevations, and grades necessary for construction as shown on the drawings.
- B. Notify utility companies to remove or relocate public utilities that conflict with proposed improvements.
- C. Protect plant life, lawns, fences, existing structures, sidewalks, paving, and curbs, unless otherwise noted on the drawings from excavating equipment and vehicular traffic.
- D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.
- E. Remove from site, material encountered in grading operations that, in opinion of the Soil Engineer or Testing Laboratory (TL) is unsatisfactory material or undesirable for backfilling, sub-grade, or foundation purposes. Dispose of in manner satisfactory to local governing agencies. Backfill areas with layers of satisfactory material and compact as specified herein.
- F. Prior to placing fill in low areas, such as previously existing creeks, ponds, or lakes, perform following procedures:
 - 1. Drain water out by gravity with ditch having flow line lower than lowest elevation in low area. If drainage cannot be performed by gravity ditch, use adequate pump to obtain the same results.
 - 2. After drainage of low area is complete, remove muck, mud, debris, and other unsatisfactory material by using acceptable equipment and methods that will keep natural soils underlying low area dry and undisturbed.
 - 3. All muck, mud, and other materials removed from low areas shall be dried on-site by spreading in thin layers for observation by the Soil Engineer or TL. Material shall be inspected and, if found to be satisfactory for use as fill material, shall be incorporated into lowest elevation of site filling operation, but not under building sub-grade or within 10'-0" of perimeter of building sub-grade or paving sub-grade. If, after observation by the TL, material is found to be unsatisfactory, it shall be removed from site.
- G. Locate and identify utilities that have previously been installed and protect from damage.
- H. Locate and identify existing utilities that are to remain and protect from damage.
- I. Maintain in operating condition existing utilities, previously installed utilities, and drainage systems encountered in utility installation. Repair surface or subsurface improvements shown on The Drawings.
- J. Verify location, size, elevation, and other pertinent data required for making connections to existing utilities and drainage systems as indicated on The Drawings.
- K. Over excavate and properly prepare areas of subgrade that are not capable of supporting proposed systems. Stabilize these areas by using acceptable geotextile fabrics or aggregate material placed and compacted as specified in Section 31 32 19.

3.2 DEWATERING

A. General:

1. Provide dewatering systems as required for excavations.
2. Design and provide dewatering system using accepted and professional methods consistent with current industry practice to eliminate water entering the excavation under hydrostatic head from the bottom or sides. Design system to prevent differential hydrostatic head, which would result in floating out soil particles in a manner, termed as a "quick" or "boiling" condition. System shall not be dependent solely upon sumps or pumping water from within the excavation where differential head would result in a quick condition, which would continue to worsen the integrity of the excavation's stability.
3. Provide dewatering system of sufficient size and capacity to prevent ground and surface water flow into the excavation and to allow Work to be installed in a dry condition.
4. Control, by acceptable means, all water regardless of source. Contractor shall be responsible for disposal of the water.
5. Confine discharge piping or ditches to available easement or to additional easement obtained by Contractor. Provide necessary permits or easement.
6. Control groundwater in a manner that preserves strength of foundation soils, does not cause instability or raveling of excavation slopes, and does not result in damage to existing structures. Where necessary, lower water level in advance of excavation utilizing wells, well points, jet educators, or similar positive methods. The water level as measured by piezometers shall be maintained a minimum of 3 feet below prevailing excavation level.
7. Commence dewatering prior to any appearance of water in excavation and continue until Work is complete to the extent that no damage results from hydrostatic pressure, flotation, or other causes.
8. Open pumping with sumps and ditches will be allowed provided it does not result in boils, loss of fines, softening of the ground, or instability of slopes.
9. Install wells or well points, if required, with suitable screens and filters so that continuous pumping of fines does not occur. Arrange discharge to facilitate collection of samples. During normal pumping and upon development of wells, levels of fine sand or silt in the discharge water shall not exceed 5 ppm. Install sand tester on discharge of each pump during testing to verify that levels are not exceeded.
10. Control grading around excavations to prevent surface water from flowing into excavation areas.

B. Design:

1. Designate and obtain the services of a qualified dewatering specialist to provide dewatering plan as may be necessary to complete the Work.
2. Contractor shall be responsible for the accuracy of the drawings, design data, and operational records required.
3. Contractor shall be responsible for the design, installation, operation, maintenance, and any failure of any component of the system.

C. Damages:

1. Contractor shall be responsible for and shall repair any damage to work in place, other contractor's equipment, utilities, residences, highways, roads, railroads, private and municipal well systems, adjacent structures, natural resources, habitat, existing wells, and the excavation. Contractor responsibility shall also include damage to the bottom due to heave and including but not limited to, removal and pumping out of the excavated area that may result from Contractor's negligence, inadequate or improper design and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system.
2. Remove sub-grade materials rendered unsatisfactory by excessive wetting and replace with approved backfill material at no additional cost to the Owner.

D. Maintaining Excavation in Dewatering Condition:

1. Dewatering shall be a continuous operation. Interruptions due to power outages or any other reason will not be permitted.
2. Continuously maintain excavation in a dry condition with positive dewatering methods during preparation of sub-grade, installation of pipe, and construction of structures until the critical period of construction or backfill is completed to prevent damage of sub-grade support, piping, structure, side slopes, or adjacent facilities from flotation or other hydrostatic pressure imbalance.
3. Provide standby equipment on site, installed, wired, and available for immediate operation if required to maintain dewatering on a continuous basis in the event any part of the system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, perform such work as may be required to restore damaged structures and foundation soils at no additional cost.
4. System maintenance shall include but not be limited to 24-hour supervision by personnel skilled in the operation, maintenance, and replacement of system components, and any other work required to maintain excavation in dewatered condition based on site conditions or as directed by the Contractor.

E. System Removal: Upon completion of the work, remove dewatering equipment from the site, including related temporary electrical service.

F. Wells shall be removed or cut off a minimum of 3 feet below final ground surface, capped, and abandoned in accordance with regulations by agencies having jurisdiction.

3.3 TOPSOIL EXCAVATION

- A. Cut heavy growths of grass from areas before stripping and remove cuttings with remainder of cleared vegetative material.
- B. Strip topsoil to a depth of not less than 6 inches from areas that are to be filled, excavated, landscaped, or re-graded to such depth that it prevents intermingling with underlying subsoil or questionable material.
- C. Stockpile topsoil in storage piles in areas shown on The Drawings or where directed. Construct storage piles to freely drain surface water. Cover storage piles as required to prevent windblown dust. Dispose of unsuitable topsoil as specified for waste material, unless otherwise

specified. Remove excess topsoil from site unless specifically noted otherwise on The Drawings.

3.4 GENERAL EXCAVATION

- A. Classification of Excavation: The Contractor shall assure himself by site investigation or other necessary means that he is familiar with the type, quantity, quality, and character of excavation work to be performed. Excavation shall be considered unclassified excavation, except as indicated in the Contract Documents.
- B. When performing grading operations during periods of wet weather, provide adequate dewatering, drainage, and ground water management to control moisture of soils.
- C. Shore, brace, and drain excavations as necessary to maintain excavation as safe, secure, and free of water at all times.
- D. Excavate building areas to line and grade as shown on the Drawings being careful not to over excavate beyond elevations needed for building sub-grade.
- E. Place satisfactory excavated material into project fill areas.
- F. Unsatisfactory excavated material shall be disposed of in manner and location that is acceptable to Owner and local governing agencies.
- G. Perform excavation using capable, well-maintained equipment and methods acceptable to Contractor and local governing agencies.

3.5 ROCK EXCAVATION

- A. Rock excavation is specified in Section 31 23 16.26 if encountered on site. The Construction Manager, Contractor and Engineer shall meet to discuss alternates should rock be found on site.

3.6 TRENCHING EXCAVATION FOR UTILITIES

- A. Contact local utility companies before excavation begins. Dig trench at proper width and depth for laying pipe, conduit, or cable. Cut trench banks vertical, if possible, and remove stones from bottom of trench as necessary to avoid point-bearing. Over-excavate wet or unstable soil, if encountered, from trench bottom as necessary to provide suitable base for continuous and uniform bedding. Replace over-excavation with satisfactory material and dispose of unsatisfactory material.
- B. Trench excavation sidewalls shall be sloped, shored, sheeted, braced, or otherwise supported by means of sufficient strength to protect workmen in accordance with applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by local ordinances. Lateral travel distance to exit ladder or steps shall not be greater than 25 feet in trenches 4 feet or deeper.
- C. Perform trench excavation as indicated on the Drawings for specified depths. During excavation, stockpile materials suitable for backfilling in orderly manner far enough from bank of trench to avoid overloading, slides, or cave-ins.

- D. Remove excavated materials not required or not satisfactory as backfill or embankments and waste off-site or at on-site locations approved by the Owner and in accordance with governing regulations. Dispose of structures discovered during excavation as specified in Section 0 41 00.
- E. Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches and other excavations as specified.
- F. Open cut excavation with trenching machine or backhoe. Where machines other than ladder or wheel-type trenching machines are used, do not use clods for backfill.
- G. Accurately grade trench bottom to provide uniform bearing and support for each section of pipe on bedding material at every point along entire length except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make joint connection properly.
- H. Trench width below top of pipe shall not be less than 12 inches nor more than 18 inches wider than outside surface of pipe or conduit that is to be installed to designated elevations and grades. Other trench width for pipe, conduit, or cable shall be least practical width that will allow for proper compaction of trench backfill.
- I. Trench depth requirements measured from finished grade or paved surface shall meet the following requirements or applicable codes and ordinances, whichever is more stringent:
 - 1. Water Mains: 5 feet 6 inches to top of pipe barrel or established by local engineering or building official; or other owner requirements, whichever is deeper.
 - 2. Sanitary Sewer: Elevations and grades as indicated on the drawings and/or as specified in Section 33 30 00 or other owner requirements.
 - 3. Storm Sewer: Elevations and grades as indicated on the drawings or other owner requirements.
 - 4. Electrical Conduits: 24 inches minimum to top of conduit or as required by NEC 300-5, NEC 710-36 codes, or local utility company requirements; or other owner requirements, whichever is deeper.
 - 5. TV Conduits: 18 inches minimum to top of conduit or as required by local utility company; or other owner requirements, whichever is deeper.
 - 6. Telephone Conduits: 18 inches minimum to top of conduit, or as required by local utility company; or other owner requirements, whichever is deeper.
 - 7. Gas Mains and Service: 30 inches minimum to top of pipe, or as required by local utility company; or other owner requirements, whichever is deeper.

3.7 SUBGRADE PREPARATION

- A. Scarification and Compaction: Areas exposed by excavation or stripping and on which sub-grade preparations are to be performed shall be scarified to minimum depth of 8 inches and compacted as specified hereinafter.
- B. Proof-rolling: Sub-grades shall be proof-rolled to detect areas of insufficient compaction. Proof-rolling shall be accomplished by making minimum of 2 complete passes with fully-loaded tandem-axle dump truck with a maximum weight of 20 tons, or approved equal, in each of 2 perpendicular directions while under the supervision and direction of the testing laboratory. Document and explain proof-rolling inspection procedures and results in the laboratory inspection report. Areas of failure shall be excavated and re-compacted as specified herein. Continual failure areas shall be stabilized in accordance with Section 31 32 19. Sub-grade exposed longer than 48 hours or on which precipitation has occurred shall be re-proof rolled.

3.8 FILLING

- A. Fill areas to contours and elevations shown on the Drawings with materials deemed satisfactory.
- B. Place fills in continuous lifts specified herein.
- C. Fill within proposed building sub-grade and paving sub-grade shall not contain rock or stone greater than 6 inches in any dimension.
- D. Unless otherwise specified for rock fill, rock, or stone less than 6-inches in largest dimension may be used in fill below structures, paving, and graded areas, up to 24 inches below surface of proposed sub-grade or finish grade of graded areas when mixed with satisfactory material. Rock or stone less than 2 inches in largest dimension may be used in fill within the upper 24 inches of proposed sub-grade or finish grade of graded areas when mixed with satisfactory material.
- E. Fill materials used in preparation of sub-grade shall be placed in lifts or layers not to exceed 8 inches loose measure and compacted as specified hereinafter.
- F. Material imported from off-site shall have CBR or LBR value equal to or above pavement design sub-grade CBR or LBR value indicated on the construction drawings, or as identified in the geotechnical report.
- G. Building area sub-grade pad shall be that portion of site directly beneath and 10 feet beyond building and appurtenances, including limits of future building expansion areas as shown on the Drawings.
- H. Prepare building area sub-grade pad in strict accordance with "Foundation Subsurface Preparation" as shown on the Drawings. The Foundation Subsurface Preparation provisions shall take precedence over the provisions of this section whenever duplication or conflict occurs.

3.9 ROCK FILL

- A. Rock fill shall include on-site excavated material classified as rock excavation as specified in Section 31 23 16.26. Rock fill may be utilized in fill up to 48 inches below top of subgrade or finish grade of graded areas unless otherwise permitted in higher elevations by the TL. Rock fill shall consist of rock having a maximum dimension not greater than 12 inches in any dimension. Rock fill shall be placed in successive horizontal layers of loose material having a thickness of approximately the maximum size of the larger rock in the lift, but not greater than 12 inches. Each layer of material shall be spread uniformly, completely saturated, and compacted. Shot rock shall not be dumped into place but shall be distributed in horizontal lifts by blading and dozing in such a manner as to ensure proper placement into final position in the embankment. Voids shall be filled with finer material including shot rock fines and limited soil fines during the spreading operation. Successive layers shall not be placed until all voids of the current lift are filled and the lift is compacted. Each successive layer of material shall adequately bond to the material on which it is placed. Compaction shall be accomplished with vibratory compactors, heavy rubber-tired rollers, or steel-wheeled rollers. Compaction shall be by uniform passes of compaction equipment in sufficient number of passes, but not less than two passes, such that no further consolidation is evident as determined by the TL.

3.10 PIPE BEDDING

- A. Excavate trenches for pipe or conduit to 4 inches below bottom of pipe and to the width as specified herein. Place 4 inches of bedding material, compact in bottom of trench, and shape to conform to lower portion of pipe barrel.
- B. Place geo-textile fabric as specified on the Drawings and in accordance with Section 31 32 19.

3.11 TRENCH BACKFILLING

- A. Materials used for trench backfill shall comply with requirements as specified herein.
- B. Backfill and compact in accordance with fill and compaction requirements in accordance with ASTM D 2321 unless otherwise shown on the drawings.
- C. Do not backfill trenches until required tests are performed and utility systems comply with and are accepted by applicable governing authorities.
- D. Backfill trenches to contours and elevations shown on the Drawings.
- E. Do not backfill over porous, wet, frozen, or spongy sub-grade surfaces.

3.12 BORINGS AND CASINGS UNDER ROADS, HIGHWAYS, AND RAILROAD CROSSINGS

- A. When indicated by the Drawings, street, road, highway, or railroad crossings for utility mains installed by jacking and boring method shall be in accordance with area specifications and governing authorities.
- B. Excavation of approach pits and trenches within right-of-way of street, road, highway, or railroad shall be of sufficient distance from paving or railroad tracks to permit traffic to pass without interference. Tamp backfill for approach pits and trenches within right-of-way in layers not greater than 6-inches thick for entire length and depth of trench or pit. Compact backfill to 98 percent of maximum density in accordance with ASTM D698, (or 95 percent of maximum density, in accordance with ASTM D1557) obtained at optimum moisture as determined by AASHTO T 180. Mechanical tampers may be used after cover of 6 inches has been obtained over top of barrel of pipe.
- C. Accomplish boring operation using commercial type boring rig. Bore hole to proper alignment and grade. Bore hole shall be within 2 inches of same diameter as largest outside joint diameter of pipe installed. Install pipe in hole immediately after bore has been made and in no instance, shall hole be left unattended while open.
- D. In event subsurface operations result in failure or damage to pavement or railroad tracks within 1 year of construction, make necessary repairs to pavement or railroad tracks. If paving cracks on either side of pipeline or is otherwise disturbed or broken due to construction operations, repair or replace disturbed or broken area.
- E. Clean, prime, and line interior and exterior of casing pipe with two coats of asphalt coating in accordance with and governing authorities.
- F. Butt weld steel casing. Welds shall be full penetration single butt-welds in accordance with AWWA C206.
- G. Install casing and utility pipe with end seals, vent pipe, and other special equipment in accordance with area specifications and governing authorities.

3.13 COMPACTION

- A. Compact as follows:

<u>Location</u>	Percent of Maximum Laboratory Density	
	<u>ASTM D698</u>	<u>ASTM D1557</u>
Subgrade & Fill Below Structures and Pavement	98	95
Subgrade & Fill in All other Areas	95	92

- B. Maintain moisture content of not less than 1 percent below and not more than 3 percent above optimum moisture content of fill materials to attain required compaction density.
- C. Exercise proper caution when compacting immediately over top of pipes or conduits. Water jetting or flooding is not permitted as method of compaction.
- D. Corrective Measures for Non-Complying Compaction: Remove and re-compact deficient areas until proper compaction is obtained. Continual failure areas shall be stabilized in accordance with Section 31 32 19 at no additional cost to Owner.

3.14 MAINTENANCE OF SUBGRADE

- A. Verify finished subgrades to ensure proper elevation and conditions for construction above subgrade.
- B. Protect subgrade from excessive wheel loading during construction, including concrete trucks, dump trucks, and other construction equipment.
- C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in manner that will comply with compaction requirements by use of material with CBR or LBR equal to or better than that specified in the construction drawings, or within the geotechnical report. Surface of subgrade after compaction shall be firm, uniform, smooth, stable, and true to grade and cross-section.
- D. Construct temporary ditches and perform such grading as necessary to maintain positive drainage away from subgrade at all times.

3.15 BORROW AND SPOIL SITES

- A. Comply with NPDES and local erosion control permitting requirements for all on-site and off-site, disturbed spoil and borrow areas. Upon completion of spoil or borrow operations, clean up spoil or borrow areas in a neat and reasonable manner to the satisfaction of Owner or off-site property owner, if applicable.

3.16 FINISH GRADING

- A. Check grading of building subgrades by string line from grade stakes set at not more than 50-foot centers. Allowable tolerance shall be plus or minus 0.10 feet from plan grade. Provide engineering and field staking as necessary for verification of lines, grades, and elevations.
- B. Grade areas where finish grade elevations or contours are indicated on the Drawings, other than paved areas and buildings, including excavated areas, filled and transition areas, and landscaped areas. Graded areas shall be uniform and smooth, free from rock, debris, or irregular surface changes. Ground surfaces shall vary uniformly between indicated elevations. Grade finished ditches to allow for proper drainage without ponding and in manner that will minimize erosion potential. For topsoil, sod, and seeding requirements refer to Section 32 91 19.13 for additional information and direction.

- C. Correct settled and eroded areas. Bring grades to proper elevation.

3.17 QUALITY ASSURANCE TESTING AND INSPECTION

- A. Responsibilities: Unless otherwise specified, quality control tests and inspection specified below will be conducted by the Contractors' Soil Engineer or Testing Laboratory (TL).
- B. Field testing, frequency, and methods may vary as determined by and between the Contractor and Soil Engineer or TL.
- C. Work shall be preformed by a "Qualified Material Testing Technician" unless specified otherwise. Report of testing and inspection results shall be made upon the completion of testing.
- D. Classification of Materials: Perform test for classification of materials used and encountered during construction in accordance with ASTM D2488 and ASTM D2487.
- E. Laboratory Testing of Materials: Perform laboratory testing of materials (Proctor, Sieve Analysis, Atterberg Limits, Consolidation Test, etc.) as specified.
- F. Field Density Tests.
 - 1. Provide one optimum moisture-maximum density curve for each type of soil encountered in sub-grade and fills. Determine maximum densities in accordance with ASTM D 1557 and ASTM D 2049, as applicable.
 - a. Analyze materials within 3 feet of finished grades of paved areas to determine frost susceptibility.
 - b. Determine suitability of materials to be used as fill.
 - 2. For borrow materials, perform a mechanical analysis (AASHTO T 88), plasticity index (AASHTO T 90), moisture-density curve (AASHTO T 180 or ASTM D 1557), and frost susceptibility analysis.
 - 3. Building Sub-grade Areas, Including 10'-0" Outside of Exterior Building Lines: In cut areas, not less than 1 compaction test for every 2,500-sq. ft. In fill areas, same rate of testing for each 8-inch lift, measured loose.
 - 4. Areas of Construction Exclusive of Building Sub-grade Areas: In cut areas, not less than 1 compaction test for every 10,000-sq. ft. In fill areas, same rate of testing for each 8-inch lift, measured loose.
 - 5. Utility Trench Backfill: Intervals not exceeding 200-feet of trench for first and every other 8-inch lift of compacted trench backfill.
 - 6. Test Method: In-place nuclear density, ASTM D 2922 (Method B-Direct Transmission).
- G. Corrective Measures for Non-Complying Compaction: Remove and re-compact deficient areas until proper compaction is obtained at no additional expense. Adjust moisture content as necessary to conform to the requirements of this section.
- H. Observation and Inspection:
 - 1. Observe all sub-grades/excavation bases below footings and slabs and verify design bearing capacity is achieved as required. Work shall be preformed by a "Qualified Material Testing Technician".
 - 2. Observe and document presence of groundwater within excavations.
 - 3. Verify cut and fill slopes as specified in the contract documents. Work shall be preformed by a "Qualified Material Testing Technician".

END OF SECTION 31 20 00

SECTION 31 23 19

DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes construction dewatering.
- B. Related Requirements:
 - 1. Section 013233 "Photographic Documentation" for recording preexisting conditions and dewatering system progress.
 - 2. Section 312000 "Earth Moving" for excavating, backfilling, site grading, and controlling surface-water runoff and ponding.

1.3 ALLOWANCES

- A. Dewatering observation wells are part of dewatering allowance.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review condition of site to be dewatered including coordination with temporary erosion-control measures and temporary controls and protections.
 - 3. Review geotechnical report.
 - 4. Review proposed site clearing and excavations.
 - 5. Review existing utilities and subsurface conditions.
 - 6. Review observation and monitoring of dewatering system.

1.5 ACTION SUBMITTALS

- A. Shop Drawings: For dewatering system, prepared by or under the supervision of a qualified professional engineer.
 - 1. Include plans, elevations, sections, and details.
 - 2. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.

3. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
4. Include written plan for dewatering operations including sequence of well and well-point placement coordinated with excavation shoring and bracings and control procedures to be adopted if dewatering problems arise.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.
- C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by dewatering operations. Submit before Work begins.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.

1.8 FIELD CONDITIONS

- A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.
 1. Make additional test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements.
 2. The geotechnical report is included referenced elsewhere in Project Manual.
- B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
 1. Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer.

2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.
 3. Prevent surface water from entering excavations by grading, dikes, or other means.
 4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
 5. Remove dewatering system when no longer required for construction.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Protect and maintain temporary erosion and sedimentation controls, which are specified in Section 311000 "Site Clearing," during dewatering operations.

3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
1. Space well points or wells at intervals required to provide sufficient dewatering.
 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

3.3 OPERATION

- A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- B. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
 - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
 - 2. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
 - 3. Maintain piezometric water level a minimum of 24 inches below bottom of excavation.
- C. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.
- D. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

3.4 FIELD QUALITY CONTROL

- A. Observation Wells: Provide observation wells or piezometers, take measurements, and maintain at least the minimum number indicated; additional observation wells may be required by authorities having jurisdiction.
 - 1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
 - 2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
 - 3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.
- B. Survey-Work Benchmarks: Resurvey benchmarks regularly during dewatering and maintain an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.
- C. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.
- D. Prepare reports of observations.

3.5 PROTECTION

- A. Protect and maintain dewatering system during dewatering operations.
- B. Promptly repair damages to adjacent facilities caused by dewatering.

END OF SECTION 31 23 19

SECTION 31 25 00

EROSION AND SEDIMENTATION CONTROLS

PART 1 – GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Installation of temporary and permanent erosion and sedimentation control systems
 - 2. Installation of temporary and permanent slope protection systems

- B. Related Sections:
 - 1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
 - 2. Section 31 10 00 - Site Clearing
 - 3. Section 31 20 00 - Earthmoving
 - 4. Section 31 37 00 - Rip-Rap Protection
 - 5. Section 33 40 00 - Storm Drainage Utilities
 - 6. Section 32 91 00 - Planting Preparation
 - 7. Section 32 93 00 - Plants

1.2 ENVIRONMENTAL REQUIREMENTS

- A. Protect adjacent property and any identified endangered or threatened species or critical habitat, any identified cultural or historic resources, and receiving water resources from erosion and sediment damage until final stabilization.

PART 2 – PRODUCTS

3.1 MATERIALS

- A. Seed, sod, and ground covers for the establishment of vegetation in accordance with Section 32 92 19.
- B. Sediment control devices as specified on the Construction Drawings or plan details.
- C. Rolled erosion control products according to Erosion Control Technology Council (ECTC) standard specifications.
- D. Temporary mulches such as loose straw, wood cellulose, or agricultural silage.
- E. Rip-Rap protection as specified in Section 31 37 00.
- F. Temporary and permanent outfall structures as specified on the drawings.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Conduct storm water pre-construction meeting with Site Contractor, all ground-disturbing Sub-contractors, site engineer of record or someone from their office familiar with the site, and state or local agency personnel having jurisdiction over SESC.

3.2 SOIL EROSION AND SEDIMENTATION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

- A. Place erosion and sediment control systems in accordance with the drawings or as may be dictated by site conditions in order to maintain the intent of the specifications and permits.
- B. Deficiencies or changes on the drawings shall be corrected or implemented as site conditions change. Changes during construction shall be posted on the drawings (Site Maps).
- C. Contractor has authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations and to direct or provide immediate permanent or temporary pollution control measures.
- D. Maintain temporary erosion and sedimentation control systems as dictated by site conditions, indicated in the construction documents, or as directed by governing authorities or Owner to control sediment until final stabilization. Contractor shall respond to maintenance or additional work ordered by Contractor governing authorities immediately, but in no case, within not more than 48 hours if required at no additional cost.
- E. Contractor shall incorporate permanent erosion control features, paving, permanent slope stabilization, and vegetation into project at earliest practical time to minimize need for temporary controls.
- F. Permanently seed and mulch cut slopes as excavation proceeds to extent considered desirable and practical.
- G. Unless required within a shorter timeframe by the applicable General Permit for Storm Water Discharges Associated with Construction Activity, disturbed areas that will not be graded or actively worked for a period of 30-45 days or more, shall be temporarily stabilized as work progresses with vegetation or other acceptable means in accordance with Section 32 91 19.13 Section 32 92 19, and/or section 32 92 23 unless otherwise specified in the Contract Documents. In the event it is not practical to seed areas, slopes must be stabilized with mulch and tackifier, bonded fiber matrix, netting, blankets, or other means to reduce the erosive potential of the area.

END OF SECTION 31 25 00

SECTION 31 32 19

GEOSYNTHETIC SOIL STABILIZATION & LAYER SEPARATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Geo-textile fabric and/or geo-grid for stabilization of sub-grade or separation of materials if required based upon site conditions. Specification to be utilized if site conditions and soil conditions dictate.
- B. Related Sections:
 - 1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
 - 2. Section 31 20 00 - Earthmoving

1.2 REFERENCED STANDARDS

- A. All work under this section shall be completed in general conformance with construction plan details, all Local Municipality / County standards or per applicable Michigan Department of Transportation's (MDOT) standard specifications for construction, standard plans, construction manual, quality assurance procedures manual (current editions), and as specified herein.

1.3 SUBMITTALS

- A. Submit name of each materials supplier and specific type and source of each type of geo-textile fabric and/or geo-grids to be used. Changes in material specified or design parameters shall be submitted to Engineer for approval.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with state and local standards in conjunction with requirements specified herein.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide products from one of the following manufacturers or approved equal as specified per construction plan details and/or as directed by Soil Engineer based on site conditions:
 - 1. Mirafi Construction Products
 - 2. WEBTEC, INC.
 - 3. Tensar Earth Technologies, Inc.
 - 4. DuPont Typar Geosynthetics

2.2 ACCESSORIES

- A. Geotextile Fabric for Stabilization: Provide products from one of the following manufactures or approved equal as specified per construction plan details and/or as directed by Soil Engineer:
 - 1. Mirafi HP 370 or HP 570, by Marafi
 - 2. SF40 or SF56, by Dupont
 - 3. LINQ GTF-200 or 300, by LINQ

4. TerraTex HD, by WEBTEC

- B. Geo-grid for Stabilization: Provide products from one of the following manufactures or approved equal per construction plan details and/or as directed by Soil Engineer based on site conditions:
 1. Geogrid BX 1100, by Tensar
 2. Geogrid BX 1200, by Tensar
 3. Mirafi BasXgrid 11, by Marafi
 4. Mirafi BasXgrid 12, by Marafi

PART 3 - EXECUTION

3.1 PREPARATION

- A. Proof-roll existing sub-grade area(s) to identify and confirm areas in need of stabilization in presence of material testing engineer and/or design engineer as necessary for verification.

3.2 GEO-TEXTILE FABRIC AND/OR GEOGRID MATRIX INSTALLATION

- A. Place geo-textile fabric and/or geo-grid over subsoil surface, lap edges and ends in accordance with manufacturer's recommendations in those areas that are shown on construction plans or in those areas that need additional stabilization prior to placement of base course. Refer to geo-technical report or on-site material testing company to identify site area(s) which may require the use of both geo-textile fabric and/or geo-grid for stabilization prior to placement of fill.

- B. Place geo-textile fabric and/or geo-grid in accordance with manufacturer's recommendations.

3.3 FIELD QUALITY CONTROL

- A. Quality control tests will be conducted by the Soil Engineer or Testing Laboratory (TL). The Contractor shall perform additional testing or inspection as considered necessary by the Soil Engineer or TL for assurance of quality control.

END OF SECTION 31 32 19

SECTION 31 37 00
RIP-RAP PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Rip-rap, stone bedding, and geo-textile filter fabric for site outlets and/or slope protection to prevent erosion from occurring if required based upon site conditions.

- B. Related Sections
 - 1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
 - 2. Section 31 20 00 - Earthmoving
 - 3. Section 31 25 00 - Erosion and Sedimentation Control
 - 4. Section 31 32 19 - Geo-Synthetic Soil Stabilization and Layer Separation
 - 5. Section 33 40 00 - Storm Drainage Utilities

1.2 REFERENCED STANDARDS

- A. All work under this section shall be completed in general conformance with construction plan details, all Local Municipality / County standards; or per applicable Michigan Department of Transportation's (MDOT's) standard specifications for construction, standard plans, construction manual, quality assurance procedures manual (current editions), and as specified herein.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Rip-Rap: Stone for rip-rap shall consist of field stone or rough unhewn quarry stone as nearly uniform in section as is practical. Stones shall be dense, resistant to action of air and water, and suitable for purpose intended. Unless otherwise specified, stones shall weigh between 50 and 150 pounds each, and at least 60 percent of stones shall weigh 100 pounds or more to prevent movement by storm water conveyance or other natural events.

- B. Bedding Stone: Quarried and crushed angular limestone, 6-inches in depth, and with the following gradation:

Sieve Designation	% By Weight Passing Square Mesh Sieves
3"	100
No. 4	20-65
No. 200	0-10

- C. Filter Fabric: Install geo-textile fabric and/or geo-grid material as specified in Section 31 32 19 where shown on construction plan details or as directed by Soil Engineer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Start stabilization only when weather and soil conditions are favorable for successful application of proposed material.
- B. Notify Engineer and Contractor of unexpected subsurface conditions. Discontinue affected work in area until notified to resume work.
- C. Dress slopes and other areas to be protected to line and grade shown on Construction Drawings prior to placing of rip-rap. Undercut areas to receive rip-rap to elevation equal to final elevation less average diameter of stones before placing rip-rap.
- D. Correct areas over-excavated in accordance with Section 31 20 00.
- E. Remove excess excavated material from site.

3.2 PLACEMENT

- A. Place rip-rap in areas where indicated on construction plan drawings.
- B. Install filter fabric and bedding stone prior to placement of rip-rap as indicated on construction plan drawings.
- C. Place stones so that greater portion of weight is carried by earth and not by adjacent stones. Place stones in single layer with close joints. Upright areas of stone shall make angle of approximately 90 degrees with embankment slope. Place courses from bottom of embankment upward, with larger stones being placed in lower courses. Fill open joints with spalls. Embed stones in embankment as necessary to present uniform top surface such that variation between tops of adjacent stones shall not exceed 3 inches.

3.3 GEOTEXTILE FABRIC AND/OR GEOGRID

- A. Place geo-textile fabric over subsoil surface, lap edges and ends in accordance with manufacturer's recommendations and as shown on the Drawings.

END OF SECTION 31 37 00

SECTION 31 50 00

EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. This Section includes permanent and temporary support of excavations and excavation protection systems.

- B. Related Sections:
 - 1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
 - 2. Section 31 10 00 - Site Clearing
 - 3. Section 31 20 00 - Earthmoving
 - 4. Section 31 25 00 - Erosion and Sedimentation Controls
 - 5. Section 31 11 00 - Water Utility Distribution Piping
 - 6. Section 33 30 00 - Sanitary Sewerage Utilities
 - 7. Section 33 40 00 - Storm Drainage Utilities

1.2 REFERENCED STANDARDS

- A. All work under this section shall be completed in general conformance with construction plans details, all Local Municipality / County standards; or per applicable Michigan Department of Transportation's (MDOT) standard specifications for construction, standard plans, construction manual, quality assurance procedures manual (current editions), and as specified herein.

1.3 PERFORMANCE REQUIREMENTS

- A. Design, provide, monitor, and maintain an anchored and braced excavation support and protection system capable of resisting soil and hydrostatic pressure and supporting sidewalls of excavations.
 - 1. Work includes removing excavation support and protection systems when no longer needed.
 - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 3. Install excavation support and protection systems without damaging existing buildings, pavements, and other improvements adjacent to excavation.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing excavation support and protection systems similar to those required for this Project and with a record of successful in-service performance.

- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the Project is located and who is experienced in providing engineering services for designing excavation support and protection systems that are similar to those indicated for this Project in material, design, and extent.
 - 1. Engineering Responsibility: Engage a qualified professional engineer to prepare or supervise the preparation of data for the excavation support and protection system including drawings and comprehensive engineering analysis that shows the system's compliance with specified requirements.

1.5 SUBMITTALS

- A. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer for excavation support and protection systems. System design and calculations must be acceptable to authorities having jurisdiction.
 - 1. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names, and addresses of architects and owners, and other information specified.
- C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by excavation support and protection systems.

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Owner or others unless permitted in writing by the Architect / Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
- B. Project Site Information: A geo-technical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of the geo-technical engineer and represent interpretations of the subsoil conditions, tests, and results of analyses conducted by the geo-technical engineer. The Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor. The contractor may, at their expense:
 - 1. Make additional test borings and/or conduct other exploratory operations as necessary to provide accuracy / assurance(s) of sub surface conditions.
 - 2. The geo-technical report is included elsewhere in the Project Documents.
- C. Survey adjacent structures and improvements, employing a qualified professional engineer or surveyor; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
 - 1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials need not be new but must be in serviceable condition.
- B. Structural Steel: ASTM A 36.
- C. Steel Sheet Piling: ASTM A 328 or ASTM A 572
- D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of 3 inches.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
 - 1. Shore, support, and protect utilities encountered.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Owner, municipality and/or authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- C. Locate excavation support and protection systems clear of permanent construction and to permit forming and finishing of concrete surfaces.
- D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure excavation support and protection systems remain stable.
- E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2 SOLDIER BEAMS AND LAGGING

- A. Install steel soldier piles before commencing excavation operations. Contractor shall space soldier piles at indicated intervals. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.
- B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
- C. Install wales horizontally at centers indicated and secure to soldier piles.

3.3 SHEET PILING

- A. Install one-piece sheet piling and tightly interlock to form a continuous barrier. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

3.4 TIEBACKS

- A. Tiebacks: Drill for, install, tension, and grout tiebacks into position. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

3.5 BRACING

- A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary, to move a brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work, unless otherwise approved by Architect.
2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and damaging structures, pavements, facilities, and utilities.
 1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction and abandon remainder.
 2. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.
- B. Leave excavation support and protection systems permanently in place.

END OF SECTION 31 50 00

SECTION 32 10 00
CONCRETE SIDEWALKS

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Installation and placement of concrete walk as indicated in the construction documents.
 - 2. Production of on-site concrete mixtures.
 - 3. Production of transit / redi-mixed / batch plant concrete mixtures.
 - 4. Installation and placement of construction joints
 - 5. Construction of all sidewalks, service walks and/or driveway approaches as indicated on construction plans.

- B. Related Sections:
 - 1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
 - 2. Section 31 20 00 - Earthmoving

1.2 REFERENCED STANDARDS

- A. All work under this section shall be completed in general conformance with construction plan details, all Local Municipality / County standards; or per applicable Michigan Department of Transportation's (MDOT's) standard specifications for construction, standard plans, construction manual, quality assurance procedures manual (current editions), and as specified herein.

- B. American Association of State Highways and Transportation Officials (AASHTO)

- C. American Concrete Institute (ACI)

- D. American Society for Testing and Materials (ASTM)

1.3 QUALITY ASSURANCE

- A. Testing and Inspection Service: The Contractor or Owner shall retain a testing agency to sample and test concrete materials proposed for use in the Work, perform tests and calculations for concrete mixtures, and perform testing during concrete placement / paving operations.

- B. Submit, to the Contractor, two copies of materials certificates signed by Material Producer and Contractor. Certificates shall state that each material item meets specified requirements.

- C. Submit, to the Contractor, job mix formulas for each required cement-aggregate mixture. Mix designs shall be within allowable tolerances as specified for the particular application.

1.4 TRAFFIC CONTROL

Maintain vehicle and pedestrian traffic during paving and repair operations in such a manner as to not disrupt normal business activities of adjacent enterprises.

1.5 WEATHER LIMITATIONS

Construct concrete surface course only when ground temperature is above 35 degrees F. and base is dry. Base course may be laid when temperature is above 35 degrees F. and rising.

These Specifications shall govern the construction of all sidewalks, service walks and driveway approaches as indicated on the Drawings.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. All cement used in sidewalk construction shall be Portland Cement, Type I or IA ASTM C-150.
- B. The fine aggregate shall meet all requirements of Section 902 of Michigan Department of Transportation Specifications for No. 2NS Natural Sand
- C. The coarse aggregate shall meet all requirements of Section 902 of Michigan Department of Transportation Standard Specification for No. 6A Coarse Aggregate.
- D. Water used in concrete shall be clean, free from oil, acids, strong alkalies or vegetable matter and potable. If City water is used in the concrete, all necessary permits shall be obtained from the City Water Department.
- E. Air-Entraining Admixture shall be in accordance with ASTM C-260.
- F. Expansion papers shall be of the pre-molded non-extruding, asphalt impregnated type, not less than 1/2-inch thick. The length shall be equal to the width of the slab, and the depth equal to the thickness of the slab plus 1-inch.
- G. The curing compound shall be white membrane type and comply with ASTM C-309. It shall not allow a moisture loss of more than 0.055 gr./sq/ cm. when applied at 200 sq. ft./ gal.
- H. Concrete shall be ready-mixed concrete.
- I. Prefabricated composite tile for detectable warning surface to be set in wet concrete. The tile color shall be brick red color or as approved by construction manager and/or garrison.

2.2 MINIMUM QUALITY REQUIREMENTS

Concrete mix shall be proportioned to provide the following:

Compressive Strength at 28 days: 3,500 psi minimum - unless otherwise specified on plans.

Total air content by volume: 5% to 8%.

Slump 3-inch maximum.

2.3 PRODUCTION OF ON-SITE CONCRETE MIXTURES

- A. All concrete shall be mixed in mechanical mixers except when permitted by the Engineer. Mixers shall have a legible, permanently attached plate showing manufacturer's rated capacity, mixing speed and serial number.
- B. The Contractor shall at his expense furnish samples of the fresh concrete and provide safe and satisfactory facilities for obtaining the samples
- C. The temperature of materials as placed into the mixer shall be such that the temperature of the mixed concrete at the time it is placed in final position is not less than 40 degrees F. nor more than 90 degrees F. Aggregates and water used for mixing shall not exceed 150 degrees F.

- D. Mixing time, measured from the time the ingredients, including water, are in the drum shall be a minimum of 1.5 minutes for the first cubic yard, plus 0.5 minutes for each additional cubic yard of capacity. The maximum amount of time mixing will be allowed to continue is three times the minimum mixing time. Mixing of the batch any longer than the maximum amount of time allowed will constitute immediate rejection of that batch. The total elapsed time between the intermingling of damp aggregates and cement and the start of mixing shall not exceed 30 minutes.
- E. Cement and other materials used in the batch shall be placed in the mixer in such a manner as to prevent any loss due to the effects of wind or an accumulation of cement on surfaces of conveyors or hoppers, or in other conditions which may vary the required quantity of cement in the concrete mixture.
- F. Water shall be measured to the correct amount for the required water/cement ratio prior to placement into the mixer. No more water will be allowed to be added. No water will be placed in the mixer by use of pressurized hoses or any other unmeasured means.
- G. Mixers and agitators shall be clean and free of any accumulated hard concrete or mortar. Mixed blades shall be in good working order. If a mixer does not meet these requirements, it must be cleaned and repaired prior to use, or a new mixer used.

2.4 SUBMITTALS OF ON-SITE MIXED CONCRETE

- A. The Contractor will keep a record of each batch mixed, which will include:
 - 1. Type and brand of cement used
 - 2. Amount of cement in sacks per cu. yd.
 - 3. Maximum sizes of aggregate
 - 4. Total water content in W/C ratio (lbs./lbs.)
 - 5. Total amount of mixing time, starting at placement of water in the mixer
 - 6. Location of placement of each batch
- B. Copies of these records shall be furnished to the Contractor, and the Testing Laboratory and the Engineer at the completion of each day's work or on demand.
- C. One copy of each delivery ticket for the Aggregate used shall be submitted to the Contractor.

2.5 READY-MIXED CONCRETE MANUFACTURER'S QUALIFICATIONS

- A. All ready-mixed concrete suppliers must be approved by the Contractor. Concrete shall be manufactured and delivered to the job site by a ready-mixed concrete manufacturer thoroughly experienced in ready-mixed concrete. If requested by the Contractor, submit a written description of proposed ready-mixed concrete Manufacturer, giving qualifications of Personnel, location of batching plant, list of Projects similar in scope to specified Work, and other information as may be requested by the Contractor.

2.6 SUBMITTAL OF TRANSIT / READY-MIXED / BATCH PLANT CONCRETE INFORMATION

- A. Statement of Purchase for Ready-Mixed Concrete: Prior to actual delivery of concrete, submit to the Contractor four copies of Statement of Purchase, giving the dry weights of cement and saturated surface dry weights of fine and coarse aggregates and quantities, type, and name of admixtures (if any) and of water per cu. yd., that will be used in the manufacture of the concrete. The Contractor shall also furnish evidence that the materials to be used and proportions selected will produce concrete of the quality specified. Whatever strengths are obtained, the quantity of cement used shall not be less than the minimum specified.

- B. Reports: Submit four copies of reports to the Contractor for ready-mix concrete slump, air content unit weight, yield and strength tests as specified in Section 15 and 17 of ASTM C94.
- C. Ready-Mixed Concrete Delivery Tickets: Submit one copy of each delivery ticket to the Contractor in accordance with Section 16 of ASTM C94.

2.7 PRODUCTION OF TRANSIT / READY-MIXED / BATCH PLANT CONCRETE

- A. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C94, and comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete," "except as otherwise specified herein.
- B. Ready-mixed concrete shall be mixed and delivered to the point of discharge at the job by means of a ready-mix concrete truck.
- C. No water from the truck water system or elsewhere shall be added after the initial introduction of the mixing water for the batch. Under no circumstances shall the approved maximum water content be exceeded, nor shall the slump exceed the maximum specified.
- D. Discharge of the concrete shall be completed within 1-1/2 hours or before the drum has revolved 300 revolutions, whichever comes first, after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregate.
- E. In hot weather (air temperature 80-degrees F. and above) or under conditions contributing to quick stiffening of the concrete, the time shall be reduced to one hour.
- F. Concrete delivered in cold weather (air temperature 45-degrees F. and lower) shall have a temperature not less than 60-degrees F. at the point of discharge at job, and in compliance with ACI 306 R "Cold Weather Concreting". Concrete placing will not be permitted when the air temperature is 35-degrees or lower
- G. Concrete delivered under hot weather conditions contributing to quick stiffening of concrete, or in air temperature of 80-degrees F. and over, shall have a temperature between 60- and 80-degrees F. at the point of discharge at job, and in accordance with ACI 305 R "Hot Weather Concreting."

2.8 CLEANING THE MIXER OR TRUCK

- A. In no case shall the mixer or truck be flushed out onto the street pavement, in a catch basin or sewer manhole, or in any public right-of-way.

2.9 FORMS

- A. Forms shall be metal or wood and of an approved section. They shall be straight, free from distortion and shall show no vertical variation greater than 1/8-inch (1/8") in 10-foot lengths from the true plane surface on the top of the forms when tested with a 10-foot straight edge and shall show no lateral variation greater than 1/4-inch (1/4") in 10-feet from the true plan surface on the lateral face of the form when tested with a 10-foot straight edge. They shall be of the depth specified for the walk, securely held in place and true to line and grade.

PART 3 – EXECUTION

3.1 GRADING

- A. All new walks shall be placed only on a prepared sub-grade, smoothed, and leveled to the grades established by the Engineer. In clay soils the sub-grade shall be excavated six inches below the curb base and filled with approved sand meeting Michigan Department of Transportation (MDOT) Class II Sand Designation. The sub-grade shall be thoroughly compacted and leveled to grade. Any existing sidewalk shall be removed except where grade will allow at least 4-inches (4") of sand fill to be placed over it

3.2 SLOPE

- A. Sidewalks shall pitch toward the street with a required cross slope of 1/4-inch per foot of width. In some extreme cases, as determined by the Engineer, the cross-slope may be increased but in no case, shall it be less than 3/16-inch per foot of width.

3.3 LINE AND GRADE

- A. The Contractor will hire a Registered Professional Land Surveyor firm to establish the line and grade from the construction plans.

3.4 FINISHING

- A. The concrete surface shall be "broom finished" to match existing sidewalk texture.

3.5 PROPERTY MARKERS

- A. All property stakes, irons, monuments, etc. shall be protected and shall not be moved without the written permission of the Property Owner.

4 CONCRETE PLACING

- 4.1.1 Prior to placing the concrete, all debris, stones, dirt, etc., shall be removed from the subgrade. The sub-grade shall be moistened with water in such a manner as to thoroughly wet the material without forming puddles or pockets of water. No concrete shall be placed on frozen subgrade.
- 4.2 The concrete shall be deposited continuously in the forms in such a manner as to avoid segregation and it shall be thoroughly tamped or vibrated so that the forms are entirely filled, and the concrete thoroughly consolidated. The slabs shall be placed in sections or blocks in one operation as monolith.

5 CONTRACTION JOINTS – Plane of Weakness Joints / Control Joints

- 5.1 Contraction joints shall be placed at right angles to the edge of the sidewalk and perpendicular to the surface and at a depth of at least 1/4 the slab thickness with a minimum depth of 1-1/4 inches. These joints shall be created via hand tooling only. No saw cutting of joints will be permitted.
- 5.2 Contraction joints shall be spaced at a minimum of every 5 feet, or as shown on the Plans.
- 5.3 The concrete surface shall be struck off to a plane surface with a straightedge. After the surface has been floated to an even surface, the contraction joint shall be cut, and all slab edges rounded with a 1/2-inch radius edging tool that will finish to a width of 2-inches.
- 5.4 After the concrete has slightly set, a broom shall be brushed lightly across the surface at right angles to forms so as to impart a rough finish.

- 5.5 After concrete has set up, a flexible joint sealant (Grey Color) shall be applied to all plane of weakness / control joints within sidewalk, sidewalk ramp, and non-traffic pavement areas only.

6 EXPANSION (OR ISOLATION) JOINTS

- 6.1 Expansion Joints shall be placed at the following locations:

- 6.1.1 At the back of the curb and front edge of the sidewalks adjacent to each driveway approach and service walk.
- 6.1.2 At intervals not to exceed 30-feet in all public sidewalks.
- 6.1.3 At the back of the curb where the ramps extend from the key flag to the street.
- 6.1.4 Between the key flag and the ramp in all cases except where there are existing expansion joints at the intersections of the sidewalks and the key flag.
- 6.1.5 At any place where a sidewalk abuts a building or fixed structure.
- 6.1.6 At any other locations indicated on the plans.

7 ADA SIDEWALK RAMP DETECTABLE WARNING SURFACE

- 7.1 Prefabricated composite tiles for detectable warning surface shall be placed at locations noted on the plans in accordance with MDOT Standard Plan Detail No. R-28-G or latest plan revision.
- 7.2 Construction shall be performed in accordance with Subsection 803.03.B through Subsection 803.03E and 803.03G of the 2003 MDOT Standard Specifications for Construction and shall meet and comply with all applicable regulations and requirements of the American with Disabilities Act Accessibility Guidelines.
- 7.3 All sidewalk slopes and grades shall meet all current requirements of the Americans with Disabilities Act Accessibility Guidelines and with MDOT Standard Plan Detail No. R-28-G or latest plan revision.
- 7.4 The prefabricated composite tile detectable warning surface shall be installed at all sidewalk ramp curb openings (curb drops) installed for pedestrian crossings as shown on MDOT Standard Plan No. R-28-G or latest plan. The tile shall be set into wet concrete. The detectable warning surface shall be centered at the curb drop or crosswalk, but in no case, shall the width of the surface be less than five (5) feet. The detectable warning surface shall consist of small domes conforming to the MDOT standard plan.
- 7.5 The prefabricated composite tiles for the detectable warning surface shall be Step-Safe® manufactured by Transpo Industries, Inc.; Armor-Tile™ manufactured by Engineered Plastics, Inc. or approved equal and shall be installed according to the manufacture's instruction and as specified on MDOT Standard Plan Detail No. R-28-G or latest plan revision.

8 CURING CONCRETE

- 8.1 Freshly placed concrete shall be protected as required to maintain the temperature of the concrete at not less than 50 degrees F. nor more than 80 degrees F. and in a moist condition continuously for the period of time necessary for the concrete to cure. Changes in temperature of the concrete during curing shall be as uniform as possible and shall not exceed 5 degrees F. in any one hour, nor 50 degrees F. in any 24-hour period.

9 IDENTIFICATION

- 9.1 Prior to the application of curing compound, the Contractor shall clearly and neatly mark the sidewalk with the Contractor's name and the year of construction. This identification shall be stamped in the concrete at both ends of the length of sidewalk constructed and at one spot in the driveway approach.

10 REMOVAL OF FORMS

- 10.1 All forms, rails and stakes shall be removed with 24-hours after placing the curb.

11 WEATHER PROTECTION OF CONCRETE DURING CURING

- 11.1.1 Cold Weather Protection: When the temperature of the atmosphere is 40-degrees F. and below, the concrete shall be protected by heating, insulation covering, housing or combination thereof as required to maintain the temperature of the concrete curing period. Cold 50-degrees F. and in a moist condition continuously for the concrete curing period. Cold weather protection shall meet the requirements of ACI 306R "Cold Weather Concreting."
- 11.1.2 Hot Weather Protection: When the temperature of the atmosphere is 90-degree F. and above, or during other climatic conditions which will cause too rapid drying of the concrete, the concrete shall be protected by windbreaks, shading, fog spraying light-colored moisture-retaining covering, or a combination thereof as required to maintain the temperature of the concrete below 80-degrees F. and in a moist condition continuously for the concrete curing period. Hot weather protection shall meet the requirements of ACI 305R "Hot Weather Concreting."

12 CLEANUP

- 12.1.1 After completion of concrete curing in an area, remove all weather protection materials and rubbish and debris resulting from specified work, sweep concrete curbs clean, and seal joints.

13 FIELD QUALITY CONTROL

- 13.1.1 Quality Control during Paving Operations: Perform the following sampling and testing of concrete mixtures for quality control during paving operations. Record the locations where samples are taken, to correlate with subsequent testing.
- 13.1.2 Perform one test per 50 cubic yards or less to a maximum of four tests for each day's paving, unless otherwise specified or directed by the Owner.
- 13.1.3 Test fresh concrete mix, and report the following:
1. Slump per ASTM C-143
 2. Air-entrainment per ASTM C-231
 3. Collect 3 cylinders for compression test per ASTM C-31
- 13.1.3.1.1 Test one cured concrete cylinder from each sample location per ASTM C-39 at 7-day and 28-day periods and report the following:
- 13.1.3.1.2 Type of failure
- 13.1.3.1.3 Compressive strength at failure.
- 13.1.3.1.4 Note: The third cylinder is to be stored for future use.
- 13.1.3.1.5 Additional testing may be required if any of the previous tests indicate insufficient values. If two successive tests indicate insufficient values, contact the Engineer for a course of action.
- 13.1.3.1.6 Concrete materials not complying with specified requirements shall be repaired or removed and replaced with new paving.

END OF SECTION 32 10 00

SECTION 32 11 23

AGGREGATE BASE COURSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Aggregate base for HMA and/or Portland cement concrete paving.
- B. Related Sections
 - 1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
 - 2. Section 31 20 00 - Earthmoving

1.2 REFERENCED STANDARDS

- A. Asphalt Institute
- B. All work under this section shall be completed in general conformance with the construction plan details, all Local Municipality / County standards; or per applicable Michigan Department of Transportation's (MDOT) standard specifications for construction, standard plans, construction manual, quality assurance procedures manual (current editions), and as specified herein.

1.3 QUALITY ASSURANCE

- A. A Testing Laboratory (TL) shall be retained by the Owner and/or the Contractor to perform construction testing of in-place base course for compliance with requirements for thickness, compaction, and density. Paving base course tolerances shall be verified by the Contractor by rod and level readings on not more than 50-foot centers to be not more than 0.05-feet above design elevation which will allow for paving thickness as shown on Construction Drawings.

1.4 SUBMITTALS

- A. Submit materials certificate to the testing laboratory that is signed by materials producer and Contractor, certifying that materials comply with, or exceed, requirements specified herein or on the Construction Drawings.
- B. Submit certification of base course materials and placement as specified in Parts 2 and 3 hereinafter.

1.5 WEATHER LIMITATIONS

- A. Do not place aggregate when base surface temperature is less than 40 degrees F, nor when air temperature is below 45 degrees F. Do not place aggregate when surface is wet or frozen. Do not place aggregate when weather conditions are unfavorable.

PART 2: PRODUCTS

1.6 BASE COURSE MATERIAL

- A. Aggregate Base Course: Aggregate base course shall consist of a well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction. Base course may consist of a granular base (crushed concrete, crushed stone, or gravel, etc), sand/aggregate base material, or a hot-mix sand asphalt base.
- B. Base course shall be as shown on the drawings, or when not shown, shall be as specified herein.
- C. Aggregate base material shall meet MDOT specifications for the material specified.
- D. Aggregate shall consist of clean, sound, durable particles of crushed stone, crushed concrete, crushed gravel, or other approved material as specified in the plans. Aggregate shall be free of lumps of clay, organic matter, and other objectionable materials or coatings. The portion retained on the No. 4 sieve shall be known as coarse aggregate; that portion passing the No. 4 sieve shall be known as fine aggregate.
 - 1. Coarse aggregates shall be angular particles of uniform density.
 - 2. Fine aggregates shall be angular particles of uniform density. Fine aggregate shall consist of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally combined with the coarse aggregate.
- E. Gradation: The specified MDOT gradation requirements shall apply to the completed base course. The aggregates shall have a maximum size of 2 inches and shall be continuously well graded.

PART 2 - EXECUTION

2.1 EXAMINATION

- A. Contractor shall verify to the Engineer in writing that the sub-grade has been inspected, tested, and gradients and elevations are correct, dry, and properly prepared in accordance with Section 31 20 00.

2.2 CONSTRUCTION

- A. Perform base course construction in accordance with the applicable State standard specifications or as shown or specified.
- B. Perform base course construction in a manner that will drain the surface properly and prevent runoff from adjacent areas from draining onto base course construction.
- C. Compact base material to not less than 98 percent of optimum density as determined by ASTM D 698 or 95 percent of optimum density, as determined by ASTM D 1557 unless otherwise indicated on the construction plans, specifications or as directed by Soil Engineer or TL.

- D. Construct to thickness indicated on Construction Drawings.
 - 1. Granular Base: Apply in lifts or layers not exceeding 8-inches, measured loose.
 - 2. Sand/Aggregate Base: Apply in lifts or layers not exceeding 4-inches, measured loose.

2.3 FIELD QUALITY CONTROL

- A. Field testing specified below will be performed by the Testing Laboratory.
- B. Field testing, frequency, and methods may vary as determined by the Engineer and the Testing Laboratory.
- C. Field density tests for in-place materials will be performed in accordance with the following:
 - 1. Nuclear Method: ASTM D 2922 (Method B-Direct Transmission)
 - 2. Base material thickness: One test for each 20,000 sq. ft. of in-place base material area.
 - 3. Base material compaction: One test in each lift for each 20,000 sq. ft. of in-place base material area.
- D. The testing laboratory will prepare reports that indicate test location, elevation data, and test results. Contractor shall be provided with copies of the reports within 96 hours of the time the test was performed. In the event that the test results show failure to meet any of the Specifications. The Contractor and Engineer will be notified immediately by the testing laboratory.
- E. The Contractor shall certify in writing to the Engineer that base course placement is in accordance with specification requirements prior to subsequent work thereon.
- F. The Contractor shall pay for retesting due to failures at no additional expense. Contractor shall provide free access to the site for testing activities.

END OF SECTION 32 11 23

SECTION 32 12 13.13

TACK COAT

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Application of bituminous material or HMA on prepared surface.
 - 2. Weather limitations.
- B. Related Sections:
 - 1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
 - 2. Section 32 12 16 - Asphalt Paving

1.2 REFERENCED STANDARDS

- 1. All work under this section shall be completed in general conformance with construction plan details, all Local Municipality / County Standards, or per applicable Michigan Department of Transportation's (MDOT) standard specifications for construction, standard plans, construction manual, quality assurance procedures manual (current editions), and as specified herein.
- 2. AASHTO – American Association of State Highway and Transportation Officials
- 3. ASTM – American Society of Testing and Materials.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Tack Coat: The material used for the tack coat shall be emulsified asphalt, Grade RS-2 and shall conform with the requirements specified in Michigan Department of Transportation (MDOT) Type SS-1h Asphalt Emulsion material) and/or AASHTO Designation M 140-82 per local requirement.

2.2 EQUIPMENT

- A. The pressure distributor used for placing the tack coat shall be equipped with pneumatic tires having sufficient width of rubber in contact with the road surface to avoid breaking the bond of or forming a rut in the surface. The distance between the centers of openings of the outside nozzles of the spray bar shall be equal to the width of the application required, within an allowable variation of 2 inches. The outside nozzle at the end of the spray bar shall have an area of opening of not less than 25 percent, nor more than 75 percent in excess of the other nozzles which shall have uniform openings. When the application covers less than the full width, the normal opening of the end nozzle at the junction line may remain the same as those of the interior nozzle.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Before applying any bituminous material, all loose material, dust, dirt, and foreign material which might prevent proper bond with the existing surface, shall be removed. Particular care shall be taken to clean the outer edges of the strip to be treated in order to ensure that the prime or tack coat will adhere.
- B. When the tack coat is applied adjacent to the curb, or any other concrete surface (except where they are to be covered with a bituminous wearing course), such concrete surfaces shall be protected by heavy paper or other protective material while the prime or tack coat is being applied. Any bituminous material deposited on such concrete surfaces shall be removed immediately.

3.2 WEATHER LIMITATIONS

- A. No bituminous material shall be applied when the air temperature is less than 50 degrees F. in the shade, or when the weather conditions or the condition of the existing surface is unsuitable. In no case shall bituminous material be applied while rain is falling or when there is water on the surface to be covered.

3.3 APPLICATION

- A. No tack coat shall be applied until the primed base or leveling course has been cleaned and is free from sand, dust, or other objectionable material.
- B. The tack coat shall be applied with a pressure distributor as specified above. It shall be heated to a suitable consistency and applied in a thin uniform layer at the rate of between 0.05-gallons and 0.10-gallons per square yard over all areas to be paved including hidden edge of curb sections.
- C. The tack coat shall be applied sufficiently in advance of the laying of the wearing surface to permit drying but shall not be applied so far in advance or over such an area as to lose its adhesiveness as a result of being covered with dust or other foreign material. Suitable precautions shall be taken by the Contractor to protect the surface while the tack coat is drying and until the wearing surface is applied.

END OF SECTION 32 12 13.13

SECTION 32 12 16

HMA ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Asphaltic concrete binder, bituminous material / HMA and surface course.
 - 2. Milling of existing pavement.

- B. Related Sections
 - 1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
 - 2. Section 31 20 00 - Earthmoving
 - 3. Section 32 11 23 - Aggregate Base Course
 - 4. Section 32 17 23 - Pavement Markings
 - 5. Section 32 16 13.13 - Concrete Curbs and Gutters
 - 6. Section 32 10 00 - Concrete Sidewalks

1.2 REFERENCED STANDARDS

- A. All work under this section shall be completed in general conformance with construction plan details, all Local Municipality / County standards, or per applicable Michigan Department of Transportation's (MDOT) standard specifications for construction, standard plans, construction manual, quality assurance procedures manual (current editions), and as specified herein.

- B. The Asphalt Institute (AI)
 - 1. MS 2 - Mix Design Methods/ Asphalt Concrete/ Hot Mix Types

- C. ASTM International (ASTM)
 - 1. ASTM D1556 - Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 - 2. ASTM D2950 - Density of Bituminous Concrete in Place by the Nuclear Methods
 - 3. ASTM D1188 - Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples.
 - 4. ASTM D2726 - Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixture.
 - 5. ASTM D5444 - Mechanical Size Analysis of Extracted Aggregate.

- D. American Association of State Highway and Transportation Officials (AASHTO)
 - 1. AASHTO M 17 - Mineral Filler for Bituminous Paving Mixtures.
 - 2. AASHTO M 140 - Emulsified Asphalt
 - 3. AASHTO M 208 - Cationic Emulsified Asphalt
 - 4. AASHTO M 226 - Viscosity Graded Asphalt Cement
 - 5. AASHTO T 245 - Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
 - 6. AASHTO TP 53 - Asphalt Content of Hot Mix Asphalt by the Ignition Method

1.3 QUALITY ASSURANCE

- A. A testing laboratory (TL) retained by the Owner or Contractor shall perform construction testing of in-place asphaltic concrete, bituminous material / HMA surface and wearing courses for compliance with requirements for thickness and compaction per contract documents.

- B. Comply with standards and specifications where applicable of Michigan Department of Transportation (MDOT), "Standard Specifications for Highway Construction" current edition.

1.4 SUBMITTALS

- A. Within 30 days prior to asphalt construction, submit actual design mix to Civil Engineering Consultant of Record and testing laboratory for review and approval. Design mix submittal shall follow a format as indicated in Asphalt Institute Manual MS-2, Marshall Stability Method; and shall include type/name of mix, gradation analysis, grade of asphalt cement used, Marshall Stability in pounds flow, effective asphalt content in percent, and direct references to state highway department specifications sections for each material. Design shall be for mixture listed in current edition of MDOT standard specifications for construction. Mix designs over 1 year old will not be accepted. Paving contractor to submit certification that mix design conforms to specification requirements.

1.5 PROJECT CONDITIONS

- A. Weather Limitations:
 - 1. Apply tack coats when ambient or base surface temperature is above 40 F, and when temperature has been above 35 F for 12 hours immediately prior to application. Do not apply when base is wet, contains excess moisture, during rain, or when frozen.
 - 2. Construct asphaltic concrete, bituminous material / HMA paving when ambient temperature is above 40 F and rising or 50 F in the shade.
- B. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.
- C. Grade Control: Establish and maintain required lines and grades, including crown and cross-slope, for each course during construction operations.

PART 2 - PRODUCTS

2.1 SUMMARY

- A. Aggregate Base: Uniformly graded mixture of crushed concrete, stone, or crushed gravel acceptable to Engineer complying with MDOT 21AA requirements or Soil Engineer's report for recommended pavement section and/or as indicated on construction plan details.
- B. Coarse Aggregate (for Bituminous Mixture): Crushed stone or gravel conforming to the following MDOT Specifications and/or as indicated on construction plan detail or Soil Engineer Report:
 - 1. HMA Base Course: MDOT 13A / 3E10 or as indicated on construction plan details.
 - 2. HMA Leveling Course: MDOT 13A / 4E10 or as indicated on construction plan details.
 - 3. HMA Wearing Course: MDOT 13A / 5E10 or as indicated on construction plan details.
- C. Fine Aggregate: Natural or manufactured sand conforming to MDOT Specifications 3FS or 3CS. Sand manufactured from limestone will not be permitted.
- D. Mineral Filler: Limestone or dolomite dust, conforming to MDOT Specification 3MF.
- E. Asphalt Cement: Conform to MDOT Designation (Penetration Grade) PG 64-22 or PG 70-22P.

- F. Tack (Bond Coat): Asphalt emulsion conforming to Michigan Department of Transportation (MDOT) Designation SS-1H.

2.2 BITUMINOUS MIXTURES

- A. Provide asphalt-aggregate mixtures complying with the following MDOT Designations as specified by Engineer or Soil Engineers Pavement Mix recommendations:
 - 1. HMA Base Course: MDOT 13A / PG 64-22 / MDOT 3E10 / PG 64-22 or PG70-22P.
 - 2. HMA Leveling Course: MDOT 13A / PG 64-22 / MDOT 4E10 / PG 64-22 or PG70-22P.
 - 3. HMA Wearing Course: MDOT 13A / PG 64-22 / MDOT 5E10 / PG64-22 or PG70-22P.
- B. Provide course thickness as indicated on construction plans (Maximum of 15% RAP / 3% Air Void Allowed per Soil Engineer Recommended Pavement Cross-section).

2.3 EQUIPMENT

- A. Equipment necessary for the paving of HMA / asphaltic concrete shall be on the project prior to beginning paving operations.
- B. Maintain equipment in satisfactory operating condition and correct breakdowns in manner that will not delay or be detrimental to the schedule of paving operations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which hot mixed bituminous paving is to be installed. Notify Contractor and Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Soil Engineer / Engineer / Contractor.

3.2 MILLING EXISTING PAVEMENT

- A. Clean existing pavement of loose and deleterious materials immediately prior to cold milling. Remove exiting bituminous pavement by cold milling to grades and cross sections indicated in the plans.
- B. Repair or replace curbs, manholes, catch basins, and other construction damaged during pavement milling operations.
- C. Prepared milled pavement as required to receive new bituminous pavement.

3.3 PREPARATION

- A. Existing Pavement: Where new hot mixed bituminous paving abuts existing bituminous pavement including repair work, provide straight line, sawing through existing bituminous pavement construction.
 - 1. Perform sawing prior to removing bituminous pavement to be replaced.
 - 2. Refer to joint spacing provisions under Placing the Mix and to patching provisions under Compacting the Mix for coordination purposes and/or per construction plan details.
 - 3. In areas where sawed lines have become damaged or worn by construction activities, the contractor shall re-saw straight, clear lines immediately prior to paving.

- B. Proof roll prepared base material surface to check for unstable areas in accordance with MDOT Specification for Construction, current edition and/or Section 31 20 00 whichever is more stringent including documentation and re-proof rolling as required. Paving work shall begin only after unsuitable areas have been corrected and are ready to receive paving.
- C. Remove loose material from compacted base material surface immediately before applying prime coat.
- D. Establish and maintain required lines and elevations.
- E. Cover the surfaces of curbs, gutters, manholes and other structures on which the asphaltic concrete mixture will be placed, with a thin, uniform coat of liquid asphalt. Where the asphaltic concrete mixture will be placed against the vertical face of an existing pavement, clean the vertical face to remove foreign substances and apply a coating of liquid asphalt at a rate of approximately 0.25 gallons per square yard.

3.4 FRAME ADJUSTMENTS

- A. Set frames for manholes and other such units, within areas to be paved, to final grade as part of this work. Include existing frames or new frames furnished in other sections of these Specifications.
- B. Surround frames set to grade with a ring of compacted hot mixed bituminous base prior to paving. Place bituminous pavement mixture up to 1 inch below top of frame, slope to grade, and compact with hand tamp.
- C. Adjust frames as required for paving. Provide temporary closures over openings until completion of rolling operations. Remove closures at completion of work. Set cover frames to grade, flush with surface of adjacent pavement.

3.5 PREPARING THE MIX

- A. Plant Equipment and Procedures: Comply with all MDOT specifications and requirements.
- B. Aggregate Storage: Keep each component of various-sized combined aggregates in separate stockpiles. Maintain stockpiles so that aggregate sizes will not be intermixed and to prevent aggregation.
- C. Asphalt Cement Preparation: Heat asphalt cement at mixing plant to a viscosity that can readily be pumped and distributed throughout the hot mixed asphalt mixture. Add asphalt cement binder to aggregate at a temperature between 235 degrees F and 350 degrees F.
- D. Aggregate Preparation: Dry aggregate and deliver to mixer at a temperature between 235 degrees F and 350 degrees F. Maintain the temperature between these limits according to the penetration grade and viscosity characteristics of the hot mixed asphalt cement, ambient temperature, and workability of the mixture, while the hot mixed asphalt cement is being added.
 - 1. Dry aggregate to reduce moisture-content and to prevent hot mixed asphalt mixture from foaming, slumping, or segregating during hauling and placing operations.
- E. Mixing: Accurately weigh or measure dried aggregates and weigh or meter asphalt cement to comply with job-mix formula requirements. Do not heat asphalt cement above 350 degrees F, at time of introduction into mixer.
 - 1. Mix aggregate and asphalt cement to achieve 90-95 percent of coated particles for base mixture and 85-90 percent of coated particles for surface mixture.

- F. Delivery: Transport hot mixed bituminous paving mixtures from mixing plant to project site in trucks having tight, clean compartments. If required, coat hauling compartment surfaces with a lime-water mixture or a soap or detergent solution to prevent bituminous pavement mixture from sticking. Elevate and drain compartment of excess solution before loading mix.
 - 1. Provide covers over hot mixed bituminous paving mixture when delivering to protect mixture from weather and to prevent loss of heat.
 - 2. During periods of cool weather or for long-distance deliveries, provide insulation around entire truck bed surfaces.

3.6 APPLICATION

- A. Tack Coat:
 - 1. Apply to contact surfaces of previously constructed asphaltic concrete base courses or Portland cement concrete and surfaces abutting or projecting into asphaltic concrete or into asphaltic concrete pavement.
 - 2. Apply tack coat to asphaltic concrete base course or sand asphalt base course. Apply emulsified asphalt tack coat between each lift or layer of full depth asphaltic concrete and sand asphalt bases and on surface of bases where asphaltic concrete paving will be constructed.
 - 3. Apply at minimum rate of 0.10 gal per sq. yd of surface.
 - 4. Allow drying until at proper condition to receive paving.

3.7 ASPHALTIC CONCRETE PLACEMENT

- A. Place asphaltic concrete mixture on completed compacted subgrade surface, spread, and strike off. Spread mixture at following minimum ambient temperatures:
 - 1. Between 40 and 50 F: Mixture temperature: 285 F
 - 2. Between 50 and 60 F: Mixture temperature: 280 F
 - 3. Higher than 60 F: Mixture temperature: 275 F
- B. Whenever possible, spread pavement by finishing machine; however, inaccessible, or irregular areas may be placed by hand methods. Spread hot mixture uniformly to required depth with hot shovels and rakes. After spreading, carefully smooth hot mixture to remove segregated coarse aggregate and rake marks. Rakes and lutes used for hand spreading shall be type designed for use on asphalt mixtures. Do not dump loads faster that they can be properly spread. Workers shall not stand on loose mixture while spreading.
- C. Paving Machine Placement: Apply successive lifts of asphaltic concrete in transverse directions with surface course placed parallel to flow of traffic. Place asphaltic paving in typical strips not less than 10'-0" wide. Asphaltic concrete pavement, including base and surface course, shall be placed in two or more equal lifts. Each lift shall be from 1 to 3 inches thick or per MDOT Specification for Construction, current edition.
- D. Joints: Make joints between old and new pavements, or between successive days and work in manner that will provide continuous bond between adjoining work. Construction joints shall have same texture, density, and smoothness as other sections of asphaltic concrete course. Clean contact surfaces of joints and apply tack coat.

3.8 ROLLING AND COMPACTION

- A. After being spread, mixture shall be compacted by rolling as soon as it will bear the weight of rollers without undue displacement. Number, weight, types of rollers, and sequences of rolling operations shall be such that the required density and surface are consistently attained while the mixture is in workable condition.

- B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
- C. Breakdown Rolling: Perform breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling and repair displaced areas by loosening and filling with hot material.
- D. Second Rolling: Follow breakdown rolling as soon as possible while mixture is hot. Continue second rolling until mixture has been thoroughly compacted as follows:
 - 1. Average Density: 96 percent of reference laboratory density according ASTM D1556, but not less than 94 percent nor greater than 100 percent.
- E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.
- F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot asphaltic concrete. Compact by rolling to maximum surface density and smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked. Any masked or marred finish surfaces shall be repaired or smoothed.

3.9 JOINTS

- A. General
 - 1. Place each asphaltic paving layer as continuous as possible to keep the number of joints to a minimum. Create joints between old and new pavement, between successive days work, and where the mixture has become cold (less than 140 degrees F). Make these joints in such a manner as to create a continuous bond between the old and new pavement construction courses.
 - 2. Offset joint of successive courses by at least 6 inches.
- B. Transverse Joints: If placing of material is discontinued or if material in place becomes cold, make a joint running perpendicular to the direction traveled by the paver. Before placement continues, trim the edge of the previously placed pavement to a straight-line perpendicular to the paver and cut back to expose an even vertical surface for the full thickness of the course. When placement continues, position the paver on the transverse joint so that sufficient hot mixture will be spread in order to create a joint after rolling that conforms to the required smoothness. If the temperature of the previously placed pavement material drops below 140 degrees F before paving is resumed, give the exposed vertical face a thin coat of liquid asphalt just before paving is continued.
- C. Longitudinal Joints: Coat longitudinal joints that are not completed before the previously laid mixture has cooled to a temperature below 140 degrees F, with liquid asphalt just before paving is continued.

3.10 SEAL COAT

- A. Apply seal coat over new wearing course if requested by owner and/or if indicated on plans.

- B. Allow pavement to cure three weeks minimum. Remove dust and oil to ensure proper adhesion of seal coat to pavement. Persistent or oil films that are not removed by mechanical brushing or scrubbing with detergent and water can be sprayed with primer at not more than 0.01 gallons per sq. yd. Detergent must be thoroughly rinsed off before pavement is sealed.
- C. Mix a sand slurry using sealer, sand, and makeup water as recommended by manufacturer.
- D. Apply sand slurry evenly and uniformly at a rate of 0.10 to 0.15 gallons per sq. yd.
- E. When sand slurry treatment is dry, apply one coat of sealer (without sand) uniformly over entire area at a rate of 0.10 to 0.15 gallons per sq. yd.

3.11 FIELD QUALITY CONTROL

- A. Field quality control tests specified herein will be conducted by the Testing Laboratory (TL). The Contractor shall perform additional testing as considered necessary by the Contractor for assurance of quality control. Retesting required because of failed initial tests shall be at the Contractor's expense.
- B. Field testing, frequency, and methods may vary as determined by and between the Contractor and the Testing Laboratory.
- C. Asphaltic surface and base courses shall be randomly cored at minimum rate of 1 core per 20,000 sq. ft of paving, but not less than 3 cores in light duty areas and 3 cores in heavy-duty areas shall be obtained. Asphaltic concrete pavement samples shall be tested for conformance with mix design. Cores shall be cut from areas representative of project.
- D. Coring holes shall be immediately filled by the Contractor with full-depth asphaltic concrete.
- E. Testing shall be performed on finished surface of each asphalt concrete course for smoothness, using 10'-0" straightedge applied parallel with, and at right angles to centerline of paved area. The following tolerances in 10 ft shall not be exceeded:

Base / Leveling Course Surface:	1/4-inch
Wearing Course Surface:	1/8-inch

- F. Thickness Test: Measure thickness of each core sample taken. The thickness of the course or the combined courses shall meet or exceed the indicated thickness. Where the deficiency exists, remove the affected pavement area, and replace it with new pavement or, at discretion of Engineer, correct deficient paving thickness with tack coat and minimum 1-in. overlay.
- G. Field density test for in-place materials:
 - 1. Density tests shall be conducted on each core sample taken in accordance with ASTM D1188 or D2726 as applicable.
 - 2. In-place density tests by nuclear method in accordance with ASTM D2950 shall also be taken as necessary to assure the specified density is obtained. Nuclear density shall be correlated with ASTM D1188 or D2726.
- H. Laboratory Air Void, Marshall Stability, and Flow: Mixture samples shall be taken at least four times for every 2000 tons or 8-hour day and compacted into specimens, using compactive blows (35, 50, or 75) equal to mix design per side with the Marshall hammer as described in AASHTO T 245. Temperature shall be equal to temperature at paving machine with reheating. After compaction, the laboratory air voids of each specimen shall be determined, as well as the Marshall stability and flow.

- I. Check surface areas as necessary to identify any area that pond water. Remove and replace all unacceptable paving as directed by Engineer.
- J. Asphalt Extraction and Aggregate Gradation: Asphalt extraction and gradation of extracted aggregate testing shall be performed in accordance with AASHTO TP 53 and ASTM D5444, respectively. At least two extractions and two gradation tests shall be taken for each 2000 tons, or each day pavement is placed.
- K. Areas of deficient paving, including compaction, smoothness, thickness, and asphalt mixture, shall be delineated, removed, and replaced in compliance with specification's requirements unless corrected otherwise as directed and approved by the Engineer.
- L. The Contractor shall certify in writing that asphalt placement is in accordance with specification requirements.

END OF SECTION 32 12 16

SECTION 32 13 13
CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Preparation and placement of Portland cement concrete parking areas.
 - 2. Preparation and placement of Portland cement concrete roads and entrances.

- B. Related Sections
 - 1. Section 02 00 00 - Existing Conditions - General Information/Site Construction.
 - 2. Section 31 20 00 - Earthmoving.
 - 3. Section 32 11 23 - Aggregate Base Course.
 - 4. Section 32 17 23 - Pavement Markings.

1.2 REFERENC'D STANDARDS

- A. All work under this section shall be completed in general conformance with construction plan details, all Local Municipality / County standards, or per applicable Michigan Department of Transportation's (MDOT's) standard specifications for construction, standard plans, construction manual, quality assurance procedures manual (current editions), and as specified herein.

- B. American Concrete Institute (ACI)
 - 1. ACI 301 - Structural Concrete for Buildings
 - 2. ACI 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete
 - 3. ACI 305R - Hot Weather Concreting
 - 4. ACI 306R - Standard Specification for Cold Weather Concreting
 - 5. ACI 308 - Standard Practice for Curing Concrete
 - 6. ACI 318 - Building Code Requirements for Reinforced Concrete

- C. American Society for Testing and Materials (ASTM)
 - 1. ASTM A185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
 - 2. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement
 - 3. ASTM C 31 - Test Methods of Making and Curing Concrete Test Specimens in the Field.
 - 4. ASTM C33 - Concrete Aggregates
 - 5. ASTM C 39 - Test Method for Comprehensive Strength of Cylindrical Concrete Specimens.
 - 6. ASTM C42 - Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
 - 7. ASTM C94 - Ready-Mixed Concrete
 - 8. ASTM C 138 - Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.
 - 9. ASTM C143 - Method for Slump of Hydraulic Cement Concrete
 - 10. ASTM C150 - Portland Cement
 - 11. ASTM C 172 - Method of Sampling Freshly Mixed Concrete.
 - 12. ASTM C231 - Air-Content of Freshly Mixed Concrete by the Pressure Method
 - 13. ASTM C260 - Air-Entraining Admixtures for Concrete
 - 14. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete
 - 15. ASTM C618 - Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.
 - 16. ASTM C920 - Standard Specification for Elastomeric Joint Sealants
 - 17. ASTM C989 - Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
 - 18. ASTM C1064 - Temperature of Freshly Mixed Portland Concrete Cement

19. ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous)
 20. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
 21. ASTM D2628 - Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
- D. Federal Specifications (FS)
1. FS HH-F-341 - Fillers, Expansion Joint: Bituminous (Asphalt & Tar)

1.3 QUALITY ASSURANCE

- A. Establish and maintain required lines and elevations in accordance with construction plans via construction staking / construction layout by a professional surveying company.
- B. Check surface areas at intervals necessary to eliminate areas which pond water. Remove and replace unacceptable paving as directed by Engineer.
- C. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
- D. Concrete Testing Service: The Contractor shall engage a qualified testing agency to perform materials evaluation tests and to design concrete mixes.

1.4 SUBMITTALS

- A. Submit certified laboratory test data or manufacturer's certificates and data for the items listed below certifying that materials are in conformance requirements specified herein. Submit the following documentation to the Engineering Consultant of Record and the Testing Laboratory for review and approval within 7 calendar days after receipt of Notice-to-Proceed, submit for approval: certified laboratory test data or manufacturers certificates and data for the following items:
 1. Portland cement concrete mix
 2. Aggregate gradations
 3. Preformed expansion joint filler
 4. Field molded/poured sealant
 5. Dowel bars
 6. Expansion sleeves
 7. Tie bars
 8. Reinforcing steel bars
 9. Welded wire fabric
 10. Air entraining admixtures
 11. Water-reducing and set-retarding admixtures (if used)

1.5 PROJECT CONDITIONS

- A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form

radius bends as required. Coat forms with non-staining type of coating that will not discolor or deface surface of concrete.

- B. Form Release Agent: Provide commercial formulation form-release agent with a maximum of 350g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- C. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A185. Furnish in flat sheets.
- D. Reinforcing Bars: Deformed steel bars, ASTM A615, Grade 60.
- E. Portland Cement: ASTM C150, Type IA
- F. Fly Ash: ASTM C 618, Class C or F, except loss on ignition (LOI) shall not exceed 3 %.
- G. Slag: ASTM C989, Grade 100 or 120.
- H. Exterior Pavement Joint Materials
 - 1. Joint Back-up Material: Polyethylene foam, 60% closed cell
 - 2. Sealant:
 - a. Dow 888, by Dow Corning.
 - b. 301 NS by Pecora.
 - c. Spectrum 800 or 900 by Tremco.
- I. Aggregate: ASTM C33.
- J. Water: Clean and potable
- K. Dowel Bars: ASTM A615, grade 60, and plain steel bars.
- L. Supports for Reinforcement: Chairs, spacers, dowel bar supports and other devices for spacing, supporting and fastening bars, welded wire fabric and dowels in place. Use wire bar-type supports complying with CRSI Specifications.
- M. Use supports with sand plates or horizontal runners where base materials will not support chair legs.

2.2 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type 1A.
 - 1. Use one brand of cement throughout Project unless otherwise acceptable to Architect.
- B. Normal Weight Aggregates: ASTM C 33, Class 4, (MDOT 6A and 2NS), and as follows. Provide aggregates from a single source.
 - 1. Maximum Aggregate Size: 1-1/2 inches.
 - 2. Do not use fine or coarse aggregates that contain substances, which could cause spalling.
- C. Water: Potable

2.3 ADMIXTURES

- A. Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

- B. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Darex AEA or Daravair; W.R. Grace & Co.
 - b. MB-VR or Micro-Air; Master Builders, Inc.
 - c. Sealtight AEA; W.R. Meadows, Inc.
 - d. Sika AER; Sika Corp.

- C. Water-Reducing Admixture: ASTM C 494, Type A.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Chemtard; ChemMasters Corp.
 - b. WRDA 19 or Daracem; W. R. Grace & Co.
 - c. Pozzoloth Normal; Master Builders, Inc.
 - d. Plastocrete 161; Sika Corp.

- D. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. WRDA 19 or Daracem; W.R. Grace & Co.
 - b. Rheobuild or Polyheed; Master Builders, Inc.
 - c. Sikament 300; Sika Corp.

- E. Water-Reducing and Accelerating Admixture: ASTM C494, Type E.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Daraset; W.R. Grace & Co.
 - b. Pozzutec 20; Master Builder, Inc.

- F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Daratard-17; W.R. Grace & Co.
 - b. Pozzoloth R; Master Builders, Inc.
 - c. Plastiment; Sika Corp.

2.4 CURING MATERIALS

- A. Water-Based Acrylic Curing Compound: Clear liquid type membrane curing compound complying with ASTM C 309, Type I, Class B.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Safe Cure and Seal (J-18)": Dayton Superior Corp.
 - b. "Dress & Seal WB": L & M Construction Chemicals, Inc.
 - c. "VOCOMP-20": W.R Meadows.
 - d. "Kure-N-Seal": Sonneborne Building Products.

- B. Water-Based Acrylic Curing Compound: White pigmented liquid type membrane curing compound complying with ASTM C 309, Type II, Class B.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Day-Chem White Pigmented Cure (J-10-W)": Dayton Superior Corp.
 - b. "1200-White": W.R Meadows.

- C. Evaporation Control: Monomolecular Film-forming compound applied to exposed concrete slab surfaces for temporary protection from moisture loss.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "E-Con": L & M Construction Chemicals, Inc.
 - b. "Confilm": Master Builders, Inc.

2.5 JOINT MATERIALS

- A. Fiber Joint Filler: Rectangular shaped with holes for load transfer devices, conforming to ASTM D 1751 (MDOT 8.16.04).
- B. Hot Poured Joint Sealant: Mixture of natural rubber or uncured synthetic rubber, or reclaimed rubber, or a combination of, with asphalt plasticizer and tackifiers conforming to ASTM D 1190 (MDOT 8.16.04).
- C. Flexible Joint Sealant: Flexible joint sealant (Grey Color) to be placed in all non-traffic pavement areas. (Refer to Specification 32 10 00 for additional information).

2.6 RELATED MATERIALS

- A. Bonding Agent: Styrene butadiene or acrylic base, rewettable type.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Day-Chem Ad Bond (J-40); Dayton Superior Corp.
 - b. Daraweld C; W.R. Grace & Co.
 - c. Everbond; L&M Construction Chemicals, Inc.
 - d. Acryl-Set; Master Builders, Inc.
 - e. Intralok; W. R. Meadows, Inc.
- B. Epoxy Adhesive: ASTM C 881, two component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class" to suit project requirements.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Resi-Bond (J-58); Dayton Superior.
 - b. Concessive Liquid; Master Builders, Inc.
 - c. Rezi-Weld 1000; W.R. Meadows, Inc.
 - d. Sikadur 32 Hi-Mod; Sika Corp.

2.7 CONCRETE MIX

- A. Prepare design mixes for each type and strength of normal-weight concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use a qualified independent testing agency for preparing and reporting proposed mix designs.
 - 1. The Contractor shall obtain the services of a testing agency for the preparation of required mix design services.
 - 2. Wherever snow-melting systems are used, establish mix design in accordance with requirements of snow melting system manufacturer for compatibility with system.
- B. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal weight concrete with the following properties:
 - 1. Compressive Strength (28 day): 4000 psi.
 - 2. Maximum Water-Cement Ratio at Point of Placement: 0.40.
 - 3. Slump Limit at Point of Placement: 3 inches.
 - a. Slump limit for concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site - verified 2 to 3-inch slump concrete.
- C. Add air-entraining admixture at manufacturer's prescribed rate of result in concrete at point of placement having an air content as follows with a tolerance of plus or minus 1-1/2 percent.
 - 1. 5.5 percent for 1-1/2 inch maximum aggregate
 - 2. 6.0 percent for 1-inch maximum aggregate

3. 6.0 percent for 3/4-inch maximum aggregate
 4. 7.0 percent for 1/2-inch maximum aggregate
- D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, project conditions, weather, test results, or other circumstances warrant.
- E. Supplementary Cementitious Materials (SCM):
1. Fly ash or slag may be used as SCM in addition to Portland cement if approved by Engineer.
 2. Fly Ash: If used, provide 15% minimum to 25% maximum of total cementitious content. If required to mitigate potential sulfate exposure or aggregate reactivity, up to 30% may be allowed. If used to mitigate potential aggregate reactivity, only Type F fly ash may be used and shall have the following maximum properties: 1.5% available alkali and 8.0% CaO. Up to 10.0% CaO will be permitted when the maximum replacement of 30% fly ash is allowed.
 3. Ground Granulated Blast Furnace Slag (GGBF): If used, provide 20% minimum to 30% maximum of total cementitious content. If required to mitigate potential sulfate exposure or aggregate reactivity, up to 50% may be allowed.
 4. When a ternary mix (combination of fly ash, GGBF, and Portland cement) is used, a maximum of 40% of SCM may be used, or when approved, up to 55% SCM may be used.
 5. Maintain air-entrainment at specified levels.
 6. In cold weather, provide adequate concrete strength gain so concrete will not be damaged from traffic and loads of use.

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94
1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which concrete curbs, walks and paving are to be installed. Notify Engineer / Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in an acceptable manner.

3.2 PREPARATION

- A. Proof-roll prepared base material surface to check for unstable areas in accordance with Section 31 20 00 including documentation and re-proof rolling as required. Paving work shall begin only after unsuitable areas have been corrected and are ready to receive paving.
- B. Remove loose material from compacted base material surface to produce firm, smooth surface immediately before placing concrete.

3.3 INSTALLATION

- A. Form Construction
1. Set forms to plan grades and lines, rigidly braced and secured.

2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place minimum of 24 hours after concrete placement.
 3. Check completed formwork for grade and alignment to following tolerances:
 - a. Top of forms not more than 1/8-inch in 10'-0".
 - b. Vertical face on longitudinal axis, not more than 1/4-inch in 10'-0".
 4. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.
- B. Reinforcement: Fasten reinforcing bars or welded wire fabric (if required) accurately and securely in place with suitable supports and ties. Remove from reinforcement all dirt, oil, loose mill scale, rust, and other substances that will prevent proper bonding of the concrete to the reinforcement.
- C. Concrete Placement
1. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel and items to be embedded or cast in. Notify other trades to permit installation of their work.
 2. Remove snow, ice or frost from subbase surface and reinforcing before placing concrete. DO NOT place concrete on surfaces that are frozen.
 3. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.
 4. Comply with requirements and with ACI 304R for measuring, mixing, transporting, and placing concrete.
 5. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
 - a. When concrete placing is interrupted for more than 1/2 hour, place a construction joint.
 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 7. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.
 - a. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcing, dowels, and joint devices.
 8. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.
 9. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off and screed.
 - a. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Architect.
 10. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
 11. Cold-Weather Placement: Comply with provisions of ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing conditions or low temperatures.
 - a. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 90 deg F (27 deg C) at point of placement.
 - b. Do not use frozen materials or materials containing ice or snow.

- c. Do not use calcium chloride, salt or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
 12. Hot-Weather Placement: Place concrete complying with ACI 305 R and as specified when hot weather conditions exist.
 - a. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled, or chopped ice may be used, to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - b. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
 - c. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.
- D. Joint Construction: Construct expansion, weakened-plane control (contraction), and construction joints straight with face perpendicular to concrete surface. Construct transverse joints perpendicular to centerline, unless otherwise detailed.
 1. Weakened-Plane Control or Contraction Joints: Provide joints at spacing of 15'-0" on centers, maximum each way. Construct control joints for depth equal to at least 1/4 of the concrete thickness, as follows:
 - a. Form tooled joints in fresh concrete by grooving top with recommended tool and finishing edge with jointer.
 - b. Form sawed joints using powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.
 2. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for period of more than 1/2 hour, except where such placements terminate at expansion joints. Construct joints in accordance with standard details.
 3. Transverse Expansion Joints: Locate expansion joints at maximum of 180'-0" on centers, maximum each way unless otherwise shown on the Construction Drawings. Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, sidewalks, and other fixed objects.
 4. Butt Joints: For joints against existing pavement, place 16" long dowels eight inches into holes drilled into center of existing slab. Epoxy dowels into holes with approved epoxy compound. Place dowels prior to concrete placement for new concrete. Dowel spacing to be 24" on center unless otherwise shown on Construction Drawings. Saw joint and fill with joint sealer.
- E. Joint Sealants: Joints shall be sealed with approved exterior pavement joint sealants and shall be installed in accordance with manufacturer's recommendations.

3.4 CONCRETE FINISHING

- A. After striking off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10'-0" straightedge. Distribute concrete as required to remove surface irregularities and re-float repaired areas to provide continuous smooth finish.
- B. Work edges of slabs and formed joints with edging tool, rounding edge to 1/2-inch radius. Eliminate tool marks on concrete surface. After completion of floating and troweling, when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

1. Inclined Slab Surfaces: Provide coarse, non-slip finish by scoring surface with stiff-bristled broom perpendicular to flow of traffic so as to produce regular corrugations not over 1/16 of an inch deep.
 2. Paving: Provide coarse, non-slip finish by scoring surface with stiff-bristled broom perpendicular to flow of traffic so as to produce regular corrugations not over 1/16 of an inch deep.
- C. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Owner.

3.5 CURING AND PROTECTION

- A. Protect and cure finished concrete paving using with curing compound or with acceptable moist-curing methods in accordance with "water-curing" section of ACI 308. Cure for a period not less than 7 days.
- B. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 306 R for cold weather protection and ACI 305 R for hot weather protection during curing.
- C. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Apply curing compound uniformly in continuous operation by power sprayer or roller, at rate, in conformance with manufacturer's recommendations.

3.6 CLEANING AND ADJUSTING

- A. The Contractor shall certify in writing that placement is in accordance with specification requirements.
- B. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.
- C. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement or as otherwise approved by the Engineer or Testing Laboratory. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

3.7 FIELD QUALITY CONTROL

- A. Field quality control tests specified herein will be conducted by the Contractors' Testing Laboratory. The Contractor shall perform additional testing as considered necessary by the Contractor for assurance of quality control. Retesting required because of failed initial tests shall be at the Contractor's expense.
- B. Field testing, frequency, and methods may vary as determined by and between the Contractor and Testing Laboratory.

- C. Review the Contractor's proposed materials and mix design for conformance with specifications.
- D. Perform testing in accordance with ACI 301 and testing standards listed herein.
- E. Strength Tests:
 - 1. Secure composite samples in accordance with ASTM C 172. Sample at regularly spaced intervals from middle portion of the batch. Sampling time shall not exceed 15 minutes.
 - 2. Mold and cure specimens in accordance with ASTM C 31.
 - a. A minimum of four concrete test cylinders shall be taken for every 100 cubic yards or less of each class of concrete placed each day and not less than once for each 5000 square feet of paved area.
 - b. During the initial 24 hours (plus or minus 8 hours) after molding, the temperature immediately adjacent to the specimens shall be maintained in the range of 60 to 80 degrees F. Control loss of moisture from the specimens by shielding from the direct rays of the sun and from radiant heating devices.
 - c. Specimens transported prior to 48 hours after molding shall not be demolded but shall continue initial curing at 60 to 80 degrees F until time for transporting.
 - d. Specimens transported after 48 hours age shall be demolded in 24 hours (plus or minus 8 hours). Curing shall then be continued but in saturated limewater at 73.4 degrees (plus or minus 3 degrees F) until the time of transporting.
 - e. Wet cure cylinders under controlled temperature until testing.
 - 3. Test cylinders in accordance with ASTM C 39.
 - a. Date test cylinders and number consecutively. Give each cylinder of each set an identifying letter (i.e., A, B, C, D). Prepare a sketch of the building plan for each test set identifying location of placed concrete.
 - b. Test one cylinder (A) at 7 days for information. If the compressive strength of the concrete sample is equal to or above the 28-day specified strength, test another cylinder (B) at 7 days. The average of the breaks shall constitute the compressive strength of the concrete sample.
 - c. Test two cylinders (B and C) at 28 days and the average of the breaks shall constitute the compressive strength of the concrete sample.
 - d. Retain fourth cylinder (D) for further testing if needed, but do not retain cylinder more than 60 days.
 - 4. Evaluation and Acceptance:
 - a. Strength level of concrete will be considered satisfactory if the average of all sets of three consecutive strength tests equal or exceed specified strength and no individual strength test (average of two cylinders) results are below specified compressive strength by more than 500 psi.
 - b. Complete concrete work will not be accepted unless requirements of ACI 301, have been met, including dimensional tolerances, appearance, and strength of structure.
 - c. Where average strength of cylinders, as shown by tests is not satisfactory, Owner reserves the right to require Contractor to provide improved curing conditions of temperature and moisture to secure required strength. If average strength of laboratory control cylinders should fall so low as to cause portions of structure to be in question by Architect/Engineer, follow core procedure set forth in ASTM C42. If results of core test indicate, in opinion of Architect/Engineer, that strength of structure is inadequate, provide without additional cost to owner, replacement, load testing, or strengthening as may be ordered by Architect/Engineer. If core tests are so ordered and results of such tests disclose that strength of structure is as required, cost of test will be paid by Owner.

- F. Slump Test: Conduct slump test for each cylinder set taken in accordance with ASTM C 143. Make additional slump tests for every other load from a stationary mixer or truck to test consistency. Sampling shall be in accordance with ASTM C 172.
- G. Air Content: Conduct air content test for each cylinder set for concrete exposed to freeze-thaw in accordance with ASTM C 231, ASTM C 173, or ASTM C 138. Indicate test method on report. Make test at same time as slump test.
- H. Unit Weight: ASTM C 138.
- I. Temperature Test: Conduct temperature test for each cylinder set taken in accordance with ASTM C 1064. Test hourly when air temperature is 40 F and below or 80 F and above. Determine temperature of concrete sample and ambient air for each strength test.
- J. In addition to required information noted previously in this Section, record the following information on concrete compression reports:
 - 1. Test cylinder number and letter.
 - 2. Specific foundations or structures covered by this test.
 - 3. Proportions of concrete mix or mix identification.
 - 4. Maximum size coarse aggregate.
 - 5. Specified compressive strength.
 - 6. Tested compressive strength.
 - 7. Slump, air-content (when applicable) and concrete temperature.
 - 8. Concrete plastic unit weight.
 - 9. Concrete Temperature.
 - 10. Elapsed time from batching at plant to discharge from delivery truck at project.
 - 11. Date and time concrete was placed.
 - 12. Ambient temperature, wind speed, and relative humidity during concrete placement.
 - 13. Name of technician securing samples.
 - 14. Curing conditions for concrete strength test specimens (field and laboratory).
 - 15. Date strength specimens transported to laboratory.
 - 16. Age of strength specimens when tested.
 - 17. Type of fracture during test.
- K. At the start of each day's mixing, report any significant deviations from approved mix design including temperature, moisture, and condition of aggregate.
- L. Certify each delivery ticket of concrete. Report type of concrete delivered, amount of water added and time at which cement, and aggregate were loaded into truck, and time at which concrete was discharged from truck
- M. In Place Pavement Testing: The Owner or Contactors' Testing Laboratory (TL) will randomly core pavement at minimum rate of 1 core per 20,000 sq. ft of pavement, with minimum of 3 cores from heavy-duty areas and 3 cores from light duty areas. Cores will be sampled and tested in accordance with ASTM C 42. Core will be tested for thickness and quality of aggregate distribution. Core holes shall be patched by the Contractor immediately with Portland cement concrete and shall be finished to provide level surface as specified herein.
- N. Additional Tests: Additional in-place tests shall be conducted as directed by the Engineer or Testing Laboratory when specified concrete strengths and other characteristics have not been attained in the structures.

3.8 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged or defective, or does not comply with requirements of this Section.
- B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. Where construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete paving free of stains, discolorations, dirt, and other foreign materials. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

SECTION 32 13 73

CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Cold-applied joint sealants.
 - 2. Hot-applied joint sealants.
 - 3. Joint-sealant backer materials.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of joint sealant and accessory.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.

1.7 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F .
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience. Provide sealant at all exterior concrete walks and paving, where pavement abuts a vertical surface, and at concrete and asphalt joints. Material shall be permanent non-water soluble, flexible exterior use silicone sealant, impervious to effects of ultraviolet light and petroleum products.

2.2 COLD-APPLIED JOINT SEALANTS

- A. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type SL.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crafcoc Inc.
 - b. Pecora Corporation.
 - c. The Dow Chemical Company.

2.3 HOT-APPLIED JOINT SEALANTS

- A. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type I.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crafcoc Inc.
 - b. Right Pointe.
 - c. W.R. Meadows, Inc.
- B. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type I or Type II.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Crafcoc Inc.
 - b. Right Pointe.
- C. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type I, II, or III.
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crafcoc Inc.
 - b. Right Pointe.
 - c. W.R. Meadows, Inc.
- D. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type IV.
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crafcoc Inc.
 - b. W.R. Meadows, Inc.

2.4 JOINT-SEALANT BACKER MATERIALS

- A. Joint-Sealant Backer Materials: Non-staining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior

experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

- A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.
- C. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of joint-sealant backings.
 - 2. Do not stretch, twist, puncture, or tear joint-sealant backings.
 - 3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:
 - 1. Place joint sealants so they fully contact joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Non-sag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
 - 1. Remove excess joint sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING AND PROTECTION

- A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.
- B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.5 PAVING-JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Joints within concrete paving.
 - 1. Joint Location:
 - a. Expansion and isolation joints in concrete paving.
 - b. Contraction joints in concrete paving.
 - c. Other joints as indicated.
 - 2. Joint Sealant: Single-component, self-leveling, silicone joint sealant Hot-applied, single-component joint sealant.
 - 3. Joint-Sealant Color: Per Architect Selection .

- B. Joint-Sealant Application: Joints within concrete paving and between concrete and asphalt paving.
 - 1. Joint Location:
 - a. Joints between concrete and asphalt paving.
 - b. Joints between concrete curbs and asphalt paving.
 - c. Other joints as indicated.
 - 2. Joint Sealant: Hot-applied, single-component joint sealant.
 - 3. Joint-Sealant Color: Per Architect Selection .

END OF SECTION 32 13 73

SECTION 32 16 13.13

CONCRETE CURBS & GUTTERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Portland cement concrete curbs, concrete gutter, and/or concrete curb and gutters.
- B. Related Sections
 - 1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
 - 2. Section 31 20 00 - Earthmoving
 - 3. Section 32 12 16 - Asphalt Paving
 - 4. Section 32 13 13 - Concrete Paving

1.2 REFERENCED STANDARDS

- A. All work under this section shall be completed in general conformance with construction plan details, all Local Municipality / County standards; and per applicable Michigan Department of Transportation's (MDOT) standard specifications for construction, standard plans, construction manual, quality assurance procedures manual (current editions), and as specified herein.
- B. American Concrete Institute (ACI)
 - 1. ACI 305R - Hot Weather Concreting
 - 2. ACI 306R - Standard Specification for Cold Weather Concreting
 - 3. ACI 308 - Standard Practice for Curing Concrete
- C. ASTM International (ASTM)
 - 1. ASTM A185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
 - 2. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement
 - 3. ASTM C31 - Test Methods of Making and Curing Concrete Test Specimens in the Field
 - 4. ASTM C39 - Method for Comprehensive Strength of Cylindrical Concrete Specimens
 - 5. ASTM C42 - Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
 - 6. ASTM C94 - Ready-Mixed Concrete
 - 7. ASTM C138 - Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
 - 8. ASTM C143 - Method for Slump of Hydraulic Cement Concrete
 - 9. ASTM C231 - Air-Content of Freshly Mixed Concrete by the Pressure Method
 - 10. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete
 - 11. ASTM C173 - Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
 - 12. ASTM C260 - Air-Entraining Admixtures for Concrete
 - 13. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete
 - 14. ASTM C618 - Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.
 - 15. ASTM C 1064 - Temperature of Freshly Mixed Portland Concrete Cement
 - 16. ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous)
 - 17. ASTM C989 - Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
 - 18. ASTM D1190 - Concrete Joint Sealer, Hot Poured, Elastic Type
 - 19. ASTM D1751 - Performed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
 - 20. ASTM D2628 - Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

- D. Federal Specifications (FS)
 - 1. FS HH-F-341 - Fillers, Expansion Joint: Bituminous (Asphalt & Tar)
- E. State Highway Department Standard Specifications

1.3 QUALITY ASSURANCE

- A. Establish and maintain required lines and elevations.
- B. Check surface areas at intervals necessary to eliminate ponding or pooling areas. Remove and replace unacceptable work as directed by Engineer.

1.4 SUBMITTALS

- A. Certificates: Submit materials certificate from materials producer and Contractor, certifying that materials comply with, or exceed requirements specified herein to the Engineering Consultant of Record and the Testing Laboratory for review and approval and within 7 calendar days after receipt of Notice-to-Proceed, submit for approval, certified laboratory test data or manufacturers certificates and data for the following items:
 - 1. Portland cement concrete mix
 - 2. Aggregate gradations
 - 3. Preformed expansion joint filler
 - 4. Field molded/poured sealant
 - 5. Dowel bars
 - 6. Expansion sleeves
 - 7. Tie bars
 - 8. Reinforcing steel bars
 - 9. Welded wire fabric
 - 10. Air entraining admixtures
 - 11. Water-reducing and set-retarding admixtures (if used)

1.5 PROJECT CONDITIONS

- A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Forms shall be of depth equal to depth of curbing or sidewalk, and so designed as to permit secure fastening together at tops. Coat forms with non-staining type of coating that will not discolor or deface surface of concrete.
- B. Reinforcing Steel: Deformed steel bars, ASTM A 615, Grade 60.
- C. Portland Cement: Shall conform to ASTM C150, Type I
- D. Fly Ash: ASTM C 618, Class C or F, except loss on ignition (LOI) shall not exceed 3 %.
- E. Slag: ASTM C989, Grade 100 or 120.

- F. Exterior Pavement Joint Materials
 - 1. Joint Back-up Material: Polyethylene foam, 60% closed cell
 - 2. Sealant:
 - a. Dow 888, by Dow Corning.
 - b. 301 NS by Pecora.
 - c. Spectrum 800 or 900 by Tremco.
- G. Aggregate: ASTM C33.
- H. Water: Clean and potable
- I. Dowel Bars: ASTM A615, grade 60, and plain steel bars.
- J. Air Entrainment: ASTM C260.
 - 1. Air-Mix or AEA-92, by Euclid.
 - 2. MB-VR MB-AE 90, or Micro-Air, by Master Builders.
 - 3. Daravair or Darex Series, by W.R. Grace.
 - 4. Equivalent approved products.
- K. Liquid Membrane Curing and Sealing Compound: ASTM C 1315, Type I, Class A or B, 25% minimum solids content, clear non-yellowing with no styrene-butadiene.
 - 1. Water Based, VOC less than 350 g/l:
 - a. Super Aqua Cure, by Euclid Chemical Corp.
 - b. Kure 1315 by Degussa.

2.2 CONCRETE MIXING

- A. Mix concrete and deliver in accordance with ASTM C94. Design mix shall produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce following:
 - 1. Compressive Strength: 3,500 psi minimum at 28 days unless otherwise indicated on the Drawings.
 - 2. Slump Range: 2"-4" for hand placed concrete, 1-1/4" to 3" for machine placed (slip-form) concrete.
 - 3. Air Entrainment: 5 to 8 percent.
- B. Supplementary Cementitious Materials (SCM):
 - 1. Slag material may be used as SCM in addition to Portland cement only if approved via written authorization.
 - 2. Ground Granulated Blast Furnace Slag (GGBF): If used, provide 20% minimum to 30% maximum of total cementitious content. If required to mitigate potential sulfate exposure or aggregate reactivity, up to 50% may be allowed based upon the engineer and/or soil engineers written recommendation and authorization.
 - 3. When a ternary mix (combination of fly ash, GGBF, and Portland cement) is used, a maximum of 40% of SCM may be used, or when approved, up to 55% SCM may be allowed based upon the engineer and/or soil engineers written recommendation and authorization.
 - 4. Maintain air-entrainment at specified levels.
 - 5. In cold weather, provide adequate concrete strength gain so concrete will not be damaged from traffic and loads of use.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Begin paving work only after unsuitable areas have been corrected and are ready to receive paving.
- B. Remove loose material from compacted base material surface to produce firm, smooth surface immediately before placing concrete.

3.2 INSTALLATION

- A. Form Construction
 - 1. Set forms to required grades and lines, rigidly braced, and secured.
 - 2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place minimum of 24 hours after concrete placement.
 - 3. Check completed formwork for grade and alignment to following tolerances:
 - a. Top of forms not more than 1/8-inch in 10'-0".
 - b. Vertical face on longitudinal axis, not more than 1/4-inch in 10'-0".
 - 4. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.
- B. Reinforcement: Fasten reinforcing bars or welded wire fabric (if required) accurately and securely in place with suitable supports and ties. Remove from reinforcement all dirt, oil, loose mill scale, rust, and other substances that will prevent proper bonding of the concrete to the reinforcement.
- C. Concrete Placement
 - 1. Concrete shall be mixed and placed when the air temperature in the shade and away from artificial heat is a minimum of 35 degrees F and rising. Hot and cold weather concreting shall be in accordance with ACI 305R and 306R, respectively.
 - 2. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until set at required finish elevation and alignment.
 - 3. Place concrete using methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
 - 4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2-hour, place construction joint. Automatic machine may be used for curb and gutter placement. Machine placement shall be at required cross section, line, grade, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified herein.
- D. Joint Construction
 - 1. Contraction Joints: Construct concrete curb or combination concrete curb and gutter, where specified on Construction Drawings, in uniform sections of length specified on Construction Drawings. Form joints between sections either by steel templates, 1/4-inch in thickness, of length equal to width of curb and gutter, and with depth which will penetrate at least 2-inches below surface of curb and gutter; or with 3/4-inch thick performed expansion joint filler cut to exact cross section of curb and gutter; or by sawing to depth of at least 2-inches while concrete is between 4 and 24 hours old. If steel templates are used, they shall be left in place until concrete has set enough to hold its shape but shall be removed while forms are still in place.
 - 2. Longitudinal Construction Joints: Tie concrete curb or combination concrete curb and gutter, where specified on Construction Drawings, to concrete pavement with 1/2-inch round deformed reinforcement bars of length and spacing shown on Construction Drawings.

3. Transverse Expansion Joints: Concrete curb, combination concrete curb and gutter, or concrete sidewalk shall have filler cut to exact cross section of curb, gutter, or sidewalk. Joints shall be similar to type of expansion joint used in adjacent pavement.
- E. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less than 1/2-inch or more than 1-inch below finished surface where joint sealer is indicated. Furnish joint fillers in 1-piece lengths for full width being placed, wherever possible. Where more than 1 length are required, lace or clip joint filler sections together.
- F. Joint Sealants: Install in accordance with manufacturer's recommendations.

3.3 CONCRETE FINISHING

- A. After striking off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10'-0" straightedge. Distribute concrete as required to remove surface irregularities and refloat repaired areas to provide continuous smooth finish.
- B. Work edges of gutters, back top edge of curb, and formed joints with edging tool, rounding edge to 1/2-inch radius. Eliminate tool marks on concrete surface. After completion of floating and troweling, when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:
 1. Curbs and gutters: Broom finish by drawing fine-hair broom across surface perpendicular to flow of traffic. Repeat operation as necessary to produce fine line texture.
- C. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up minor honeycombed areas. Remove and replace areas or sections with major defects as directed Owner.

3.4 CURING AND PROTECTION

- A. Protect and cure finished concrete paving using with curing compound or with acceptable moist-curing methods in accordance with "water-curing" section of ACI 308. Cure for a period not less than 7 days.
- B. Use solvent-based curing compound when compound is applied below 40 F.

3.5 BACKFILL

- A. After concrete has set sufficiently, spaces on either side of concrete curb, combination concrete curb and gutter, or concrete sidewalk shall be refilled to required elevation with suitable material compacted in accordance with Section 31 20 00.

3.6 CLEANING AND PROTECTION

- A. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.
- B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

3.7 FIELD QUALITY CONTROL

- A. Field quality control tests specified herein will be conducted by the Owner's Independent Testing Laboratory at no cost to the Contractor. The Contractor shall perform additional testing as considered necessary by the Contractor for assurance of quality control. Retesting required because of failed initial tests shall be at the Contractor's expense.
- B. Field testing, frequency, and methods may vary as determined by and between the Owner and the Owner's Testing Laboratory.
- C. Review the Contractor's proposed materials and mix design for conformance with specifications.
- D. Perform sampling testing and evaluation in accordance with ASTM C94 and as follows.
- E. Strength Tests:
 - 1. Secure composite samples in accordance with ASTM C 172. Sample at regularly spaced intervals from middle portion of the batch. Sampling time shall not exceed 15 minutes.
 - 2. Mold and cure specimens in accordance with ASTM C 31.
 - a. A minimum of four concrete test cylinders shall be taken for every 50 cubic yards or less of concrete placed each day.
 - b. Construction Manager may choose to waive testing requirements on concrete placements less than 9 cubic yards.
 - 3. Test cylinders in accordance with ASTM C 39.
- F. Slump Test: Conduct slump test for each cylinder set taken in accordance with ASTM C 143.
- G. Air Content: Conduct air content test for each cylinder set for concrete exposed to freeze-thaw in accordance with ASTM C 231, ASTM C 173, or ASTM C 138.

END OF SECTION 32 16 13.13

SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Painting and marking of pavements, curbs, guard posts, and light pole bases.
 - 2. Complete all paving as indicated in the construction documents.
 - 3. Preparation of existing surface.
 - 4. Layout for pavement markings.
 - 5. Painting of letters, markings, stripes, and islands on the pavement surface.
- B. Related Sections
 - 1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
 - 2. Section 32 12 16 - Asphalt Paving
 - 3. Section 32 13 13 - Concrete Paving

1.2 REFERENCED STANDARDS

- A. All work under this section shall be completed in general conformance with construction plan details, all Local Municipality / County standards, or per applicable Michigan Department of Transportation's (MDOT) standard specifications for construction, standard plans, construction manual, quality assurance procedures manual (current editions), and as specified herein.
- B. American Association of State Highway and Transportation (AASHTO)
 - 1. AASHTO M248 - Ready-Mixed White and Yellow Traffic Paints
- C. ASTM International (ASTM)
 - 1. ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness by Notched Gauges.
- D. Federal Specifications (FS)
 - 1. FS A-A-2886 - Paint, Traffic, Solvent Based (supersedes FS TT-P-85 and FS TT-P-115, Type I)
 - 2. FS TT-P-1952 - Paint, Traffic and Airfield Marking, Waterborne

1.3 QUALITY ASSURANCE

- A. Use trained and experienced personnel in applying the products and operating the equipment required for properly performed work.

1.4 SUBMITTALS

- A. Material Certificates: Provide copies of material certificates signed by material producer and Contractor, certifying that materials comply with, or exceed, specified requirements.
- B. Pavement marking plan indicating lane separations and defined parking spaces. Note dedicated handicapped spaces with international graphic symbol.

1.5 PROJECT CONDITIONS

- A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Paint shall be waterborne, or solvent borne, colors as shown or specified herein. Pavement marking paints shall comply with all applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.
- B. Waterborne Paint: Paints shall conform to FS TT-P-1952.
- C. Solvent Borne Paint: Paint shall conform to FS A-A-2886 or AASHTO M248. Paint shall be non-bleeding, quick-drying, and alkyd petroleum base paint suitable for traffic-bearing surface and be mixed in accordance with manufacture's instructions before application for colors White, Yellow, Blue, and Red.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the work area and correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Immediately before application of the paint, the existing surface shall be dry and entirely free from dirt, grease, oil, acids, laitance, or other foreign matter which would reduce the bond between the coat of paint and the pavement. The surface shall be thoroughly cleaned by sweeping and blowing as required to remove all dirt, laitance, and loose materials. Areas which cannot be satisfactorily cleaned by power brooming and/or blowing shall be scrubbed as directed with a water solution of tri-sodium phosphate (10%Na₃P or by weight) or an approved equal solution. After scrubbing, the solution shall be rinsed off and the surface dried prior to painting.
- B. Where existing pavement markings are indicated on Construction Drawings to be removed or would interfere with adhesion of new paint, a motorized abrasive device shall be used to remove the markings. Equipment employed shall not damage existing paving or create surfaces hazardous to vehicle or pedestrian traffic. Within public rights-of-way, appropriate governing authority shall approve method of marking removal.
- C. New pavement surfaces shall be allowed to cure for not less than 30 days before application of marking materials.

3.3 CLEANING EXISTING PAVEMENT MARKINGS

- A. In general, markings shall not be placed over existing pavement marking patterns. Existing pavement markings, which are in good condition but interfere or conflict with the newly applied marking patterns, shall be removed. Deteriorated or obscured markings that are not misleading or confusing or do not interfere with the adhesion of the new marking material do not require removal. Whenever grinding, scraping, sandblasting or other operations are performed, the work shall be conducted in such a manner that the finished pavement surface is not damaged or left in a pattern that is misleading or confusing. When these operations are completed the

pavement surface shall be blown off with compressed air to remove residue and debris resulting from the cleaning work.

3.4 LAYOUTS AND ALIGNMENT

- A. The contractor is responsible for laying out a sample section of striping for approval by the Engineer before the contractor may proceed with the striping program. The contractor is to ensure that all subsequent striping meets the quality of the approved sample application.
- B. On those sections of pavements where no previously applied figures, markings, or stripes are available to serve as a guide, suitable layouts and lines of proposed stripes shall be spotted in advance of the point application. Control points shall be spaced as such intervals as will ensure accurate location of all markings.
- C. The contractor shall provide and experienced technician to supervise the location, alignment, layout, dimensions, and application of the paint.

3.5 EQUIPMENT

- A. All equipment for the work shall be approved by the contractor and shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, and such auxiliary hand painting equipment as may be necessary to satisfactorily complete the job.
- B. The mechanical marker shall be an approved atomizing spray-type marking machine suitable for application of traffic paint. It shall produce an even and uniform film thickness at the required coverage and shall be designed so as to apply markings of uniform cross-sections and clear-cut edges without running or spattering and within the limits for straightness set forth herein. When needed, a dispenser shall be furnished which is properly designed for attachment to the mechanical marker and suitable for dispensing the required quantity of reflective material.
- C. Suitable adjustments shall be provided on the sprayer/sprayers of a single machine or by furnishing additional equipment for painting the width required.

3.6 APPLICATION

- A. Apply two coats of paint at manufacturer's recommended rate, without addition of thinner, with maximum of 100 square feet per gallon or as required to provide a minimum wet film thickness of 15 mils and dry film thickness of 7 ½ mils per coat. Paint shall be applied for a total dry film thickness of 15 mils. Apply with mechanical equipment to produce uniform straight edges. At sidewalk curbs and crosswalks, use straightedge to ensure uniform, clean, and straight stripe.
- B. Markings shall be applied at the locations and to the dimensions and spacing indicated on the plans or as specified. Paint shall not be applied until the indicated alignments are laid out and the conditions of the existing surface have been approved by the Owner.
- C. The paint shall be mixed in accordance with the manufacturer's instructions before application. The paint shall be thoroughly mixed and applied to the surface of the pavement with the marking machine at its original consistency without the addition of thinner. If the paint is applied by brush, the surface shall receive two (2) coats; the first coat shall be thoroughly dry before the second coat is applied.
- D. Install markings according to manufacturer's recommended procedures for specified material.

- E. A period of one (1) week shall elapse between application of the bituminous seal coat, slurry seal or the placement of the bituminous surface course and the marking of the pavement. The paint shall not bleed excessively, curl, or discolor when applied to bituminous surfaces.
- F. In the application of straight stripes, any deviation in the edges exceeding ½ inch in 50 feet shall be obliterated and the marking corrected. The width of the marking shall be as designated within a tolerance of 5 percent (5%).
- G. The following items shall be painted with colors noted below except where modified by owner. Coordinate all specified painted areas with owner prior to application:
 - 1. Pedestrian Crosswalks: Yellow
 - 2. Exterior Sidewalk Curbs, Light Pole Bases, and Guard posts: Yellow
 - 3. Fire Lanes: Red or per local code
 - 4. Lane Striping where separating traffic moving in opposite directions: Yellow
 - 5. Lane Striping where separating traffic moving in the same direction: White
 - 6. ADA Symbols: Blue or per local code
 - 7. ADA Parking Space: Blue or as shown on the drawings.
 - 8. Parking Stall Striping: White or Yellow per Owner Requirements

3.7 FIELD QUALITY CONTROL

- A. Inspection: After the paint has thoroughly dried, visually inspect the entire application and touch up as required to provide clean, straight lines and surfaces throughout.

3.8 CLEANING

- A. Waste materials shall be removed at the end of each workday. Upon completion of the work, all containers and debris shall be removed from the site. Paint spots upon adjacent surfaces shall be carefully removed by approved procedures that will not damage the surfaces and the entire job left clean and acceptable.

END OF SECTION 32 17 23

SECTION 32 17 26

TACTILE WARNING SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Surface-applied detectable warning tiles.
 - 2. Detectable warning mats.
 - 3. Surface-applied detectable warning metal tiles.
- B. Related Requirements:
 - 1. Section 321313 "Concrete Paving" for concrete walkways serving as substrates for tactile warning surfacing.
 - 2. Section 321400 "Unit Paving" for unit paving installations incorporating detectable warning unit pavers specified in this Section.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For each type of exposed finish requiring color selection.
- C. Samples for Verification: For each type of tactile warning surface, in manufacturer's standard sizes unless otherwise indicated, showing edge condition, truncated-dome pattern, texture, color, and cross section; with fasteners and anchors.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

1.5 QUALITY ASSURANCE

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

- A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.
- B. Weather Limitations for Adhesive Application:
 - 1. Apply adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when substrate is wet or contains excess moisture.
- C. Weather Limitations for Mortar and Grout:
 - 1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering and wear.
 - b. Separation or delamination of materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TACTILE WARNING SURFACING, GENERAL

- A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities for tactile warning surfaces.
 - 1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.
- B. Source Limitations: Obtain each type of tactile warning surfacing , joint material , setting material , anchor , and fastener from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 DETECTABLE WARNING TILES

- A. Surface-Applied Detectable Warning Tiles: Accessible truncated-dome detectable warning concrete tiles configured for surface application on existing concrete walkway surfaces, with slip-resistant surface treatment on domes, field of tile, and beveled outside edges.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Access Products, Inc.
 - b. ADA Solutions, Inc.
 - c. AlertTile; a division of Cape Fear Systems, II, LLC.
 - d. Engineered Plastics Inc.; Armor-Tile.
 2. Material: Cast-fiber-reinforced polymer concrete tile.
 3. Color: As selected by Architect from manufacturer's full line.
 4. Shapes and Sizes:
 - a. Rectangular panel, as required to achieve plan detail dimensions: including 24 by 24 inches 24 by 36 inches 24 by 48 inches 24 by 60 inches 36 by 48 inches 36 by 60 inches .
 - b. Radius panel, as required to achieve plan detail dimensions: nominal 24 inches deep by 6-foot 8-foot 10-foot 12-foot 15-foot outside radius.
 5. Dome Spacing and Configuration: Manufacturer's standard compliant spacing, in manufacturer's standard pattern.
 6. Mounting: Adhered and fastened to existing concrete walkway.
- B. Surface-Applied Detectable Warning Metal Tiles: Accessible truncated-dome detectable warning metal tiles or plates configured for fastening to surface of existing concrete walkway surfaces, with slip-resistant surface treatment on domes, field of tile, and beveled outside edges.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advantage Tactile Systems.
 2. Material: Stainless-Steel Plate and Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
 3. Finish and Color:
 - a. Manufacturer's standard powder coat, color as selected by Architect from manufacturer's full line.
 - b. Mill finish.
 4. Shapes and Sizes:
 - a. Rectangular panel, 24 by 24 inches 24 by 36 inches 24 by 48 inches 24 by 60 inches .
 5. Dome Spacing and Configuration: Manufacturer's standard compliant spacing, in manufacturer's standard pattern.
 6. Mounting:
 - a. Permanently fixed detectable warning tile adhered and fastened to existing concrete walkway.

2.3 DETECTABLE WARNING MATS

- A. Surface-Applied Detectable Warning Mats: Accessible truncated-dome detectable warning resilient mats, UV resistant, manufactured for adhering to existing concrete walkway surfaces, with slip-resistant surface treatment on domes, field of mat, and beveled outside edges.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AlertTile; a division of Cape Fear Systems, II, LLC.
 2. Material: Modified rubber compound, UV resistant.
 3. Color: As selected by Architect from manufacturer's full range.
 4. Shapes and Sizes:
 - a. Rectangular panel, 24 by 36 inches 24 by 48 inches 24 by 60 inches .

5. Dome Spacing and Configuration: Manufacturer's standard compliant spacing, in manufacturer's standard pattern.
6. Mounting: Adhered to pavement surface with adhesive and fastened with fasteners.

2.4 ACCESSORIES

- A. Adhesive: As recommended by manufacturer for adhering tactile warning surfacing unit to pavement.
- B. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF TACTILE WARNING SURFACING

- A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.
- B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

3.3 INSTALLATION OF DETECTABLE WARNING TILES

- A. Surface-Applied Detectable Warning Tiles:
 1. Lay out detectable warning tiles as indicated and mark concrete pavement.
 2. Prepare existing paving surface by grinding and cleaning as recommended by manufacturer.
 - a. Cut perimeter kerf in existing concrete pavement to receive metal tile flange.
 3. Apply adhesive to back of tiles in amounts and pattern recommended by manufacturer, and set tiles in place. Firmly seat tiles in adhesive bed, eliminating air pockets and establishing full adhesion to pavement. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
 4. Install anchor devices through face of tiles and into pavement using anchors located as recommended by manufacturer. Set heads of anchors flush with top surface of mat.
 5. Mask perimeter of tiles and adjacent concrete, and apply sealant in continuous bead around perimeter of tile installation.
 6. Remove masking, adhesive, excess sealant, and soil from exposed surfaces of detectable warning tiles and surrounding concrete pavement using cleaning agents recommended in writing by manufacturer.
 7. Protect installed tiles from traffic until adhesive has set.

3.4 INSTALLATION OF DETECTABLE WARNING MATS

- A. Lay out detectable warning mats as indicated and mark concrete pavement at edges of mats.
- B. Prepare existing paving surface by grinding and cleaning as recommended by manufacturer.
- C. Apply adhesive to back of mat in amounts and pattern recommended by manufacturer, and set mat in place. Firmly seat mat in adhesive bed, eliminating air pockets and establishing full adhesion to pavement. If necessary, temporarily apply weight to mat to ensure full contact with adhesive.
- D. Install anchor devices through face of mat and into pavement using anchors located as recommended by manufacturer. Set heads of anchors flush with mat surface.
- E. Mask mat perimeter and adjacent concrete, and apply sealant in continuous bead around perimeter of mat.
- F. Remove masking, adhesive, excess sealant, and soil from exposed surfaces of detectable warning mat and surrounding concrete pavement using cleaning agents recommended in writing by manufacturer.
- G. Protect installed mat from traffic until adhesive has set.

3.5 CLEANING AND PROTECTION

- A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.
- B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 32 17 26

SECTION 32 84 00
PLANTING IRRIGATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Attention is directed to the Bidding and Contract Requirements and General and Supplemental Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK

- A. Furnish all labor, materials, supplies, equipment, tools, and transportation, and perform all operations in connection with and reasonably incidental to the complete installation of the irrigation system, and guarantee/warranty as shown on the drawings, the installation details, and as specified herein. The system shall be constructed to grades and conform to areas and locations as shown on the drawings. Removal and or restoration of existing improvements, excavation and back-fill, and all other work in accordance with plans and specifications are required.
- B. Extent of irrigation system work is shown on drawings and by provisions of this Section.
- C. Sprinkler lines shown on the drawings are essentially diagrammatic. Spacing of the sprinkler heads or quick coupling valves are shown on the drawings and shall be exceeded only with the permission of the Owner's authorized representative.
- D. Items of work specifically included are:
 - 1. Procurement of all applicable licenses, permits, and fees.
 - 2. Coordination of all utilities.
 - 3. Connection of electrical power supply to the irrigation control system.
 - 4. Connection of water source/supply to the irrigation system.
 - 5. Maintenance period.
 - 6. Sleeving for irrigation pipe and wire.

1.03 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.04 QUALITY ASSURANCE

- A. The "Contractor" shall maintain continuously a competent superintendent, satisfactory to the Owner, with authority to act for him in all matters pertaining to the work.
- B. The "Contractor" shall coordinate his work with the other trades
- C. The "Contractor" shall confine his operations to the area to be improved and to the areas allotted him by the Owner's representative for material and equipment storage.
- D. The "Contractor" shall have a minimum of 5 years experience installing irrigation systems of comparable size and complexity.

1.05 SUBMITTALS

- A. Submit samples according to Division 00 and Division 01 Specification Sections.

- B. Materials List: Include **backflow device, valves, valve boxes, sprinklers, controller, rain sensors, wire, wire connectors, pipe, fittings, and clamps** to be used on the project prior to purchasing materials. Quantities of material need not be included.
- C. Manufacturer's Data: Submit manufacturer's catalog cuts, specifications, and operating instructions for equipment shown on the materials list.
- D. Shop Drawings: Upon irrigation system acceptance, submit written operating and maintenance instructions. Provide format and contents as directed by the Landscape Architect. Include instruction sheets and parts lists for all operating equipment.
- E. Project Record (As-Built) Drawings
 1. Submit record drawings to Owner/Owner Representative.
 2. Record pipe and wiring network alterations. Record work that is installed differently than shown on the construction drawings. Record which valve operates which area by "clouding" or encircling the area and placing the correct valve number and controller identification nearby. Record accurate reference dimensions, measured from at least two permanent reference points of each irrigation system valve, each controller or control unit, each sleeve end, each stub-out for future pipe or wiring connections, and other irrigation components enclosed within a valve box. Place all dimensions and notes on the same page as the drawing. Use arrows and legends when needed.
 3. Before construction completion, obtain from the engineer/landscape architect/owner's representative an AutoCAD file copy of the drawings. Using AutoCAD, duplicate information contained on the project drawings maintained on site. Label each sheet "Record Drawings". Completion of the record drawings will be a prerequisite for the review at the completion of the irrigation system installation.

1.06 RULES AND REGULATIONS

- A. Work and materials shall be in accordance with the latest edition of the National Electric Code, the Uniform Plumbing Code as published by the Western Plumbing Officials Association, and applicable laws and regulations of the governing authorities.
- A. When the contract documents call for materials or construction of a better quality or larger size than required by the above-mentioned rules and regulations, provide the quality and size required by the contract documents.
- B. If quantities are provided either in these specifications or on the drawings, these quantities are provided for information only. It is the "Contractor's" responsibility to determine the actual quantities of all material, equipment, and supplies required by the project and to complete an independent estimate of quantities and wastage.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver irrigation system components in manufacturer's original undamaged and unopened containers with labels intact and legible.
- B. Deliver plastic piping in bundles, packaged to provide adequate protection of pipe ends either threaded or plain.
- C. Store and handle materials to prevent damage and deterioration

- D. Provide secure, locked storage for valves, sprinkler heads and similar components that cannot be immediately replaced, to prevent installation delays.

1.08 CODES AND STANDARDS

- A. The entire installation shall fully comply with all local and state laws and ordinances and with all established codes applicable thereto.
- B. Any permits for the installation or construction of the work included under this contract which are required by any of the legally constituted authorities having jurisdiction, shall be obtained, and paid for by the "Contractor", each at the proper time. He shall also arrange for and pay all costs concerning any inspections and examinations required by these authorities.
- C. In all cases where inspection of the sprinkler system work is required and/or where portions of the work are specified to be performed under the direction and/or inspection of the Owner's authorized representative, the "Contractor" shall notify the Owner's authorized representative at least 24 hours in advance of the time and such inspection and/or direction is required.
- D. Any necessary re-excavation or alterations to the system needed because of failure of the "Contractor" to have the required inspections shall be performed at the "Contractor's" own expense.

1.09 TESTING

- A. Notify the engineer/landscape architect/owner's representative three days in advance of testing.
- B. Pipelines jointed with rubber gaskets or threaded connections may be subjected to a pressure test at any time after partial completion of backfill. Pipelines jointed with solvent-welded PVC joints shall be allowed to cure at least 24 hours before testing.
- C. Subsections of mainline pipe may be tested independently, subject to the review of the engineer/landscape architect/owner's representative.
- C. Furnish clean, clear water, pumps, labor, fittings, and equipment necessary to conduct tests or retests.
- D. Volumetric Leakage Test:
 - 1. Cap riser of mainline components for volumetric pressure tests. Backfill to prevent pipe from moving under pressure. Expose coupling and fitting.
 - 2. Purge all air from the pipeline before test.
 - 3. Subject mainline pipe to the anticipated operating pressure of 100 PSI for two hours. Maintain constant pressure. The amount of additional water pumped in during the test shall not exceed 1.24 gallon per 100 joints of 3-inch diameter pipe and 1.6 gallons per 100 joint of 4-inch diameter pipe. Replace defective pipe, fitting, joint, valve, or appurtenance. Repeat the test until the pipe passes test.
 - 4. Cement or caulking to seal leaks is prohibited
- E. Operational Test:
 - 1. Activate each remote-control valve in sequence from controller. The engineer/landscape architect/owner's representative will visually observe operation, water application patterns, and leakage.
 - 2. Replace defective remote-control valve, solenoid, wiring, or appurtenance to correct operational deficiencies.

3. Replace, adjust, or move water emission devices to correct operational or coverage deficiencies.
4. Replace defective pipe, fitting, joint, valve, sprinkler, or appurtenance to correct leakage problems. Cement or caulking to seal leaks is prohibited.
5. Repeat test(s) until each zone passes all tests.
6. Repeat tests, replace components, and correct deficiencies at no additional cost to the owner.

1.10 CONSTRUCTION REVIEW

- A. The purpose of on-site reviews by the engineer/landscape architect/owner's representative is to periodically observe the work in progress, the "Contractor's" interpretation of the construction documents, and to address questions with regard to the installation.
- B. Scheduled reviews such as those for irrigation system layout or testing must be scheduled with the engineer/landscape architect's/owner's representative as required by these specifications.
- C. Impromptu reviews may occur at any time during the project.
- D. A review will occur at the completion of the irrigation system installation and project record (as-built) drawing submittal.

1.11 GUARANTEE/WARRANTY AND REPLACEMENT

- A. It shall be the "Contractor's" responsibility to ensure and guarantee satisfactory operation of the entire system and the workmanship and restoration of the area. The entire system shall be guaranteed to be complete and perfect in every detail for **a period of one year from the date of its final acceptance** and he hereby agrees to repair or replace any such defects occurring within that year, free of expense to the Owner. If final acceptance is not given the "contractor" will continue to be responsible for and maintain the irrigation system until acceptance is granted.
- B. Minor maintenance and adjustment shall be by the Owner.
- C. For a period of one year from commencement of the formal maintenance period, fill and repair depressions or settling more than one-quarter ($\frac{1}{4}$ "). Restore landscape or structural features damaged by the settlement of irrigation trenches or excavation. Repair damage to the premises caused by a defective item.
- D. Make repairs within seven (7) days of notification from the engineer/landscape architect/owner's representative.
- E. Contract documents govern replacements identically as with new work. Make replacements at no additional cost to the contract price.
- F. Guarantee/warranty applies to originally installed materials, equipment, and replacements made during the guarantee/warranty period.

1.12 WINTERIZATION AND SPRING START-UP

- A. Coordinate the winterization and start-up with the landscape maintenance personnel.

- B. "Contractor" shall winterize the system each year until final acceptance is granted and throughout the warranty period as part of this contract. "Contractor" will provide written instructions to the Owner for future service and maintenance.
- C. Return to the site during the subsequent spring season and demonstrate to the Owner the proper procedures for the system start-up, operation, and maintenance. Repair any damage caused in improper winterization at no additional cost to the owner.
- D. After completion, testing and acceptance of the system, the "Contractor" will instruct the Owner's personnel in the operation and maintenance of the system.

PART 2 - MATERIALS

2.01 GENERAL

Use materials that are new and without flaws or defects of any type, and which are the best of their class and kind. All material overages at the completion of the installation are the property of the "Contractor" and are to be removed from the site.

2.02 SUBSTITUTIONS

The Contractor shall use materials as specified. Material other than specified will be permitted only after written application by the "Contractor" and written approval by the Landscape Architect. Substitutions will only be allowed when in the best interest of the Owner.

2.03 SLEEVING

- A. Install separate sleeve beneath paved areas to route each run of irrigation pipe or wiring bundle.
 - 1. Sleeving material beneath pedestrian pavements shall be PVC Class 160 pipe with solvent welded joints.
 - 2. Sleeving beneath drives and streets shall be PVC Class 160 pipe with solvent welded joints.
 - 3. Sleeving diameter: equal to twice that of the pipe or wiring bundle.

2.04 PIPE AND FITTINGS

- A. Mainline Pipe and Fittings:
 - 1. Use rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting the requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with an integral belled end.
 - 2. Use Class 160, SDR-26, rated at 160 PSI, conforming to the dimensions and tolerances established by ASTM Standard D2241. Use PVC pipe rated at higher pressures than Class 160 in the case of small nominal diameters that are not manufactured in Class 160.
 - 3. Use rubber-gasketed pipe equipped with Reiber Gasket System for mainline pipe with a nominal diameter greater than 3-inches. Use rubber-gasketed deep bell ductile iron fitting conforming to ASTM A-536 and ASTM F-477. Use lubricant approved by the pipe manufacturer. Size slip fitting socket taper to permit a dry unsoftened pipe end to be inserted no more than halfway into the socket. Saddle and cross fittings are not permitted. Use male adapters for plastic to metal connections. Hand Tighten male adapters plus one turn with a strap wrench.
 - 4. Use solvent weld pipe for mainline pipe with a nominal diameter less than or equal to 3-inches or where a pipe connection occurs in a sleeve. Use Schedule

- 40, Type 1, PVC solvent weld fittings conforming to ASTM Standard D2466 and D1784. Use primer approved by the pipe manufacturer. Solvent cement to conform to ASTM Standard D2564.
 5. Provide pipe homogeneous throughout and free from visible cracks, holes, foreign materials, blisters wrinkles and dents.
 6. Provide pipe continuously and permanently marked with manufacturer's name or trademark, size schedule and type of pipe working pressure at 73 degrees F. and (NSF) approval
 7. Pipe sizes referenced in the construction documents are minimum sizes and may be increased at the option of the "Contractor".
 8. All pipes damaged or rejected because of defects shall be removed from the site at the time of said rejection.
- B. Lateral Pipe and Fitting
1. All sprinkler laterals pipe downstream from the zone valves, sized 2" and smaller shall be flexible non-toxic polyethylene (PE) pipe. Use SDR-11.5, PE23, rated at PSI that is National Sanitation Foundation (NSF) approved, conforming to ASTM Standard D2239. Use Type 1, PVC insert fitting conforming to ASTM Standard D2609 designed for use with flexible polyethylene (PE) pipe. Use stainless steel worm gear clamps (including stainless steel screw) to join pipe and fittings. Pipe larger than 2" shall be rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting the requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with an integral belled end suitable for solvent welding.
 2. Use Class 160, SDR-26, rated at 160 PSI, conforming to the dimensions and tolerances established by ASTM Standard D2241. Use solvent weld pipe for lateral pipe. Use Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784 for PVC pipe. Use primer approved by the pipe manufacturer and purple in color. Solvent cement to conform to ASTM Standard D2564, of a type approved by the pipe manufacturer appropriate to weather conditions.
 3. For drip irrigation laterals downstream of zone control valves, use UV radiation resistant polyethylene pipe manufactured from prime Union Carbide or a Union Carbide licensee with a minimum of 2% carbon black. Use PVC/compression line fittings compatible with the drip lateral pipe. Use tubing stakes or landscape fabric staples to hold aboveground pipe in place.
- C. Specialized Pipe and Fittings:
1. All above grade pipe shall be copper pipe: Use Type "M" rigid conforming to ASTM Standard B88. Use wrought copper or cast bronze fitting, soldered, or threaded per the installation details. Use 95% tin and 5% antimony solder.
 2. Galvanized steel pipe: Use Schedule 40 conforming to ASTM Standard A120. Use galvanized, threaded, standard weight malleable iron fittings.
 3. Ductile iron pipe: Use Class 50 conforming to ANSI A21.51. Use a minimum of Class 53 thickness pipe for flanged piping. Use mechanical joints conforming to ANSI A21.10 and ANSI A21.11 (AWWA C111) or flanged fittings conforming to ANSI/AWWA C110 and ANSI B16.1 (125#).
 4. Use a dielectric union wherever a copper-based metal (copper, brass, and bronze) is joined to an iron-based metal (iron, galvanized steel, and stainless steel).
 5. Low-Density Polyethylene Hose:
 - a. Use pipe specifically intended for use as a flexible swing joint.
Inside diameter: 0.490 ± 0.010 inch.
Wall thickness: 0.100 ± 0.010 inch.
Color: Black
 - b. Use spiral barb fittings supplied by the same manufacturer as the hose.

7. Assemblies calling for threaded pipe connections shall use PVC Schedule 80 nipples and PVC Schedule 40 threaded fittings.
 8. Joint sealant: Use only Teflon-type tape or Teflon-based paste pipe joint sealant on plastic threads. Use non-hardening, nontoxic pipe joint sealant formulated for use on water-carrying pipes on metal threaded connections.
- D. Thrust Blocks:
1. Use thrust blocks for fitting on pipe greater than or equal to 3-inch diameter or any diameter rubber gasket pipe.
 2. Use 3,000-PSI concrete.
 3. Use 2-mil plastic.
 4. Use No. 4 re-bars wrapped or painted with asphalt tar-based mastic coating.

2.05 MAINLINE COMPONENTS

- A. Main System Shutoff Valve: per local practice and in compliance with local code.
- B. Winterization Assembly: per local practice and in compliance with the local code.
- C. Backflow Prevention Assembly: as presented in the installation details.
- D. Isolation Gate Valve Assembly: as presented in the installation details. Install a separate valve box over a 3-inch depth of $\frac{3}{4}$ -inch gravel for each assembly.
- E. Quick Coupling Valve Assembly: double swing joint arrangements as presented in the installation details.

2.06 SPRINKLER AND BUBBLER IRRIGATION COMPONENTS

- A. Remote Control Valve (RCV) Assembly for Sprinkler and Bubbler Laterals: as presented in the installation details. Use 3M DBY wire connectors to join control wires to solenoid valves. Install a separate valve box over a 3" depth of $\frac{3}{4}$ " gravel for each assembly.
- B. Sprinkler Assembly: as presented in the drawings and installation details. When required use the sprinkler manufacturer's pressure compensating screens (ex. Rain Bird PCS) to achieve 30 PSI operating conditions on each sprinkler and to control excessive operating pressures.
- C. Bubbler Assembly: as presented in the drawings and installation details.

2.07 CONTROL SYSTEM COMPONENTS

- A. Irrigation Controller Unit:
 1. As presented in the drawing and installation details.
 2. Lighting protection: Provide 8-foot copper-clad grounding rod at controller location (when specified).
 3. Wire markers: pre-numbered or labeled with indelible non-fading ink, made of permanent, non-fading material.
- B. Control Wire:
 1. Use American Wire Gage (AWG) No. 14 solid copper, Type UF or PE cable, UL approved for direct underground burial from the controller unit to each remote valve.
 2. Color: Use white for common ground wire. Use red colors for control wires. Spare control wires shall be marked or labeled different from that of the active control wire. Wire color shall be continuous over its entire length.

3. Splices: Use 3M DBY-R wire connector with waterproof sealant. Wire connector to be of plastic construction.
- C. Instrumentation:
1. As presented in the drawing and installation details.
 2. When required provide, install, and test an anemometer for irrigation shutdowns at user-present wind velocity thresholds, soil moisture monitoring to override irrigation in the event of high soil moisture levels, and a temperature sensor to prevent irrigation when temperatures drop below a user-preset threshold.
 3. Provide a rain sensor to prevent irrigation during or immediately after rainfall events
- D. Power Wire:
1. Electric wire from the power source to satellite control unit shall be solid or stranded copper, Type UF single-conductor cable, UL approved for direct underground burial. Power wires shall be black, white, and green in color. Size as presented in the drawings. The "Contractor" is responsible for verifying that the power wire sizes shown on the drawings are compatible and adequate for the control system being used.
 2. Splices: Use 3M DBY-R connectors.
 3. Conduit: PVC Schedule 40.

2.08 OTHER COMPONENTS

- A. Tools and Spare Parts: Provide operating keys, servicing tools, test equipment, spare parts, and other items indicated in the general notes of the drawings.
- B. Other Materials: Provide imported fill material as required to complete this work. Provide other materials or equipment shown on the drawings or installation details, which are part of the irrigation system, although such items may not have been referenced in these specifications.

PART 3 – EXECUTION

3.01 INSPECTION AND REVIEWS

- A. Site Inspections:
1. The bidder acknowledges that he has examined the site, plans and specifications, and the submission of a proposal shall be considered evidence that examination has been made.
 2. Verify construction site conditions and note irregularities affecting work of this section. It shall be the contracting installer's responsibility to report to the Owner's authorized representative any deviations between drawings, specifications, and the site. Failure to do so before the installing of equipment and resulting in replacing and/or relocation of equipment shall be done at the "Contractor's" expense.
 3. Examine final grades and installation conditions. Do not start irrigation system work until unsatisfactory conditions are corrected.
 4. Beginning work of this section implies acceptance of existing conditions.
- B. Utility Locations:
1. The exact location of all existing utilities and structures and underground utilities are not indicated on the drawings; their locations shall be determined by the "Contractor", and he shall conduct his work so as to prevent interruption of service or damage to them.

2. Arrange for and coordinate with local authorities the location of all underground utilities.
 3. Repair any underground utilities damaged during construction. Make repairs at no additional cost above the contract price.
 4. The "Contractor" shall protect existing structures and utility services and be responsible for their replacement if damaged by him.
 5. The "Contractor" shall be responsible to verify onsite water pressure when applicable prior to construction. The "Contractor" is responsible to remedy any water pressure discrepancy discovered at their expense if the discrepancy is not reported prior to construction.
- C. Irrigation System Layout Review:
1. Irrigation system layout review will occur after the staking has been completed unless specifically waived by the Landscape Architect. Notify the engineer/landscape architect/ owner's representative one-week in advance of review.
 2. The engineer/landscape architect/owner's representative at this review will identify modifications.

3.02 LAYOUT OF WORK

- A. Stake out the irrigation system. Items staked include sprinklers, pipe, control valves, manual drains, quick coupling valves, backflow preventer, controller, and isolation valves.
- B. Install all mainline pipe and mainline components inside of project property lines.
- C. Minor adjustments in system layout will be permitted to clear existing fixed obstructions. Final system layout shall be acceptable to the Landscape Architect.

3.03 EXCAVATION, TRENCHING, AND BACKFILLING

- A. Excavating shall be considered unclassified and shall include all materials encountered, except materials that cannot be excavated by normal mechanical means.
- B. Excavate to permit the pipes to be laid at the intended elevations and to permit workspace for installing connections and fittings.
- C. Minimum cover (distance from top of pipe or control wire to finish grade):
 1. 14-inch over mainline pipe and over electrical conduit.
 2. 6-inch over control wire.
 3. 10-inch over lateral pipe to sprinklers and bubblers and over manifold pipe to drip system zone control valves.
 4. 8-inch over drip in turf or paved areas downstream of drip system zone control valves.
 5. 3-inch minimum mulch cover over drip lateral pipe in planting beds downstream of drip system zone control valves.
 6. PVC UV radiation-resistant lateral pipe shall be installed directly on the soil surface.
- D. PVC or PE lateral pipes may be pulled into the soil using a vibratory plow device specifically manufactured for pipe pulling. Minimum burial depths equals minimum cover listed above provided soil moisture content and other conditions are suitable to allow for full depth of bury with a minimum of stretching and scraping of the pipe. Landscape Architect reserves the right to determine suitability or conditions.
- E. Backfill only after lines have been reviewed and tested.

- F. Excavated material is generally satisfactory for backfill. Backfill shall be free from rubbish, vegetable matter, and stones larger than 2 inches in maximum dimension. Remove material not suitable for backfill. Backfill placed next to pipe shall be free of sharp objects, which may damage the pipe.
- F. Backfill unsleeved pipe by depositing the backfill material equally on both sides of the pipe in 6-inch layers and compacting each layer to 90% Standard Proctor Density, ASTM D698-78. Use of water for compaction, "puddling," will not be permitted.
- G. Enclose pipe and wiring beneath roadways, walks, curbs, etc., in sleeves. Minimum compaction of backfill for sleeves shall be 95% Standard Proctor Density, ASTM D698-78. Use of water for compaction around sleeve, "puddling," will not be permitted.
- H. Dress backfilled areas to original grade. Incorporate excess backfill into existing site grades.
- I. Where utilities conflict with irrigation trenching and pipe work, contact the engineer/landscape architect/owner's representative for trench depth adjustments.
- J. Provide approved fine grained earth fill or sand to point 4" above the top of pipe, where soil conditions are rocky or otherwise objectionable.
- K. Excavate trenches and install piping and backfill during the same working day. Do not leave open trenches or partially filled trenches open overnight.

3.04 SLEEVING AND BORING

- A. Install sleeving at a depth that permits the encased pipe or wiring to remain at the specified burial depth.
- B. Extend sleeve ends six inches beyond the edge of the paved surface. Cover pipe ends and mark with stakes. Mark concrete with a chiseled "X" at sleeve end and locations.
- C. Bore for sleeves under obstructions that cannot be removed. Employ equipment and methods designed for horizontal boring.

3.05 ASSEMBLING PIPE AND FITTING

- A. General:
 - 1. Keep pipe free from dirt and pipe scale. Cut pipe ends square and debur. Clean pipe ends.
 - 2. Keep ends of assembled pipe capped. Remove caps only when necessary to continue assembly.
 - 3. All mainline and continuously pressurized pipe is to be installed using open trenches. Lateral pipe may be installed by "Plowing" if soil conditions permit, and soils do not contain gravel, rock, construction debris, or other potential damaging material.
 - 4. Trenches may be curved to change direction or avoid obstructions within the limits of the curvature of the pipe. Minimum radii of curvature are 25 feet for 2-inch diameter pipe and 100 feet for 2 ½, 3, and 4-inch diameter pipe. All curvature results from the bending of the pipe lengths. No deflection will be allowed at a pipe joint.
- B. Mainline and Fittings:
 - 1. Use only strap-type friction wrenches for threaded plastic pipe.

2. PVC Rubber-Gasketed Pipe:
 - a. Use pipe lubricant. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.
 - b. Epoxy-coated steel fittings shall not be struck with a metallic tool. Cushion blows with a wood block or similar shock absorber.
 3. PVC Solvent Weld Pipe:
 - a. Use a primer and solvent cement. Join pipe in a manner recommended by the manufacturer and in accordance with accepted industry practices.
 - b. Cure for 30 minutes before handling and 24 hours before allowing water in pipe.
 - c. Snake pipe from side to side within the trench.
 4. Fittings: the uses of cross type fittings or saddle-tees are not permitted.
 5. Install thrust blocks on the mainline pipe work in accordance with pipe manufacturer's written instructions.
- C. Lateral Pipe and Fittings:
1. Use only strap-type friction wrenches for threaded plastic pipe.
 2. PVC Solvent Weld Pipe:
 - a. Use primer and solvent cement. Join pipe in the manner recommended by the manufacturer and in accordance with accepted industry practices.
 - b. Cure for 30 minutes before handling and 24 hours before allowing water in the pipe.
 - c. Snake pipe from side to side within the trench:
 3. Polyethylene (PE) Pipe:
 - a. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.
 - b. Snake pipe from side to side within the trench.
 - c. Double clamp pipe 1-1/2" diameter and larger.
 4. UV Radiation-Resistant Polyethylene Pipe:
 - a. Join pipe in the manner recommended by the manufacturer and in accordance with accepted industry practices.
 - b. Snake pipe side to side within the trench, on the soil surface, and hold in place with the tubing stakes or landscape fabric staples spaced every five feet. Pipe is not to be compressed or crimped by the stake or staple or other construction activity.
 5. The use of cross types fittings and /or saddle tees are not permitted.
- D. Specialized Pipe and Fitting:
1. Copper Pipe:
 - a. Buff surface to be joined to a bright finish. Coat with solder flux.
 - b. Solder so that a continuous bead shows around the joint circumference.
 2. Galvanized Steel Pipe:
 - a. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.
 - b. Use factory-made threads whenever possible. Field-cut threads will be permitted only where necessary. Cut threads on axis using clean, sharp dies.
 - c. Apply Teflon-type tape or pipe joint compound to the male threads only.
 3. Ductile Iron Pipe:
 - a. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.
 - b. Insert dielectric union wherever a copper-based metal (copper, brass, bronze) and an iron-based metal (iron, galvanized steel, and stainless steel) are joined.
 4. Low-Density Polyethylene Hose: Install per manufacturer's recommendations.
 5. PVC Threaded Connections:

- a. Use only factory-formed threads. Field-cut threads are not permitted.
- b. Use only Teflon-type tape or Teflon-based paste.
6. Threaded Connections:
 - a. When connection is plastic to metal, the plastic component shall have male threads and the metal component shall have female threads.
 - b. Make metal-to-metal, threaded connections with Teflon-type tape or pipe joint compound applied to the male threads only.
- E. Thrust Blocks:
 1. Use cast-in-place concrete bearing against undisturbed soil.
 2. Size, orientation, and placement shall be as shown on the installation details.
 3. Wrap fitting with plastic to protect bolts, joint, and fitting from concrete.
 4. Install re-bar with mastic coating as shown on the installation details.

3.06 INSTALLATION OF MAINLINE COMPONENTS

- A. Main System Shut Off Valve: Install where indicated on the drawing.
- B. Winterization Assembly: Install where indicated on the drawing.
- C. Backflow Prevention Assembly: Install where indicated on the drawing. Install assembly so that its elevation, orientation, access, and drainage conform to the manufacturer's recommendations and all applicable health codes.
- D. Quick Coupling Valve Assembly: Install where indicated on the drawings.
- E. Manual Drain Valve Assembly: Install where indicated on the drawings and at other low points in the mainline piping.

3.07 INSTALLATION OF SPRINKLER AND IRRIGATION COMPONENTS:

- A. Remote Control Valve (RCV) Assembly for Sprinkler and Bubbler Laterals:
 1. Flush mainline before installation of RCV assembly.
 2. Install where indicated on the drawing. Wire connectors and waterproof sealant shall be used to connect control wires to remote control valve wire. Install connectors and sealant per the manufacturer's recommendations.
 3. Install only one RCV to a valve box. Locate valve box at least 12 inches from and align with nearby walls and edges of paved areas. Group RCV assemblies together where practical. Arrange grouped valve boxes in rectangular patterns. Allow at least 12 inches between valve boxes.
 4. Adjust RCV to regulate the downstream operating pressure.
 5. Attach ID tag with controller station number to control wiring.
- B. Sprinkler Assembly:
 1. Flush lateral pipe before installing sprinkler assembly.
 2. Install per the installation details at locations shown on the drawings.
 3. Locate rotor sprinklers 6 inches from adjacent walls, fences, or edges of paved areas.
 4. Locate spray sprinklers 3 inches from adjacent walls, fences, or edges of paved areas.
 5. Install sprinklers perpendicular to the finish grade.
 6. Supply appropriate nozzle or adjust arc of coverage of each sprinkler for best performance.
 7. Adjust the radius of throw of each sprinkler for best performance.
- C. Bubbler Assembly:

1. Flush lateral pipe before installing bubbler assembly.
2. Install bubbler assembly per the installation details at locations shown on the drawings.
3. Adjust the output flow of each bubbler for performance.

3.08 INSTALLATION OF CONTROL SYSTEM COMPONENTS:

A. Irrigation Controller Unit:

1. The location of the collector unit as depicted on the drawings is approximate; the engineer/landscape architect/owner's representative will determine the exact site location during sprinkler layout review.
2. Lighting protection: Drive 8-foot copper-clad grounding rod into the soil. If rock prevents driving, bury at least four feet deep. Use one rod for each controller. Connect controller to ground rod with AWG No. 10 solid conductor copper wire. Secure wire to grounding rod with brass or bronze clamp. Locate the connection in a separate valve box (when specified).
3. Attach wire markers to the ends of control wires inside the controller unit housing. Label wires with the identification numbers (see drawings) of the remote-control valve to which the control wire is connected.
4. Install a 120-volt, 15-amp switched and grounded 3-prong receptacle with GFIC inside the controller unit housing.
5. Connect control wires to the corresponding controller terminal.

B. Control Wire:

1. Bundle control wires where two or more are in the same trench. Bundle with pipe wrapping tape at 10-foot intervals.
2. Control wiring may be chiseled into the soil using a vibratory plow device specifically manufactured for pie pulling and wire installation. Appropriate chisel must be used so that wire is fed into a chute on the chisel, and wire is not subject to pulling tension. Minimum burial depth must equal minimum cover previously listed.
3. Provide a 24-inch excess length of wire in an 8-inch diameter loop at each 90-degree change of direction, at both ends of sleeves and at 100-foot intervals along continuous runs of wiring. Do not tie wiring loop. Coil 24-inch length of wire within each remote-control valve box.
4. Install common ground wire and one control wire for each remote-control valve. Multiple valves on a single control wire are not permitted.
5. If a control wire must be spliced, make splice with wire connectors and waterproof sealant, installed per the manufacturer's instructions. Locate splice in a valve box that contains an irrigation valve assembly, or in a separate 6-inch round valve box.
6. Use same procedure for connection to valves as for in-line splices.
7. Unless noted on plans, install wire parallel with and below PVC mainline pipe.
8. Protect wire not installed with PVC mainline pipe with a continuous run of warning tape placed in the backfill six inches above the wiring.

C. Instrumentation:

1. Install sensor per the installation details and manufacturer's recommendations. Install at locations shown on the drawings.
2. Install electrical connections between central control unit components and sensors per manufacturer's recommendations.

D. Power Wire:

1. Route power wire as directed on plans. Install with a minimum number of field splices. If a power wire must be spliced, make splice with recommended

- connector, installed per manufacturer's recommendations. Locate all splices in a separate 10-inch round valve box. Coil 2 feet of wire in valve box.
2. All power wire shall be laid in a trenches. The use of a vibratory plow is not permitted.
 3. Green wire shall be used as the common ground wire from power source to all satellites.
 4. Carefully backfill around power wire to avoid damage to wire insulation or wire connectors.
 5. Unless noted on plans, install wire parallel with and below mainline pipe. Install wire 2 inches below top of PVC mainline pipe.
 6. Encase wire not installed with PVC mainline pipe in electrical conduit with a continuous run of warning tape placed in the backfill, 6 inches above wiring.

3.09 INSTALLATION OF OTHER COMPONENTS:

- A. Tools and Spare Parts: Prior to the review at completion of construction, supply to the owner operating keys, servicing tools, spare parts, test equipment, and any other items indicated in general notes on the drawings. Provide at least (2) quick coupling keys and hose adapters.
- B. Other Materials: Install other materials or equipment shown on the drawings or installation details which are part of the irrigation system, even though such items may not have been referenced in these specifications.

3.10 MAINTENANCE:

- A. Upon completion of construction and review by the engineer/landscape architect/owner's representative, maintain irrigation system for duration of 30 calendar days. Make periodic examinations and adjustments to irrigation system components to achieve the most desirable application of water.
- B. Following completion of the "Contractor's" maintenance period, the owner will be responsible for maintaining the system in working order during the remainder of the guarantee /warranty period, for performing necessary minor maintenance, for trimming around sprinklers, for protecting against vandalism, and for preventing damage after the landscape maintenance operation.

3.11 ACCEPTANCE

- A. Instruct the Owner's designated personnel in the operation of the system, including adjustment of sprinklers, controller(s), valves, pump controls, and moisture sensing controls.

3.12 CLEANING

- A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soils, debris, and equipment. Repair damage resulting from sprinkler system installation.

END OF SECTION 32 84 00

SECTION 32 91 00

PLANTING PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Division 0, Bidding and Contract Requirements, and Division 1 General Requirements, apply to this Section.

1.2 SUMMARY OF WORK

- A. These general landscape work requirements apply to all landscape work operations.
- B. Related Work specified elsewhere:
 - 1. Section 32 91 19, "Landscape Grading"
 - 2. Section 32 92 19, "Seeding"
 - 3. Section 32 93 00, "Plants"
 - 4. Section 32 01 90 "Operation and Maintenance of Planting"

1.3 QUALITY ASSURANCE

- A. Comply with all applicable local, state, and federal requirements regarding materials, methods of work, and disposal of excess and waste materials.
 - 1. Obtain and pay for all required inspections, permits, and fees. Provide notices required by governmental authorities.

1.4 PROJECT CONDITIONS

- A. Locate and identify existing underground and overhead services and utilities within contract limit work areas. Notify each utility in writing two (2) business days prior to the commencement of work. (Call Miss Dig-1-800-482-7171 in Michigan). Thus, all missing members will be routinely notified. This does not relieve the contractors of the responsibility for notifying utility owners who are not part of the Miss Dig Systems. The Contractor shall provide adequate means of protection of utilities and services designated to remain. Repair to utilities damaged during site work operations shall be at the Contractor's expense.
 - 1. When uncharted or incorrectly charted underground piping or other utilities and services are encountered during site work operations, stop work immediately, notify the applicable utility company immediately to obtain procedure directions. Cooperate with the applicable utility company in maintaining active services in operation.
 - 2. Locate, project, and maintain benchmarks, monuments, control points and project engineering reference points. Re-establish disturbed or destroyed items at Contractor's expense.
 - 3. Perform landscape work operations and the removal of debris and materials to assure minimum interference with streets, walks, and other adjacent facilities.
 - 4. Obtain governing authorities' written permission and any applicable permits when required to close or obstruct streets, walks and adjacent facilities. Provide alternate routes around closed or obstructed traffic ways when required by governing authorities.

5. Treat planting and lawn areas as required with "Round Up", by Monsanto, per label directions; including applicable time frames to kill existing vegetation prior to planting, seeding, and sodding.
6. Control dust caused by the work. Dampen surfaces as required. Comply with pollution control regulations of governing authorities.
7. Protect existing buildings, paving and other services or facilities on site and adjacent to the site from damage caused by site work operations. Cost of repair and restoration of damage items to original conditions at Contractor's expense.
8. Protect and maintain streetlights utility poles and services, traffic signal control boxes, curb boxes, valves, and other services, except items designated for removal.
9. The General Contractor will occupy the premises and adjacent facilities during the entire period of construction. Perform landscape work operations to minimize conflicts and to facilitate General Contractor's use of the premises and conduct of his normal operations.
10. Perform landscape preparation work before commencing landscape construction.
11. Locate, protect, and maintain active utilities and site improvements to remain.
12. Provide necessary barricades, coverings, and protection to prevent damage to existing vegetation and improvements indicated to remain.

PART 2 - PRODUCTS

2.1 MATERIALS/EQUIPMENT

- A. As selected by the General Contractor, except as indicated.
 1. Tree Protection Fencing: orange plastic snow fencing 4' height.
 2. Posts: Steel T-Post
 3. Herbicide for lawn restoration: "Round-up" by Monsanto.

PART 3 - EXECUTION

3.1 EXISTING UTILITIES

- A. Call "811 Dig before construction begins. Information on the drawings related to existing utility lines and services is from the best sources presently available. All such information is furnished only for information and is not guaranteed. The Contractor is responsible for familiarizing himself with the site prior to the start of construction. Excavate test pits as required to determine exact locations of existing utilities.

3.2 CLEARING

- A. Locate and suitably identify trees and improvements indicated to remain on plans.
- B. Protective fencing as described in Section 01 56 39 is to be installed prior to any work being done on site to ensure that the proper areas are located on-site. Altered fence lines must be approved by the Landscape Architect or Owners representative.

- C. Any necessary inspections of protective barriers by Governing Agencies will be the responsibility of the Contractor.
- D. Any equipment that will compact the soil within the dripline areas of existing trees is not allowed.
- E. Protect existing trees scheduled to remain as detailed against injury or damage including cutting, breaking, or skinning of roots, trunks, or branches, smothering by stockpiled construction materials, excavated materials or vehicular traffic within branch spread. NO VEHICULAR TRAFFIC IS PERMITTED BENEATH DRIP LINE AT ANYTIME – Note all lawn areas to be worked by hand.
- F. Employ a licensed Arborist to repair damage to trees.
- G. Repair or replace trees and vegetation indicated to remain which are damaged by construction operations in a manner acceptable to the Landscape Architect.
- H. Clear and grub areas within contract limits as required for site access and execution of the work. Stop grubbing sufficient distance from the drip line to prevent surface root damage.
- I. Remove trees, plants, undergrowth, other vegetation, and debris, except items indicated to remain.
- J. Remove stumps and roots to clear depth of 36" below subgrades. Remove stumps and roots to their full depth within 5'0" of underground structures, utility lines, footings, and paved areas.
- K. Salvable improvements: Carefully remove items indicated on plans to be salvaged and store on site as indicated on the plans or as directed by the Owners Representative. The Contractor will be responsible for protecting salvaged items. In the case of vegetation, the Contractor shall be responsible for protecting the roots from drying out with appropriate mulch and irrigation.
- L. Water trees and vegetation within the limits of work to maintain their health during construction operations.

3.3 TOPSOIL

- A. Topsoil is described as organic material, reasonably free of clay clumps, stone, roots, and other objectionable material.
- B. Strip topsoil to full depth, stop at sub soil and prevent intermingling.
- C. Stockpile topsoil in areas indicated or as directed.
- D. Dispose of unsuitable topsoil same as waste materials.

3.4 DISPOSAL OF WASTE MATERIALS

- A. Regularly stockpile, haul from site, and legally dispose of waste materials and debris. Accumulation is not permitted.

- B. Maintain disposal routes, clear, and free of debris.
- C. On site burning of combustible cleared materials is not permitted.
- D. Upon completion of landscape preparation work, clean areas within contract limits, remove tools and equipment. Site to be clear, clean, and free of materials and debris suitable for site work operations.
- E. Materials, items, and equipment not scheduled for reinstallation or salvaged for the General Contractor are the property of the Landscape Contractor. Remove cleared materials from the site as the work progresses. Storage and sale of Landscape contractors salvage items on site is not permitted.

END OF SECTION 32 91 00

SECTION 32 91 19
LANDSCAPE GRADING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Division 0, Bidding and Contract Requirements, and Division 1 General Requirements, apply to this Section.

1.2 SUMMARY OF WORK

- A. Prepare and place topsoil as shown and specified. The work includes Topsoil distribution and finish grading per indicated depth of topsoil.
- B. Related Work specified elsewhere:
 - 1. Section 32 91 00, "Planting Preparation"
 - 2. Section 32 92 19, "Seeding"
 - 3. Section 32 93 00, "Plants"
 - 4. Section 32 01 90, "Operation and Maintenance of Planting"

1.3 QUALITY ASSURANCE

- A. Stockpiled topsoil to be approved by owner's representative prior to reuse.
- B. Contractor or Landscape Architect to make recommendations on type and quantity of additives required to establish satisfactory pH factor and supply of nutrients to bring nutrients to satisfactory level for planting.

1.4 PROJECT CONDITIONS

- A. Known underground and surface utility lines are indicated on the drawings.
- B. Protect existing trees, plants, lawns, and other features designated to remain as part of the landscaping work.
- C. Promptly repair damage to adjacent facilities caused by topsoil operations. Cost of repair at Sub-Contractor's expense.
- D. Promptly notify the General Contractor and Landscape Architect of unexpected subsurface conditions.
- E. Contractor to review proposed site grading and familiarize himself with proposed changes.

PART 2 - MATERIALS

2.1 TOPSOIL

- A. Topsoil stockpiled for proposed reuse must meet criteria specified and conforms to adjustments and recommended by the Landscape Architect or Owner's Representative.

All processing cleaning and preparation of this stored topsoil to render it acceptable for use is the responsibility of the Landscape Contractor.

- B. Provide additional topsoil as required to complete work. It shall be acceptable for contractor to amend excess subsoil to create topsoil. Submit quantity and cost of proposed additional topsoil to Owner's Representative prior to acquisition or creation. Topsoil must meet criteria specified. All processing, cleaning, and preparation of this supplied topsoil to render it acceptable for use is the responsibility of the Landscape Contractor.
- C. Supplied and stockpiled topsoil shall be fertile, friable; and representative of local productive soil capable of sustaining vigorous plant growth and free of clay lumps, subsoil, noxious weeds, or other foreign matter such as stones, roots, sticks and other extraneous material; not frozen or muddy; pH of soil range between 5.0 and 7.5.
- D. Prepared topsoil shall be used in planting mixtures as specified in Section 32 93 00, "Plants"; all beds prepared as specified.

PART 3 - EXECUTION

3.1 DESCRIPTION

- A. Prepare and place topsoil within contract limits, including transition areas to new elevations, levels, profiles, and contours indicated. Provide uniform levels and slopes between new elevations and existing grades.
- B. Grade surfaces to assure areas drain away from building structures and to prevent ponding and pockets of surface draining.
- C. Lawn and Planting area: Haul, spread topsoil 3" minimum compacted depth in lawn areas or as indicated on drawings.
- D. For trees, shrubs, ground cover beds and plant mix for beds see Section 32 93 00, "Plants".
- E. Provide earth berming where indicated on Plans.
- F. Berming to be free flowing in shape and design, as indicated and to blend into existing grades gradually so that toe of slope is not readily visible. Landscape Architect or General Contractor's representative to verify final contouring.
- G. Regardless of finish grading elevations indicated, it is intended that grading be such that proper drainage of surface water away from buildings will occur and that no low areas are created to allow ponding. Landscape Contractor to consult the General Contractor and Landscape Architect regarding variation in proposed grade elevations before rough grading is completed.
- H. Do not place topsoil when subgrade is frozen excessively wet or dry in a condition which will inhibit proper grading/planting.
- I. Do not cover construction debris with topsoil. Do not bury construction debris in subsurface or bermed areas.

- J. After topsoil has been spread, clear surface of all objects 2" or greater and all objects which will hinder final grading, planting, sodding or seeding.
- K. Protect newly graded placed topsoil against erosion.
- L. Prior to acceptance all area shall be repaired with regards to soil erosion and grades re-established.

3.2 CLEANING

- A. Upon completion of top soiling operations, clean areas within contract limits, remove tools, equipment and haul all excess topsoil off-site. Site shall be clear, clean, free of debris, and suitable for site work operations.

END OF SECTION 32 91 19

SECTION 32 92 19

SEED INSTALLATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Division 0, Bidding and Contract Requirements, and Division 1 General Requirements, apply to this Section.

1.2 SUMMARY

- A. Provide seeded lawns as shown and specified. The work includes, but is not limited to, the following principal items:

1. Planting topsoil preparation.
2. Finish grading.
3. Hydroseeding lawns, as indicated areas.
4. Mulching.
5. Seeding erosion control.
6. Reconditioning existing lawns.

- B. Related work specified elsewhere:

1. Section 32 91 00, "Planting Preparation"
2. Section 32 91 19, "Landscape Grading"
3. Section 32 93 00, "Plants"
4. Section 32 01 90, "Operation and Maintenance of Planting"

1.3 SUBMITTALS

- A. General:

1. Submit each item in this Article according to Division 01 General Requirements.

- B. Seed Mixture Certification:

Submit seed vendor's certification for required grass seed mixture, indicating percentage by weight, and percentages of purity, germination, and weed seed for each grass species.

- C. Maintenance Instructions:

1. Upon seeded lawn acceptance, submit written instructions recommending procedures for maintenance of seeded lawns, including fertilization schedule as specified in the section "Landscape Maintenance and Warranty Standards".

1.4 QUALITY ASSURANCE

A. Contractor's Qualifications:

1. Contractor shall have minimum 5 years previous experience performing seeding projects of comparable size and scope.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Seed and Soil Amendments:

1. Deliver seed, soil amendment and fertilizer materials in original unopened containers, showing weight, analysis, name of manufacturer and conformance to State Law. Store in a manner to prevent wetting and deterioration.

B. Planting Topsoil:

1. Store and protect planting topsoil and other materials at an approved area of the site. Protect planting topsoil from excessive leaching, if stored for more than six weeks, by covering with tarpaulins. Frozen or muddy planting topsoil is not acceptable.

1.6 PROJECT CONDITIONS

- A. Work Notification: Notify Landscape Architect or General Contractor's Representative at least seven (7) working days prior to start of seeding operation.
- B. Protect utilities, paving, plant materials and other facilities from damage caused by seeding operations. Damage to existing features shall be repaired to the full satisfaction of the Owner's Representative and at no expense to the Owner.
1. The irrigation system will be installed prior to seeding. Locate, protect, and maintain the irrigation system during construction operations. Repair irrigation system components damaged during construction operations, at no expense to the Owner. All repairs shall conform to drawings and Section "Irrigation System".
 2. Provide hose and lawn watering equipment as required.
- C. Perform seeding work only after planting and other work affecting found surface has been completed.
- D. Weather Conditions:
1. Perform top soiling, fertilizing, and seeding operations only when weather and soil conditions are suitable in accordance to locally accepted practice.

1.7 WARRANTY AND REPLACEMENT

- A. Refer to the Drawings and general provisions of Division 0, Bidding and Contract Requirements, and Division 1 General Requirements and Landscape Maintenance and Warranty Standards for warranty requirements.

PART 2 - PRODUCTS

2.1 TOPSOIL

- A. Topsoil to be used as planting topsoil, whether from on-site or from offsite sources, shall meet the requirements outlined in Division 2 Section "Topsoil".

2.2 LAWN SEED

- A. Fresh, clean, and new crop seed mixture.
- B. Seed shall be mixed by a method acceptable to the Landscape Architect.
- C. Seed shall be composed of the following varieties, mixed to the specified proportions by weight, and tested to minimum percentages of purity and germination. Seed shall be free of Poa Annuua, bent grass, and noxious weed seeds.
- D. Irrigated Mix(es):
 - 1. Low-Grow seed mix.
 - A. Application rate: 220 lbs/acre
 - B. Available from: Nativescape, LLC, (517) 456-9696
 - C. Mix shall contain a minimum of 6 slow-growing fine fescue varieties.
 - 2. Non noxious weed seeds permitted.
 - 3. Fertilize for irrigated lawn 12-12-12.

2.4 FERTILIZER

- D. Granular, commercial non-burning product composed of not less than 50% organic slow acting fertilizer specified below.
- E. Guaranteed analysis starter fertilizer containing 20% nitrogen, 26% phosphoric acid, and 6% potash by weight, or similar approved composition.

2.3 MULCH

- A. Straw Mulch
 - 1. Clean straw, well seasoned before baling, and free of mature seed-bearing stalks or roots of prohibited or noxious weeds.
- B. Wood Cellulose Fiber Mulch
 - 1. Degradable green dyed wood cellulose fiber or 100% recycled long fiber pulp suitable for hydro mulching, free from weeds or other foreign matter toxic to seed germination.
- C. Tackifier
 - 1. Liquid concentrate of type when diluted with water will form a transparent 3-dimensional film like crust permeable to water and air. Concentrate shall be free of agents toxic to seed germination.

2.4 WATER

- A. Free of substances harmful to seed growth.

2.5 SEEDING EROSION CONTROL

A. Straw Bales:

1. Clean oat or wheat straw, well seasoned before baling, and free of mature seed-bearing stalks or roots of prohibited or noxious weeds. Bales shall be bound with twine. Steel wires are not acceptable. Bales shall weigh not less than 50 pounds.

B. Blanket:

1. Machine produced mat of curled and barbed Aspen wood excelsior. Fibers are 80% 6" or longer. Fiber is evenly distributed throughout the blanket and is of consistent thickness. The top of each blank is covered with a photodegradable plastic mesh. Blanket affixed to soil surface with wire staples
2. "Curlex Erosion Control/Revegetation Blanket" by American Excelsior Co.

D. Mesh Netting:

1. Polypropylene Mesh Netting:
2. "Radix" erosion control mesh netting by Tenax.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect rough graded surfaces to determine they are satisfactory. A satisfactory rough graded surface is defined as one that is reasonably smooth and level, free of depressions, ridges, and stones over 1-1/2" size.
- B. Do not allow seeding operations work to proceed until rough graded surfaces are acceptable for seeding operations as determined by the seed applicator.

3.2 TOPSOIL PROCESSING

- A. Test topsoil before commencing topsoil processing operations, in accordance with requirements of Division 2 Section "Topsoil" and Division 1 Section "Quality Control – General".
- B. Sift, clean, and amend on-site stockpiled topsoil and topsoil imported to the site, to render them acceptable for use as planting topsoil. When processing operations are completed, planting topsoil shall comply with requirements for "Planting Topsoil" specified Division 2 Section "Topsoil".
- C. If on-site stockpiled topsoil quantities are not sufficient to complete the Work, including if existing topsoil proves unacceptable, provide additional topsoil as required to complete the Work.
- D. The types and quantities of soil amendments required shall be determined after the soil is tested.

3.3 PLACING PLANTING TOPSOIL

- A. Uniformly distribute planting topsoil in quantity sufficient to provide full depth of soil after light rolling and finish grading operations are completed, but not less than 4 inches.
- B. Planting topsoil shall be spread, cultivated, lightly compacted to prevent future settlement, dragged, and graded to finished grade. Planting topsoil, when placed, shall be dry enough so as not to puddle or bind. Do not place planting topsoil when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to proper grading or other lawn operations.
- C. Limit preparation to areas which will be immediately seeded.

3.4 FINISH GRADING

- A. Finish grade such that after thorough settlement and compaction of soil, the grade shall slope to drain, be free of depressions or other irregularities, and shall be uniform in slope between grading controls and the elevations indicated.
- B. Finish grade new lawn areas to meet existing lawn area grade at their juncture. Finish grade 1/2 inch below top of curbs and walks.
- C. Restore prepared areas to specified condition if eroded settled or otherwise disturbed after finish grading and prior to seeding.

3.5 FERTILIZING

- A. If the prepared seedbed is eroded or compacted by rainfall prior to fertilizing, regrade the surface.
- B. Apply fertilizer at a rate to provide 1.0 lb. of actual nitrogen per 1,000 sq. ft. (220 lbs/acre).
- C. Apply fertilizer by mechanical rotary or drop type distributor. Thoroughly and evenly incorporate into soil, by disking or other method approved by the Owner's Representative.
- D. In areas inaccessible to power equipment, fertilizers shall be applied and worked into soil with hand tools.

3.6 SEEDING

- A. General:
 - 1. Immediately before seeding, scarify, loosen, float, and drag planting topsoil.
- B. Schedule:
 - 1. Seed immediately after preparation of bed. Spring seeding between April 1 and June 1 and fall seeding between August 15 and October 15 or at such other times acceptable to the Owner's Representative.
- C. Seeding:

1. Perform seeding operations when the soil is dry and when winds do not exceed 5 miles per hour velocity.
2. Apply seed with a rotary or drop type distributor. Apply seed evenly by sowing in two equal applications. Applications shall be at right angles to each.
3. After seeding, rake or drag surface of soil lightly to incorporate seed into top 1/8" of soil. Roll with light lawn roller.

D. Hydroseeding:

1. Use a hydro mulcher (sprayer) and apply hydroseed slurry mixture(s) to provide not less of the following materials per acre:
 - a. Fertilizer
 - 1) Apply fertilizer at a rate to provide 1.0 lb. of actual nitrogen per 1,000 sq. Ft. (43.6 lbs. per acre).
 - b. Tackifier
 - 1) 60 gals./acre.
 - c. Wood Cellulose Fiber Mulch
 - 1) 2,000 lbs./acre.

E. Mulching:

1. Place straw mulch on seeded areas within 24 hours after seeding.
2. Place straw mulch uniformly in a continuous blanket at the rate of 2-1/2 tons per acre, or two 50 lb. bales per 1,000 sq. ft. of area. A mechanical blower may be used for straw mulch application when acceptable to the Architect.
3. Crimp straw into soil by mechanical means.
4. Anchor straw mulch with liquid tackifier applied uniformly at a rate of 60 gal. per acre.
5. Protect buildings, paving, plantings, and all non-seeded areas from liquid tackifier over-spray.

3.7 EROSION CONTROL

A. Straw Bales:

1. Install straw bales in ditches or problem swales to slow down water velocity and soil loss.

B. Erosion Control Mesh Netting:

1. Install erosion control mesh netting, stapled in place, per manufacturer's specifications, over straw mulch in all seeded areas with a slope of 3:1 or greater.

C. Erosion Control Blanket:

1. Install erosion control blankets stapled in place per manufacturer's specifications.
2. Erosion control blanket can be used instead of straw mulch and erosion control mesh netting in seeded areas with a slope of 3:1 or greater.

3.8 RECONDITIONING LAWNS

- A. Recondition lawn areas damaged by Contractor's operations, from storage of materials or equipment, and from movement of construction vehicles, at no expense to the Owner.
- B. Recondition existing lawn areas indicated.
- C. Provide fertilizer, seed and soil amendments as specified elsewhere herein for new lawns. Provide topsoil to fill low areas and, as applicable, to meet new finish grades.
- D. Cultivate bare and compacted areas thoroughly.
- E. Remove diseased or unsatisfactory lawn growth. Do not bury into soil. Remove topsoil containing foreign materials, including oil drippings, stone, gravel, and construction materials.
- F. Where substantial lawn remains, but is thin, mow, rake, aerate if compacted, cultivate soil, fertilize, and seed.
- G. Water newly seeded areas. Maintain adequate soil moisture until new grass is established.

3.9 MAINTENANCE

- A. Refer to Section "Landscape Maintenance".

3.10 CLEANING

- A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, debris, and equipment.

3.11 FIELD QUALITY CONTROL

- A. Test representative samples of on-site stockpiled topsoil and topsoil to be imported to the site. Comply with applicable requirements of Division 1 Section "Quality Control – General" and Division 2 Section "Topsoil".

END OF SECTION 32 92 19

SECTION 32 92 23
SOD INSTALLATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Division 0, Bidding and Contract Requirements, and Division 1 General Requirements, apply to this Section.

1.2 SUMMARY

- A. Provide sodded lawns as shown and specified. The work includes, but is not limited to, the following:
 - 1. Finish grading
 - 2. Sodding lawns
- B. Related Sections: The following Sections may contain requirements that relate to this Section:
 - 1. Section 32 91 00, "Planting Preparation"
 - 2. Section 32 91 19, "Landscape Grading"
 - 3. Section 32 92 19, "Seeding"
 - 4. Section 32 93 00, "Plants"
 - 5. Section 32 01 90, "Operation and Maintenance of Planting"

1.3 SUBMITTALS

- A. General:
 - 1. Submit each item in this Article according to Division 01 General Requirements.
- B. Sod Certificate:
 - 1. Submit sod grower's certification of grass species, stating botanical and common names; percentage by weight of each species and variety; and percentage of germination, purity and weed. Identify source location.
- C. Maintenance Instructions:
 - 1. Recommend procedures to be established by Owner for maintenance of sod during 12-month period. Submit instructions at the beginning of the required maintenance period and prior to final acceptance.
- D. Planting Schedule:
 - 1. Submit schedule indicating anticipated dates for planting. Schedule shall be submitted prior to initiation of sodding work.

1.4 QUALITY ASSURANCE

A. Sodder's Qualifications:

1. Engage an experienced sodding company which has completed sodding work similar in size and intent to that indicated for this Project and with a record of successful sod establishment. The sodding company shall have a Nurseryman Dealer's License for the State of Michigan.
2. Contractor shall maintain an experienced full-time supervisor at the Project Site during times when sodding work is in progress

B. Acceptable Sodded Installation:

1. Sodded lawns will be acceptable provided the requirements, including maintenance, have been met, and a healthy, well rooted, even colored, uniform stand of grass is established. The grass will be free of weeds, open joints, bare areas, and surface irregularities.

1.5 DELIVERY, STORAGE AND HANDLING

A. Fertilizer:

1. Deliver fertilizer materials in original, unopened containers, showing weight, analysis, and name of manufacturer. Store in a manner to prevent wetting and deterioration.

B. Sod:

1. Deliver, store, and handle sod according to the requirements of the Turfgrass Producers International (formerly the American Sod Producers Association's (ASPA) "Guidelines and Specifications to Turfgrass Sodding".
2. Protect sod from sun, wind, and dehydration prior to installation.
3. Do not tear, stretch, or drop sod during handling.

1.6 PROJECT CONDITIONS

- A. Notify Landscape Architect at least seven (7) working days prior to commencement of sodding operations.
- B. Locate and protect utilities, irrigation, system, paving, plant materials and other facilities from damage caused by sodding operations. Items damaged shall be repaired or replaced to the full satisfaction of the
- C. Perform sodding work only after all planting and other work affecting ground surfaces has been completed.
- D. Perform fertilizing and sodding operations only when weather and soil conditions are suitable and in accordance with locally accepted practices.
- E. Restrict traffic from newly sodded areas until lawn is established.
- F. Irrigate, as necessary.

1.7 MAINTENANCE, WARRANTY AND REPLACEMENT

- A. See Section 32 01 90, "Operation and Maintenance of Planting".
- B. All sodded lawn shall be warranted for a period of one year after the date of final acceptance. A final inspection will be conducted with Landscape Architect at the end of the warranty period. All dead or drying sod will be replaced to the satisfaction of the Landscape Architect.
- C. Maintenance Period Prior to Final Acceptance:
 - 1. Provide all labor, equipment and services required to maintain the sodded lawn in a healthy, vigorous condition during installation and until the date of final acceptance, but not less than 30 days after the date of substantial completion.
 - 2. When the full maintenance period has not elapsed before the end of the planting season, or if the sodded lawn is not fully established at that time, continue maintenance during the next planting season.
 - 3. Begin maintenance immediately after sod is installed. Inspect sod daily during the installation period and perform needed watering and maintenance promptly.
 - 4. Any materials found to be dead or in poor condition, due to faulty or inferior materials or workmanship, shall be replaced immediately at the Contractor's expense. All replacement materials shall be warranty as for original installation.

PART 2 - PRODUCTS

2.1 SOD

- A. Harvest and handle sod according to the requirements of the Turfgrass Producers International (formerly the American Sod Producers Association's (ASPA) "Guidelines and Specifications to Turfgrass Sodding" and the additional requirements noted herein.
- B. An "approved" nursery grown blend of two, minimum, improved Kentucky Bluegrass varieties. Sod shall be grown on topsoil. Sod grown on peat will not be accepted.
- C. Sod containing Common Bermudagrass, Quackgrass, Johnsongrass, Poison Ivy, Nutsedge, Nimblewill, Canada Thistle, Timothy, Bentgrass, Wild Garlic, Ground Ivy, Perennial Sorrel, or Bromegrass weeds will not be accepted.
- D. Provide well-rooted, healthy sod, free of diseases, nematodes and soil borne insects. Provide sod uniform in color, leaf texture, and density. Sod shall be free of weeds, undesirable grasses, stones, roots, thatch, and extraneous material; and capable of growth and development when planted.
- E. Furnish machine stripped (1/2") and of supplier's standard width, length, and thickness. Sod shall be machine cut at a uniform soil thickness of one-half inches (1/2") plus or minus 1/4 inch (1/4"), at the time of cutting. Measurement shall exclude top growth and thatch, thick with clean cut edges.
- F. Standard size sections of sod shall be strong enough so that it can be picked up and handled without damage.

- G. Sod shall be mowed before harvesting to a uniform height of one to one and a half inches (1" to 1-1/2").
- H. Cut, deliver, and install sod within a 24-hour period.
- I. Do not harvest or transport sod when frozen, dormant, or when moisture content may adversely affect sod survival.
- J. Do not tear, stretch, or drop sod during handling.

2.2 FERTILIZER

- A. Granular, non-burning product composed of not less than 50% organic slow acting, warranty analysis professional fertilizer.
- B. Type A: Starter fertilizer containing 20% nitrogen, 12% phosphoric acid and 8% potash by weight or similar approved composition.

2.3 STAKES

- A. Softwood, 3/4" dia. x 8" long or,
- B. Steel tee shaped pins, 4" head x 8" leg.

2.4 WATER

- A. Free of substances harmful to sod growth.

2.5 TOPSOIL

- A. See Section 32 91 19, "Landscape Grading"

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect fine and rough graded surfaces to ascertain satisfactory conditions.
- B. If no topsoil is spread, till existing soil to a depth of 4-6 inches and amend soil based on recommendations in the soil report.
- C. Do not start sodding until unsatisfactory conditions are corrected.

3.2 SITE PREPARATION

- A. If the prepared sod bed is eroded or compacted by rainfall prior to fertilizing, regrade the surface.
- B. Limit preparation to areas which will be immediately sodded. Spread topsoil, fine grade.
- C. Treat lawn areas with "Round-Up", by Monsanto, per label directions as required to kill existing vegetation prior to sodding.

- D. Loosen topsoil of lawn areas to a minimum depth of 3". Remove stones over 1" in any dimension and sticks, roots, rubbish and extraneous matter.
- E. Apply fertilizer at the rate specified on the soil report, by mechanical rotary or drop type distributor. Evenly incorporate fertilizer into the soil to a depth of 3" by discing or other methods approved by Landscape Architect. Fertilize areas inaccessible to power equipment with hand tools and incorporate fertilizer into soil.
- F. Amend soil as necessary and as outlined in Section 32 91 19, "Landscape Grading".

3.3 SOD INSTALLATION

A. General:

- 1. Moisten dry soil prior to sodding, to a depth of 6 inches. Do not saturate.
- 2. Restore eroded, settled, or otherwise disturbed areas to specified condition after fine grading and prior to sodding.
- 3. Do not tear, stretch, or drop sod during installation.

B. Sodding:

- 1. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips. Do not overlay edges. Stagger strips to offset joints in adjacent courses. Remove excess sod to avoid smothering of adjacent grass. Provide sod so top of pad is flush with adjacent curbs, sidewalks, drains, and seeded areas.
- 2. Do not lay dormant sod or install sod on saturated or frozen soil.
- 3. Install initial row of sod in a straight line, beginning at the bottom of slopes and perpendicular to direction of the sloped area. Place subsequent rows parallel to and against previously installed row.
- 4. Install traditional sized (1 square yard) sod, within swales and intermittent waterways, perpendicular to the direction of flow. Peg sod to resist washout during the establishment period. Sod from large rolls shall be laid in the direction of the flow.
- 5. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets and form a smooth surface. Work sifted soil into minor cracks between pieces of sod.
- 6. Peg sod on slopes greater than 3:1 to prevent slippage. Install stakes at rate recommended by sod manufacturer, but not less than 2 stakes per strip of sod.
- 7. Water sod thoroughly with a fine spray within two hours of planting. During the first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 4 inches below the sod. Maintain soil moisture until sod is established.
- 8. Sod indicated areas within contract limits and areas adjoining contract limits disturbed as a result of construction operations.

3.4 MAINTENANCE PRIOR TO FINAL ACCEPTANCE

A. General:

1. See Section 32 01 90, "Operation and Maintenance of Planting".
2. Sodded lawns will be considered satisfactory provided the requirements of this Section have been met, including maintenance. Sod shall be well rooted, evenly colored, and viable. It will be free of weeds, open joints, bare areas, and surface irregularities. Replant lawns that do not meet the requirements. Continue maintenance until lawn is satisfactory.
3. Maintain and establish sodded lawns by watering, fertilizing, weeding, mowing, trimming, and replanting, to produce a uniformly smooth lawn. Replant bare areas with the same materials specified for lawns.

B. Watering

1. If necessary, provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawns uniformly moist to a depth of 4 inches.
2. Water lawn at the minimum rate of 1 inch per week.

C. Mowing:

1. The first mowing shall not be attempted until the sod is firmly rooted and securely in place. Never remove more than 1/3 of the grass leaf. Maintain bluegrass between 1.5 and 2.5 inches.
2. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet.

D. Fertilization:

1. Apply fertilizer to lawn after first mowing and when grass is dry.
2. Use fertilizer that will provide actual nitrogen of at least 1 lb. per 1000 sq.ft. (0.5 kg per 100 sq. m) of lawn area. Applications shall be based on a soil test.

3.5 CLEANING AND PROTECTION

1. Perform cleaning during installation of the work and upon completion of the work. Remove all excess materials, debris, and equipment from site.
2. Erect barricades, fencing and warning signs as required to protect newly sodded areas from all traffic. Maintain barricades, fencing and signs throughout the maintenance period and until the lawn is accepted.

3.6 ACCEPTANCE

- A. See Section 32 01 90, "Operation and Maintenance of Plantings".

END OF SECTION 32 92 23

SECTION 32 93 00

PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Division 00, Bidding and Contract Requirements, and Division 01, General Requirements, apply to this Section.

1.2 SUMMARY

- A. Provide trees, plants, bulbs, and ground covers as shown and specified. The work includes, but is not limited to the following:

1. Trees, shrubs, ground cover, perennials, and bulbs.
2. Planting mixes and mulches.
3. Protection of existing features.

- B. Related Sections: The following Sections may contain requirements related to this Section:

1. Section 32 91 00, "Planting Preparation"
2. Section 32 91 19, "Landscape Grading"
3. Section 32 92 19, "Seeding"
4. Section 32 01 90, "Operation and Maintenance of Planting"

1.3 REFERENCES

- A. Plant names indicated, comply with "Standardized Plant Names": as adopted by the latest edition of the American Joint Committee of Horticultural Nomenclature. Names of varieties not listed conform generally with names accepted by the nursery trade. Provide stock true to botanical name and legibly tagged.
- B. Comply with sizing and grading standards of the latest edition of "American Standard for Nursery Stock". A plant shall be dimensioned as it stands in its natural position.

1.4 SUBMITTALS

- A. General:

1. Submit each item in this Article according to Division 00 and Division 01 Specification Sections.
2. Submit the following materials certification to Landscape Architect:
 - a. Topsoil source and pH value
 - b. Peat moss.
 - c. Plant fertilizer.
 - d. Shredded bark mulch.
 - e. Planting accessories.
 - f. Preemergent herbicides.
 - g. Plant fertilizers.

- B. Planting Schedule:

1. Submit planting schedule indicating anticipated dates for each plant species.
- C. Qualification Data:
1. Submit qualification data for firms and people specified in Quality Assurance to demonstrate their capability and experience. Include lists of completed projects with names and addresses of Architect, Owners and other information specified.

1.5 QUALITY ASSURANCE

A. Landscaper's Qualifications:

1. Engage an experienced landscaping company which has completed a minimum of five (5) years of successful experience with landscaping work similar in size and intent to that indicated for this Project, and with a record of successful landscape establishment.

B. Measurements:

1. Measure trees and shrubs according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150 mm) above ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

1.6 DELIVERY, STORAGE AND HANDLING

A. Inspection:

1. Inspection of nursery stock will be made at the nursery by the Owner's Representative whenever such inspection is deemed advisable. Approval on such inspection shall not be construed as an acceptance of it. Acceptance for planting will not be made until the stock has been delivered and inspected at the planting project site. Inspection will include examination of the root systems of plants. Plants may be examined by removing soil from the root systems of balled or container grown plants or digging in the nursery row. Sufficient plant root systems will be inspected for each species and separate plant source to determine the extent and condition of plant root systems. The Contractor shall give the Owner's Representative at least 24 hours notice before making any delivery of stock, and each shipment shall be accompanied by itemized list showing sizes, species and varieties included.

B. Plant Material:

1. Cover plants transported via open vehicles with a protective covering to prevent wind burn.
2. Protect plant material during delivery to prevent damage to root ball or desiccation of leaves. The Contractor is cautioned to exercise care in handling, loading, unloading, and storing of plant materials. Plant materials that have been damaged in any way will be discarded and if installed, shall be replaced with undamaged materials at the Contractor's expense.
3. Deliver all plants with legible identification labels stating correct plant name and size as indicated on drawings. Label trees and bundles of containers of like shrubs or ground cover plants with durable waterproof labels with water-resistant ink which will remain legible for at least 60 days.

4. If plants cannot be planted immediately upon delivery or within four (4) hours properly protect and maintain them in a healthy, vigorous manner. Shade and protect plants in outside storage areas from the wind and direct sunlight until planted. Heel-in bare root plants. Protect balled and burlapped plants from freezing or dryout by covering the balls or roots with moist burlap, sawdust, wood chips, shredded bark, peat moss, or other approved material. Provide covering which allows air circulation. Keep all plants in a moist condition until planted by watering with a fine mist spray. Water heeled-in plantings daily. No plant shall be bound with rope or wire in a manner that could damage or break the branches.
5. Handle balled and burlapped stock by the root ball.

1.7 PROJECT CONDITIONS

A. Existing Features:

1. Locate and protect utilities, irrigation system, paving, plant materials and other facilities from damage caused by landscaping operations. Items damaged shall be repaired or replaced to the full satisfaction of the Owner's Representative.
2. Frozen or muddy topsoil is not acceptable.
3. A complete list of plants, including a schedule of sizes, quantities and other requirements is shown on the proposal form. In the event that quantity discrepancies or material omissions occur in the proposal form Subcontractor shall notify the Landscape Architect during the proposal bidding process.
4. An irrigation system will be installed prior to planting. Locate, protect, and maintain the irrigations system during planting operations. Repair irrigation system components damaged during planting operations at the Landscape Subcontractor's expense.
5. The Landscape Contractor shall inspect existing soil conditions in all areas of the site where his operations will take place prior to the beginning of work. It is the responsibility of the Landscape Contractor to notify the General Contractor's Representative and the Landscape Architect in writing of any conditions which could affect the survivability of plant material to be installed.

WEATHER CONDITIONS

- B. Perform planting operations only when weather and soil conditions are suitable and in accordance with locally accepted practice.

1.8 SCHEDULE OF PLANTING

A. General:

1. Planting times other than those indicated herein shall be acceptable to the Owner's Representative assuming all criteria have been met.
2. Notify Landscape Architect at least seven (7) days prior to installation of plant material.

B. Evergreen Material:

1. Plant evergreen materials between August 15 and November 1 or in spring before new growth begins. If project requirements require planting at other times, plants shall be sprayed with anti-desiccant prior to planting operations.
- C. Deciduous Material:
1. Plant deciduous materials in a dormant condition. If deciduous trees are planted in-leaf, they shall be sprayed with an anti-desiccant prior to planting operation.

1.9 WARRANTY AND MAINTENANCE

- A. Refer to Section 32 01 90, "Operation and Maintenance of Planting"

PART 2 - PRODUCTS

2.1 PLANT MATERIALS

- A. Stock furnished shall be at least the minimum size indicated. Larger stock is acceptable at no additional charge. Larger plants shall not be cut back to size indicated.
- B. All plants provided shall be nursery grown conforming to ANSI Z60.1 under climatic conditions similar to those in the locality of the project for a minimum of 2 years.
- C. No pruning wounds shall be present with a diameter of more than 1" and such wounds must show vigorous bark growth on all edges.
- D. Provide "specimen" plants with a special height, shape, or character of growth. Tag specimen trees or shrubs at the source of supply. When specimen plants cannot be purchased locally, provide sufficient photographs of the proposed specimen plants for approval.
- E. Provide plants typical of their species or variety; with normal, densely developed branches and vigorous, fibrous root systems. Provide only sound, healthy, vigorous plants free from defects, disfiguring knots, sun scald injuries, frost cracks, abrasions of the bark, plant diseases, insect eggs, borers, and all forms of infestation. All plants shall have a fully developed form without voids and open spaces.
- F. Label at least 1 tree and 1 shrub of each variety and caliper with a securely attached waterproof tag bearing legible designation of botanical and common name.
- G. Deciduous Trees:
1. Deciduous Shade Trees: Deciduous shade trees shall be straight and symmetrical with a crown having a persistent main leader. The amount of crown shall be in good overall proportion to the total height of the tree. Where a multistem clump is specified, it shall have a minimum of 3 stems originating from the ground. Shape of multistemmed clump shall be natural according to species and type. A single trunk branching near the ground is unacceptable.
- H. Evergreen Trees:
1. Shall be branched to the ground and shall meet the requirements for height and spread indicated in the plant list. Sheared evergreen trees are not acceptable.
- I. Shrubs:

1. Shrubs shall meet the requirements for spread and height indicated in the plant list. The measurements for height shall be taken from the ground level to the average height of the top of the plant and not the longest branch. Single stemmed or thin plants will not be accepted. Side branches shall be generous, well-twiggged, and the plant as a whole well-bushed to the ground. Plants planted in rows shall be matched in form.

J. Balled and Burlapped Plants:

1. Dig balled and burlapped plants with firm, natural balls of earth of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant. Provide ball sizes complying with the latest edition of the "American Standard for Nursery Stock". Cracked or mushroomed balls are not acceptable.

K. Bare-Root Plants:

1. Dig with adequate fibrous roots, cover with a uniformly thick coating of mud puddled immediately after they are dug, or packed in moist straw or peat moss.

L. Container-Grown Stock:

1. Grown in a container for sufficient length of time for the root system to have developed to hold its soil together, firm, and whole.
2. No plants shall be loose in the container, and container stock shall not be root bound.

M. Ground Cover, Vines and Perennials:

1. Plants shall be furnished in suitable containers. Plants shall be at least one year old and shall have been grown long enough to ensure sufficient root growth to hold soil in place and retain the original shape when removed from the container. Vines shall have at least 4 runners 12 inches long. Ground cover plants and perennials shall have healthy tops to a size proportionate to the root requirements typical to species or variety.

N. Plants planted in rows shall be matched in form.

1. Plants shall be furnished in suitable containers. Plants shall be at least one year old and shall have been grown long enough to ensure sufficient root growth to hold soil in place and retain the original shape when removed from the container. Vines shall have at least 4 runners 12 inches long. Ground cover plants and perennials shall have healthy tops to a size proportionate to the root requirements typical to species or variety.

2.2 TOPSOIL

- A. Provide percolation testing by filing plant pits with water and monitoring length of time for water to completely percolate into soil. Submit test results to landscape architect prior to starting work.
- B. See Section 32 91 19, "Landscape Grading".

2.3 PLANTING ACCESSORIES

- A. Water:

1. Free of substances harmful to plant growth.
- B. Mulch:
1. Single shredded native hardwood bark mulch; not larger than 3" in length and 1/2" in width, free of wood chips and sawdust.
 2. Double shredded native hardwood bark mulch; not larger than 1" in length, free of wood chips and sawdust.
 3. Premium grade shredded cedar bark mulch; not larger than 3" in length.
- C. Staking and Guying:
1. Stakes:
 - a. Rough sawn, sound, new hardwood, or pressure treated softwood, free of knots, holes, or cross grains and other defects, painted at one end.
 - b. Stake Size, 2" x 2" x 8'-0" long.
 - c. Guying Size, 2" x 2" x 36" long.
 2. Guy and Strap Material:
 - a. 3/4" wide, flat woven polypropylene material, ArborTie® or equal, installed per manufacturer's specifications.
 3. Guy Cable:
 - a. 3/4" wide, flat woven polypropylene material, ArborTie® or equal, installed per manufacturer's specifications.
- D. Tree Wrap:
1. Standard waterproofed tree wrapping paper, 4" wide, made of 2 layers of crepe draft paper, cemented together with bituminous asphalt, with a stretch factor of 33 percent.
 2. Remove all tree wrap material after first winter.
 3. Twine: 2 ply jute material.
- E. Anti-Desiccant:
1. Protective water; insoluble film emulsion providing a protective film over plant surfaces; permeable moisture retarder to permit transpiration. Mixed and applied in accordance with manufacturer's instructions.
- F. FERTILIZER/ PLANT MIX
1. Peat Moss: Brown to black in color, weed and seed free granulated raw peat.
 - a. Provide ASTM D2607 sphagnum peat moss with a pH below 6.0 for encaceous plants.

2. Planting Mixture Type A-Trees: Standard planting backfill shall be a mixture of 2/3 native soil (excavated from plant pits), 1/3 topsoil. Add peat, fertilizer Type "A" and "B" to mixture per manufacturer's requirements. Follow planting details and planting notes on drawings.
3. Planting Mixture Type B for Perennial Flowers, Groundcover Beds, and ericaceous plants: Planting backfill shall be a mixture of 1/3 screened topsoil, 1/3 sand, and 1/3 peat. All existing soil shall be excavated and removed. Adding fertilizer types "A" and "B" mixture per manufacturer's requirements. Follow planting details. Planting Mixture Type C for Annual Flower Beds: Same as Type "B". Submit a sample to the Landscape Architect for approval prior to installation.
4. Plant Fertilizer Type A to be "Drimanure" applied per manufacturer recommendations. Shemin's 1-313-291-1200
5. Plant Fertilizer Type B to be "Shemin 13-13-13". Apply per manufacturer recommendations. Shemin's 1-313-291-1200.
6. Bone Meal-5lbs. per cubic yard of soil mixes.
7. Lime to be ground dolomitic limestone, ninety-five (95%) percent passing through a #100 mesh screen. Use to adjust soil pH only, under direction of Landscape Architect.
8. Sand to be clean, coarse, ungraded conforming to ASTM-C-3 for fine aggregates.

PART 3 - EXECUTION

3.1 PROTECTION OF EXISTING FEATURES

- A. Provide necessary safeguards and exercise caution against injury or defacement of any existing site improvements and plantings. Contractor shall be responsible for any damage and shall correct and/or replace damaged items at his expense. No trucks or vehicles of any kind shall be allowed to pass over paths, sidewalks, or curbs, unless adequate protection is provided.
- B. Use all means necessary to protect planting materials before, during and after installation and to protect the installed work and materials of other trades. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner's Representative at Contractor's expense.
- C. Contractor shall replace all existing and proposed plant material damaged due to inadequate watering during all phases of construction with plant material of like size and species.

3.2 EXAMINATION

- A. Examine areas to receive landscaping for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 PREPARATION

- A. See Planting Preparation (32 91 00) and Landscape Grading (32 91 19) sections.
- B. Finish Grade Preparation:

1. Contractor shall ensure that finish grade is within tolerance indicated in Section 32 91 19 "Landscape Grading" prior to commencing planting operation.

C. Plant Material Preparation:

1. Actual planting shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally accepted practice.
2. Only as many plants as can be planted and watered on that same day shall be distributed in a planting area.
3. Containers shall be opened, and plants shall be removed in such a manner that the ball of earth surrounding the roots is not broken and they shall be planted and watered as herein specified immediately after removal from the containers. Containers shall not be opened prior to placing the plants in the planting area.

D. Pre-Plant Weed Control:

1. If live perennial weeds exist on site at the beginning of work, spray with a non-selective systemic contact herbicide, as recommended and applied by an approved licensed landscape pest control advisor and applicator. Leave sprayed plants intact for at least fifteen (15) days to allow systemic kill.
2. Clear and remove these existing weeds by mowing or grubbing off all plant parts at least 1/4" below the surface of the soil over the entire area to be planted.
3. After irrigation system is operational apply water for five (5) to ten (10) days as needed, to achieve weed germination. Apply contact herbicides and wait as needed before planting. Repeat, if required by Owner's Representative.
4. Maintain site weed free until final acceptance by Architect Owner's Representative utilizing mechanical and chemical treatment.

LAYOUT OF MAJOR PLANTINGS

- E. Locations for plants and outlines of areas to be planted shall be marked on the ground by the Contractor before any plant pits are dug. All such locations shall be approved by the Landscape Architect. If underground construction or utility lines are encountered in the excavation of planting areas, other locations for planting may be recommended by the Contractor and shall be approved by the Landscape Architect. Layout shall be accomplished with flagged grade stakes indicating plant names and specified container size on each stake. It shall be the contractors' responsibility to confirm with the Landscape Architect and governing agencies the location and depth of all underground utilities and obstructions. Adjust, as necessary.

3.4 PLANTING

A. Planting of Trees and Shrubs:

1. Excavation for planting shall include the stripping and stockpiling of all acceptable topsoil encountered within the areas to be excavated for trenches, tree holes, plant pits and planting beds.
2. Excess soil generated from the planting holes and not used as backfill or in establishing the final grades shall be removed from the site.

3. All excavated holes shall have vertical sides with roughened surfaces and shall be of a size indicated on drawings scarify bottom of pit to a depth of 6".
 4. Protect all areas from excessive compaction when trucking plants or other material to the planting site.
 5. Center plant in pit or trench. Place upright and plumb.
 6. Remove all containers, plastic and fiber, wire, all ropes, twine and synthetic (rot proof) wrap.
 7. Face plants with fullest growth into prevailing wind, while providing the best appearance or relationship to each other or adjacent structure.
 8. Set plant plumb and hold rigidly in position until soil has been tamped firmly around ball or roots. No filling will be permitted around trunks or stems.
 9. All plants which settle deeper than the surrounding grade shall be raised to the correct level. After the plant has been placed, additional backfill shall be added to the hole to cover approximately one-half of the height of the root ball. At this stage, water shall be added to the top of the partly filled hole to thoroughly saturate the root ball and adjacent soil.
 10. Rhododendrons should be fertilized with a 5-10-10 fertilizer at the rate of 2 lbs/100 square feet. Remove spent flower blooms directly after blooming. Do not prune after June 15.
 11. Set bare-root stock on cushion of planting soil. Spread roots without tangling or turning toward surface, and carefully work backfill around roots by hand. Muddle with water until backfill layers are completely saturated. Plumb before backfilling and maintain plumb while working backfill around roots and placing layers above roots. Remove injured roots by cutting cleanly; do not break.
 12. After balled and burlapped plants are set and sterilized, remove burlap from top 1/3 of ball. Muddle planting soil mixture around bases of balls and fill all voids.
- B. Planting of Ground Cover Vines and Perennial Plants:
1. Ground cover shall be planted in straight rows and evenly spaced, unless otherwise noted, and at intervals called out in the drawings. Triangular spacing shall be used unless otherwise noted on the drawings.
 2. Each rooted plant shall be planted with its proportionate amount of flat soil. Plantings shall be immediately watered after planting until the entire area is soaked to the full depth of each hole.
 3. Care shall be exercised at all times to protect the plants after planting. Any damage to plants by trampling or other operations of this Contract shall be repaired immediately at Contractor's expense.
 4. Plant to within 6" of the stems of trees and shrubs within planting bed and to within 4" of the edge of the bed.
- C. Filling:
1. The planting hole or bed shall be filled with planting mixture and hand-tamped firm.

2. After filling, an earthen basin shall be constructed around each plant. Each basin shall be of a depth sufficient to hold at least three (3) inches of water. The basins shall be constructed of amended backfill materials. Remove basin in all turf areas after initial watering.
- D. Apply pre-emergent herbicide to bed areas per manufacturer's recommendation before mulching.

PRUNING

- E. Pruning shall be limited to the minimum necessary to remove injured twigs and branches, and to shape the plant material as directed by the Landscape Architect. Pruning may not be done prior to delivery of plants.

3.5 MULCH

- A. Mulch tree and shrub planting pits and shrub beds with required mulching material 4" deep immediately after planting. Thoroughly water mulched areas. After watering, rake mulch to provide a uniform finished surface.
- B. Mulch ground cover and perennial beds first with mulch 2" to 3" deep and then plant ground cover and perennials through the mulch.

3.6 TREE WRAPPING

- A. Inspect trees for injury to trunks, evidence of insect infestation, and improper pruning before wrapping.
- B. Wrap trunks of all trees spirally from bottom to top with specified tree wrap and secure in place.
- C. Overlap 1/2 the width of the tree wrap strip and cover the trunk from the ground to the height of the second branch.
- D. Secure tree wrap in place with twine wound spirally downward in opposite direction, tied around the tree in at least 3 places including the top and bottom.
- E. Remove wrap at end of guarantee period.

3.7 STAKING/GUYING

- A. Stake/guy all trees immediately after planting, but not before lawn seeding or sodding operations (if required). Trees shall be installed plumb and rigid as indicated on drawings and maintained until final acceptance.
- B. Stake deciduous trees under 3" caliper. Stake evergreen trees under 6'-0" tall.
- C. Stake multi-stemmed deciduous trees.
- D. Guy deciduous trees 3" caliper and larger. Guy evergreen trees 6'-0" tall and taller.

3.8 CARE OF EXISTING TREES

- A. Selectively prune existing trees under Architect's Landscape Architect's direction. Remove sucker shoots, dead, rubbing, and damaged branching.
- B. Fertilize designated existing trees with 2 to 3 lbs. of commercial plant fertilizer approved by the Architect, containing 12% nitrogen, 12% phosphoric acid, and 12% potash by weight. 1/4 of nitrogen in form of nitrates, 1/4 in form of ammonia salt, and 1/2 in form of organic nitrogen, per inch of trunk diameter, for trees less than 6" diameter and 3 to 5 lbs. for trees greater than 6" diameter. Fertilize in early spring before growth begins or in late October. Fertilize at 2' to 3' on center in a triangular pattern to a depth of 18" within the drip line. Injection or drilling fertilization methods, when used, shall be approved prior to initiation.
- C. Water existing trees every 2 weeks until acceptance. Water thoroughly with a fine mist sprinkler head, soaker hose, or hose at a low flow rate over the entire drip line area as required to allow water to penetrate to a depth of 12" to 18"

3.9 PRUNING

- A. With prior approval of Landscape Architect prune branches of deciduous stock, after planting, to balance the loss of roots and preserve the natural character appropriate to the particular plant requirements. In general, remove 1/4 to 1/3 of the leaf bearing buds, proportion shall in all cases be acceptable to the Architect. Remove or cut back broken, damaged, and unsymmetrical grown of new wood.
- B. Multiple leader plants: Preserve the leader which will best promote the symmetry of the plant. Cut branches flush with the trunk of main branch, at a point beyond a lateral shoot or bud a distance of not less than 1/2 the diameter of the supporting branch. Make cut on an angle.
- C. Prune evergreens only to remove broken or damaged branches.

3.10 CLEANING

- A. After all planting operations have been completed, remove all trash, excess soil, empty plant containers and rubbish from the property. All scars, ruts or other marks in the ground caused by this work shall be repaired and the ground left in a neat and orderly condition throughout the site. Contractor shall pick up all trash no less frequently than each Friday before leaving the site, once a week, and/or on the last working day of each week. All trash shall be removed completely from the site.
- B. The Contractor shall leave the site area broom-clean and shall wash down all paved areas within the Contract area, leaving the premises in a clean and safe condition.

END OF SECTION 32 93 00

SECTION 33 05 00

MANHOLES AND STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Monolithic concrete, modular pre-cast concrete manhole assemblies.
- B. Related Sections
 - 1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
 - 2. Section 31 20 00 - Earthmoving
 - 3. Section 33 30 00 - Sanitary Sewerage Utilities
 - 4. Section 33 40 00 - Storm Drainage Utilities
 - 5. Section 33 11 00 - Water Distribution Piping

1.2 REFERENCED STANDARDS

- A. All work under this section shall be completed in general conformance with construction plan details, all Local Municipal / County standards, or applicable Michigan Department of Transportation's (MDOT) standard specifications for construction, standard plans, construction manual, quality assurance procedures manual (current editions), and as specified herein.
- B. American Society for Testing and Materials (ASTM)
 - 1. ASTM A 48 - Gray Iron Castings
 - 2. ASTM C 55 - Concrete Building Brick
 - 3. ASTM C 478 - Pre-cast Reinforced Concrete Manhole Sections
 - 4. ASTM C 923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes
 - 5. ASTM D 1248 - Polyethylene Plastics Molding and Extrusion Materials
- C. International Masonry Industry All-Weather Council (IMIAC)
 - 1. Recommended Practices and Guide Specification for Cold Weather Masonry Construction

1.3 SUBMITTALS

- A. Shop Drawings: Indicate reference to Construction Drawings for all manhole structure locations with elevations, piping with sizes, locations, and elevations of any penetrations. Submit to Engineer for review and approval a minimum of four (4) weeks prior to installation date.
- B. Product Data: Provide data for manhole covers, component construction, features, configuration, and dimensions.

PART 2 - PRODUCTS

2.1 MANHOLE STRUCTURES

- A. Pre-cast Concrete: Reinforced pre-cast concrete barrel of specified diameter.
 - 1. Manhole sections conforming to ASTM C 478 with gaskets in accordance with ASTM C 923.

2. Construct manholes of pre-cast concrete sections as required by Construction Drawings to size, shape, and depth indicated.
- B. Concrete Block/Brick: ASTM C 55, Grade N Type I-moisture controlled, normal weight, of same grade, type and weight as block units, nominal modular size of 3 5/8-inches x 7 5/8-inches x 2 1/4-inches
- C. Mortar and Grout: Mortar for finishing and sealing shall be Class "C". Honeycombing less than 2-inches deep shall be repaired using Class "D" mortar.
- D. Brick Transition Reinforcement: Formed steel 8-gauge wire with galvanized finish.
- E. Configuration:
 1. Barrel Construction: Concentric with eccentric cone top section.
 2. Shape: Cylindrical
 3. Clear Inside Dimensions: 48-inches diameter minimum or as indicated on Construction Drawings.
 4. Design Depth: As indicated on Construction Drawings.
 5. Clear Lid Opening: 22-inches minimum
 6. Pipe Entry: Provide openings as indicated on Construction Drawings
 7. Main and Lateral Pipes: Neatly cut off main and lateral pipes flush with inside of manhole or inlet where they enter structure walls. Point up irregularities and rough edges with non-shrink grout.
- F. Inverts: Shape inverts for smooth flow across structure floor as indicated on Construction Drawings. Use concrete and mortar to obtain proper grade and contour. Finish surface with fine textured wood float.

2.2 COMPONENTS

- A. Lid and Frame:
 1. Manufacturer: Neenah Foundry Company, East Jordan Iron Works, and/or approved equal. All drainage structure covers shall be manufactured or machined per Local Municipal / County Standards and/or with a generic "Storm Water Only – Dump No Waste / Drains to Water Way" logo if no other designation is stated on attached Local Municipal Standard / County Detail Sheets.
 2. ASTM A 48, Class 30B heavy-duty cast iron construction, machined flat bearing surface.
 3. Removable lid, closed or open as indicated on Construction Drawings, sealing gasket.
- B. Weep Holes:
 1. All catch basins shall have 3-inch weep holes cast into the walls. The exterior of the weep holes shall receive ¼ inch wire mesh with a 12-inch belt of crushed rock, or a perimeter drain tile system to collect subsurface drainage.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify items specified by other Sections are properly sized and located.
- B. Verify that built-in items are in proper location and ready for roughing into work.
- C. Verify that the excavation for manholes is correct.

3.2 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves as indicated on Construction Drawings.

3.3 PRECAST MANHOLE CONSTRUCTION

- A. Place base pad to proper elevation and location and trowel top surface level for placement of manhole barrel.
- B. Place manhole barrel plumb and level to correct elevations and anchor to base pad.
 - 1. After completion of slab foundation, lower first joint of manhole barrel into position, grooved end first; and set level and plumb on concrete base. Align and adjust to proper grade prior to placing and forming invert. Pour invert immediately after setting of first section of manhole barrel.
 - 2. Prior to setting subsequent manhole barrel sections, apply primer to tongue and groove ends and allow to set in accordance with manufacturer's recommendations. Place "Ram-neck", or equivalent, plastic rope on tongue end. Lower next section into position and remove excess material from interior of structure. Add additional material on exterior of joint, if necessary, for completely watertight joint.
- C. Set cover frames and lids level without tipping, to correct elevations. Utilize pre-cast rings or brick and mortar to achieve final rim elevation. Maximum limit: 4 courses.

END OF SECTION 33 05 00

SECTION 33 11 00

WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Site water piping and fittings including domestic potable waterline and fire protection system supply waterline, valves, and fire hydrants.
- B. Related Sections
 - 1. Section 02 00 00 - Existing Conditions - General Information/Site Construction.
 - 2. Section 31 10 00 - Site Clearing.
 - 3. Section 01 56 39 - Tree and Plant Protection.
 - 4. Section 31 20 00 - Earthmoving.
 - 5. Section 33 30 00 - Sanitary Sewerage Utilities.
 - 6. Section 33 05 00 - Manholes and Structures.
 - 7. Section 33 40 00 - Storm Drainage Utilities.

1.2 REFERENCED STANDARDS

- A. All work under this section shall be completed in general conformance with construction plan details, all Local Municipality / County standards; or per applicable Michigan Department of Transportation's (MDOT's) standard specifications for construction, standard plans, construction manual, quality assurance procedures manual (current editions), and as specified herein.
- B. American Society of Mechanical Engineers (ASME)
 - 1. ASME B 16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
- C. ASTM International (ASTM)
 - 1. ASTM B88 - Seamless Copper Water Tube
 - 2. ASTM D1784 - Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
 - 3. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR-Series)
 - 4. ASTM D2564 - Poly (Vinyl Chloride) (PVC) Solvent Cement
 - 5. ASTM D2672 - Poly (Vinyl Chloride) (PVC) Integrally Molded Bell Ends for Solvent - Cemented Pipe Joints.
 - 6. ASTM D3139 - Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals
 - 7. ASTM F477 - Elastomeric Gaskets and Lubricant
 - 8. ASTM F656 - Poly (Vinyl Chloride) (PVC) Cement Primer
- D. American Water Works Association (AWWA)
 - 1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
 - 2. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and other Liquids
 - 3. AWWA C116 - Protective Fusion-Bonded Epoxy Coatings for The Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service
 - 4. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
 - 5. AWWA C153 - Ductile-Iron Compact Fittings for Water Service
 - 6. AWWA C500 - Gate Valves for Water and Sewage Systems
 - 7. AWWA C550 - Protective Interior Coatings for Valves and Hydrants
 - 8. AWWA C504 - Rubber-Seated Butterfly Valves
 - 9. AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances

- 10. AWWA C605 - Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
 - 11. AWWA C651 - Disinfecting Water Mains
 - 12. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Through 12 Inches, for Water Distribution
- E. National Fire Protection Associations (NFPA)
 - 1. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances
 - F. ANSI/NSF Standard 14 Plastic Piping System Components and Related Materials (ANSI/NSF)
 - G. ANSI/NSF Standard 61 Drinking Water System Components – Health Effects (ANSI/NSF)

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Firm with at least 3 years of successful installation experience on projects with water systems similar to that required for project.
- B. Codes and Standards:
- C. Comply with construction plan details, all Local Municipal standards / County standards and/or requirements. The municipal and/or county standard water main detail sheet(s) and/or detailed specifications are referenced and considered part of the Contract Documents. If a discrepancy occurs between these standard details and these specifications - Notify Project Architect / Engineer of all such conditions prior to commencing work or ordering materials.
- D. Comply with standards of authorities having jurisdiction for fire protection systems. Include materials, hose threads, installation, and testing.
- E. Comply with standards of authorities having jurisdiction for potable water piping and plumbing systems. Include materials, installation, testing and disinfection.
- F. Products, where marked for compliance with code or test standards, shall also mark specific standard as required in the Contract Documents.
- G. Perform installation in accordance with utility company or municipality requirements.
- H. Valves: Mark manufacturer's name and pressure rating on valve body.
- I. Perform disinfection of potable lines in accordance with AWWA C651.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate reference to Construction Drawings for all water main, gate valve well structures, water services, locations, and elevations for piping with sizes, location, and elevations of any penetrations. Submit to Engineer for review and approval a minimum of four (4) weeks prior to installation date.
- B. Product Data: Provide Project Engineer with data on pipe materials, pipe fittings, hydrants, valves, and accessories per construction details and/or as specified herein.
- C. Manufacturer's Certificate: Certify that products meet or exceed state or local requirements.

- D. Furnish one (1) copy of test results of meter test and hydrostatic pressure test to Engineer / Construction Manager / Contractor / Owner and utility company upon completion of water distribution backfilling operations.
- E. Project Record Documents:
 - 1. Disinfection report: Record the following:
 - a. Type and form of disinfectant used.
 - b. Date and time disinfectant injection start and time of completion.
 - c. Test locations.
 - d. Initial and 24-hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
 - e. Date and time of flushing start and completion.
 - f. Disinfectant residual after flushing in ppm for each outlet tested.
 - 2. Bacteriological report: Record the following:
 - a. Date issued, project name, testing laboratory name, address, and telephone number.
 - b. Time and date of water sample collection.
 - c. Name of person collecting samples.
 - d. Test locations
 - e. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
 - f. Coli form bacteria test results for each outlet tested.
 - g. Certification that water conforms, or fails to conform, to bacterial standards.
 - h. Bacteriologist's signature and authority.
 - 3. Accurately record actual locations of piping mains, valves, connections, and top of pipe elevations.
 - 4. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, for shipping as follows:
 - 1. Ensure that valves are dry and internally protected against rust and corrosion.
 - 2. Protect valves against damage to threaded ends, flange faces and weld ends.
 - 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. Storage: Use the following precautions for valves, including fire hydrants, during storage:
 - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 - 2. Protect valves from weather. Store valves indoors and maintain temperature higher than ambient dew point temperature. Support valves off ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use hand wheels or stems as lifting or rigging points.
- D. Deliver pipes and tubes with factory-applied endcaps. Maintain endcaps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings and piping specialties from moisture and dirt.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Comply with all current local municipal / county standards and/or requirements as applicable for work defined herein.

2.2 PIPE

- A. Pipe sizes less than 3-inches that are installed below grade and outside building shall comply with one or combination of following options per plan details or as approved by owner:
1. Seamless Copper Tubing: Type "K" soft copper, ASTM B88.
 - a. Fittings: Wrought copper (95-5 Tin Antimony solder joint), ASME B 16.22.
 2. Polyvinyl Chloride (PVC) Water Pipe: Pipe, ASTM D 2241, with SDR 21 rating, continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D1784 material classification.
 - a. Pipe joints: Integrally molded bell ends, ASTM D2672.
 - b. Cement primer: ASTM F656.
 - c. Solvent cement: ASTM D2564.
- B. Pipe sizes 4 to 16 inches that are installed below grade and outside building shall comply with one or combination of following options per plan details or as approved by owner:
1. Ductile Iron Water Pipe: AWWA C151, Pressure class 350 (4-12") Pressure Class 250 (14-16").
 - a. Fittings: Either mechanical joint or push-on joint, AWWA C153, and shall be coated with a 6-8 mil nominal thickness fusion bonded epoxy conforming to the requirements of AWWA C550 and C116, or cement mortar lined in accordance with AWWA C104.
 - b. Elastomeric gaskets and lubricant: ASTM F477.
 - c. Lining: ANSI A21.4 / AWWA C104, cement mortar, seal coated.
 - d. Gaskets, Glands, and Bolts and Nuts: AWWA C111.
 - e. Mechanical Joint Type Pipe: ANSI A21.11 / AWWA C111, rubber gaskets, ductile or cast-iron glands and steel bolts and nuts.
 2. Polyvinyl Chloride (PVC) Water Pipe: Pipe, AWWA C900, rated DR 18 (Class 150), continually marked as required by NSF/ANSI Standard 14 or 18. All pipe must have NSF-pw stamp.
 - a. Elastomeric gaskets and lubricant: ASTM F477 for smaller pipes.
 - b. Pipe joints: Integrally molded bell ends, ASTM D3139.

2.3 VALVES

- A. Gate Valves, 2-Inches and Larger per local Municipality / County detail sheets and standards or as specified herein:
1. Manufacturer and Model: Mueller Resilient Wedge Gate Valves or approved equal.
 2. AWWA C500, Iron body, non-rising stem with square nut, single wedge, resilient seat, flanged or mechanical joint ends, control rod, post indicator where indicated on Construction Drawings, extension box and valve key.
- B. Ball Valves, 2-Inches and Smaller per local Municipality / County detail sheets and standards or as specified herein:
1. Manufacturer and Model: Mueller Oriseal or approved equal.
 2. Brass body, Teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA compression inlet end, compression outlet with electrical ground connector, with control rod, extension box and valve key.
- C. Butterfly Valves, From 2-Inch to 24-Inch: AWWA C504, Iron body, bronze disc, resilient replaceable seat, water or lug ends, infinite position lever handle.

- D. Check Valves, Post Indicator Valves, And Backflow Preventers if required for project.
 - 1. Refer to Section 13900 - Fire Suppression in Architectural/Building Specifications

2.4 FIRE HYDRANTS

- A. Fire Hydrants: Type as required per local Municipality / County detail sheets and standards or as specified herein. All hydrants shall be EJIW 5BR250 or equal with breakaway flanges. All hydrants shall be spaced to meet requirements of UFC 3-600-01, section 3-7.3.3 spacing requirements. Fire hydrants shall not be closer than 50 feet to any building.
- B. Hydrant Extensions: Fabricate in multiples of 6-inches with rod and coupling to increase barrel length as may be required based upon depth of bury and plan elevation to avoid utility crossings.
- C. Hose and Steamer Connections: City of Detroit standards with two 4-inch diameter pumper nozzles with Detroit standard thread or equal.
- D. Finish: Apply primer and 2 coats of enamel or special coating to color as required by Local Municipality / County requirements.
- E. Valves Boxes: Cast iron having top section and cover with local municipality / county standard or generic "WATER" manufactured or cast into cover, bottom section with base of size to fit over valve and barrel approximately 5 inches diameter, and adjustable cast iron extension of length required for depth of bury of valve, and per Municipality requirements. All valve boxes shall be rated for traffic conditions and be heavy duty to accommodate loading of an AASHTO WB-40 design vehicle under standard H-20 highway loading conditions.
- F. Tapping Sleeve and Tapping Valve: Complete assembly, including tapping sleeve, tapping valve, and bolts and nuts. Use sleeve and valve compatible with tapping machine.
- G. Tapping Sleeve: Cast iron or ductile iron 2-piece bolted sleeve with flanged outlet for new branch connection. Sleeve may have mechanical end joints with rubber gaskets or sealing rings in sleeve body. Use sleeve that mates with size and type pipe material being tapped. Outlet flange shall be size required for branch connection.
- H. Wells: Masonry or pre-cast construction with concrete base per Contract Documents details.

2.5 ACCESSORIES

- A. Thrust Blocking: Place 3000 psi concrete to provide sufficient bearing area to transmit unbalanced thrust from bends, tees, caps, or plugs to undisturbed soil without loading undisturbed soil in excess of 2,500 psf when water main pressure is 100 psi.

MINIMUM THRUST BLOCKING BEARING AREAS

Pipe Diameter	Tees Sq. Ft	90° Bend Sq. Ft	45° Bend Sq. Ft	22½° Bend Sq. Ft	11¼° Bend Sq. Ft	5 5/8 Bend Sq. Ft	Cap/Plug Sq. Ft
3"	1.0	1.0	1.0	1.0	1.0	1.0	1.5
4"	1.0	1.0	1.0	1.0	1.0	1.0	2.0
6"	1.5	2.0	1.0	1.0	1.0	1.0	3.0
8"	2.5	3.5	1.8	1.0	1.0	1.0	4.0
10"	4.0	5.5	2.8	1.5	1.0	1.0	6.0

12"	6.0	8.0	4.0	2.0	1.5	1.0	8.5
14"	8.0	11.0	5.5	3.0	2.0	1.5	12.0
16"	10.0	14.2	7.0	4.0	3.0	2.5	15.0
18"	21.0	21.0	12.0	6.0	4.0	3.5	24.0

- B. Locked mechanical joint fittings shall be installed where vertical changes in direction are required and, if approved by Owner and governing authority, can be installed in lieu of above thrust blocking requirements.
- C. Polyethylene Encasement: Single layer of two-ply cross-laminated high-density polyethylene encasement per AWWA C105, Section 4.1.2, Type III, Class C (Black), Grade 33, tensile strength 5,000 psi minimum, elongation 100 percent, thickness nominal 0.004 inch (4 mil).
- D. Trace Wire: Magnetic detectable conductor, (#12 Copper) brightly colored plastic covering imprinted with "Water Service" in large letters.

2.6 ANCHORAGES AND THRUST RESTRAINT

- A. Clamps, Straps and Washers: ASTM A 506, steel.
- B. Rods: ASTM A 575, steel.
- C. Rod Couplings: ASTM A 197, malleable iron.
- D. Bolts: ASTM A 307, steel.
- E. Cast Iron Washers: ASTM A 126, gray iron.
- F. Thrust Blocks: 3500 PSI concrete.

2.7 CONCRETE MATERIALS

- A. Concrete: Ready mixed, ASTM C 94, 3500 psi at 28 days.
 - 1. Cement: ASTM C 150, Type II.
 - 2. Fine Aggregate: ASTM C 33, sand.
 - 3. Coarse Aggregate: ASTM C 33, Size No. 67.
 - 4. Water: Potable.
- B. Reinforcement:
 - 1. Bars: ASTM A 615, Grade 60.
 - 2. Fabric: ASTM A 185, welded wire fabric, plain. Flat sheets only.

2.8 SLEEVES

- A. Sleeve: Steel pipe, ASTM A 53, Type E or S, Grade B, or ASTM A 139, Grade B, Asphalt coated, diameter and length indicated, complete with polyethylene insulators spaced 10 feet O.C. maximum with double insulators at each end. Provide watertight flexible rubber end seal to each end.

2.9 IDENTIFICATION

- A. Plastic Underground Warning Tapes: Polyethylene plastic tape, 6 inches wide by 4 mils thick, solid blue in color with continuously printed caption in black letters "CAUTION - WATER LINE BURIED BELOW."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that building service connection and municipal utility water main size, location, and depth are as indicated on Construction Drawings.
- B. Installer must examine areas and conditions under which water systems are to be installed. Notify Owner's Representative in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 PREPARATION

- A. Ream pipe and tube ends and remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare pipe for connections to equipment with flanges or unions.
- D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.
- E. Grade trench bottom to provide a smooth, firm, stable and rock-free foundation, throughout the length of the pipe.
- F. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with bedding material shown to the indicated level.
- G. Shape bottom of trench to fit bottom of pipe. Fill unevenness with compacted bedding material. Dig bell holes at each pipe joint to relieve the bells of all loads and to ensure continuous bearing of the pipe barrel on the foundation.

3.3 TRENCHING AND BEDDING

- A. Excavate pipe trench and place bedding material in accordance with Section 31 20 00.

3.4 INSTALLATION - PIPE AND FITTINGS

- A. Maintain minimum separation of water main facilities from new or existing sanitary and storm sewer piping in accordance with all state or local codes.
- B. Install ductile iron pipe and fittings in accordance with AWWA C600.
- C. Install PVC pipe and fittings in accordance with AWWA C605.
- D. Ductile iron pipe and fittings shall be installed with polyethylene encasement around the pipe for the entire length of the project except where water main is within steel casing or is concrete encased. Install polyethylene encasement in accordance with AWWA C105, Method A.
- E. Install pipe to allow for expansion and contraction without stressing pipe or joints or as specified by pipe manufacturer.

- F. Install access fittings in accordance with local codes to permit disinfection of water system performed under this Section.
- G. Connections with Existing Pipelines: Where connections are made between new work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions with least interference with operation of existing pipeline and in compliance with local utility company.
- H. Form and place concrete for thrust blocks or other specified methods of retainage at each change of direction or end of pipe main.
- I. Place pipe to depth in accordance with Section 3120 00.
- J. Backfill trench in accordance with Section 31 20 00.
- K. Install trace wire continuous over top of non-metal pipe. Bury a minimum of 6 inches below finish grade, and above pipeline.

3.5 INSTALLATION - VALVES AND HYDRANTS

- A. Install gate valves as indicated on Construction Drawings. Support valve on concrete pads with valve stem vertical and plumb. Install valve boxes in manner that will not transmit loads, stress, or shock to valve body. Center valve box over operating nut of valve vertical and plumb. Securely fit valve box together leaving cover flush with finished surface.
- B. Install fire hydrant assemblies as indicated on Construction Drawings in vertical and plumb position with steamer / pumper nozzle pointed perpendicular to traffic where hydrant is adjacent to street, roadway, or parking lot drive or toward protected building unless otherwise directed by local authorities. Support hydrant assembly on concrete pad and firmly brace on side opposite inlet pipe against undisturbed soil and concrete blocking. Place minimum of 6-cubic feet of crushed stone or gravel around hydrant base and barrel after thrust blocking has cured at least 24 hours. Maintain vertical position of hydrant backfilling and compacting.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect distribution system with chlorine before acceptance for domestic operation. Chlorine dosage shall be not less than 50 parts per million. Flush lines before introduction of chlorinating materials and after contact period of not less than 24 hours. Flush with clean water after contact period until residual chlorine content is not greater than 1.0 part per million. Flush water discharged from water supply lines or hydrants shall not be allowed to discharge directly onto exposed soil or turf which could result in erosion of soil. If potential for erosion exists at the discharge point, measures shall be taken to prevent erosion. Open and close valves in lines being disinfected several times during contact period. After disinfection, take water sample and bacteriological test in accordance with AWWA C651. Do not place distribution system in service until approval is obtained from local governing authorities.
- B. Contractor shall provide a means of neutralizing the super-chlorinated water before releasing into the environment. This may be accomplished by either a method of de-chlorination, direct release into a detention area approved by owner, or any method acceptable to federal, state, and local codes. Direct release to open ground shall not be allowed, unless contained within an on-site detention facility with 6" permanent storage. In this case, the Contractor shall time the release to assure that no rainstorms are imminent. The intent of this condition is to allow the majority of the chlorine to evaporate into the atmosphere before a rainstorm has the opportunity to wash the residual downstream. Contractor shall not release super-chlorinated water directly

into the sanitary sewer system, private or public, nor any storm drain system not directly discharging into the detention facility.

3.7 SERVICE CONNECTIONS

- A. Provide water service connection in compliance with utility company requirements including reduced pressure backflow preventer (if required) and water meter with by-pass valves and sand strainer.

3.8 FIELD QUALITY CONTROL

- A. Test water distribution system pipe installed below grade and outside building in accordance with the following procedures and/or City of Detroit requirements as applicable:
 - 1. Perform testing of pipe materials, joints, and other materials incorporated into construction of water mains and force mains to determine leakage and water tightness. Test pressure pipeline in accordance with Section 4 of AWWA C600 and NFPA 24. In the event state or local code requires more stringent test, more stringent test shall take precedence.
 - 2. Pressure Test: After pipe has been laid, subject newly laid pipe or valve section to hydrostatic pressure of at least 1.5 times working pressure at point of testing and not less than 1.25 times working pressure at highest point along test section.
 - 3. Leakage Test: Conduct leakage test concurrently with pressure test. Leakage is defined as quantity of water that must be supplied into newly laid pipeline or valve section thereof to maintain pressure within 5 psi of specified test pressure after air in pipeline has been expelled and pipeline has been filled with water. Leakage shall not be measured by drop in pressure in test section over period of time.
 - a. Leakage test for ductile iron pipe shall not be greater than that determined by the following formula:
$$L = \frac{SD\sqrt{P}}{133,200}$$

Where: L = allowable leakage, (gallons per hour)
S = length of pipe tested, (feet)
D = nominal diameter of pipe, (inches)
P = average test pressure during test, (psig)
 - b. Leakage test for PVC pipe shall be in accordance with AWWA Standard C605.
 - 4. Visible Leakage: Repair visible leaks regardless of amount of leakage measured.
 - 5. Acceptance of Installation: If test of pipe laid in place discloses leakage greater than that specified, Contractor shall, at his own expense, locate leak and make repairs as necessary until leakage is within specified allowance. Supply water for testing at no expense to Owner.

3.9 FINAL ACCEPTANCE

- A. Connect to existing water main after hydrostatic and bacteriological test have been successfully completed and reviewed by the Municipality.

END SECTION 33 11 00

SECTION 33 30 00

SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Sanitary sewer drainage piping, fittings, accessories, cleanouts, and bedding.
 - 2. Connection of site sanitary sewer system to municipal sanitary sewer systems.

- B. Related Sections
 - 1. Section 02 00 00 - Existing Conditions - General Information/Site Construction.
 - 2. Section 31 10 00 - Site Clearing.
 - 3. Section 01 56 39 - Tree and Plant Protection.
 - 4. Section 31 20 00 - Earthmoving.
 - 5. Section 31 25 00 - Erosion and Sedimentation Controls.
 - 6. Section 33 11 00 - Water Utility Distribution Piping.
 - 7. Section 33 05 00 - Manholes and Structures.
 - 8. Section 33 40 00 - Storm Drainage Utilities.

1.2 REFERENCED STANDARDS

- A. All work under this section shall be completed in general conformance with construction plan details, all Local Municipal / County standards; and per applicable Michigan Department of Transportation's (MDOT's) standard specifications for construction, standard plans, construction manual, quality assurance procedures manual (current editions), and as specified herein.

- B. ASTM International (ASTM)
 - 1. ASTM A74 - Cast Iron Soil Pipe and Fittings
 - 2. ASTM A746 - Ductile Iron Gravity Sewer Pipe
 - 3. ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings
 - 4. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings
 - 5. ASTM C700 - Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
 - 6. ASTM D2241 - Poly (vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
 - 7. ASTM D2657 - Heat-Joining Polyolefin pipe and Fittings
 - 8. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - 9. ASTM D3035 - Polyethylene (PE) Plastic Pipe Using Flexible Elastomeric Seals
 - 10. ASTM D3139 - Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals
 - 11. ASTM D3261 - Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene Plastic Pipe and Tubing
 - 12. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 - 13. ASTM F1417 - Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.

- C. American Water Works Association (AWWA)
 - 1. AWWA C111 - Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
 - 2. AWWA C600 - Ductile-Iron Water Mains and Their Appurtenances
 - 3. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In, For Water Distribution
 - 4. AWWA C901 - Polyethylene (PE) Pressure Pipe, Tubing and Fittings 1/2 Inch Through 3 Inches, For Water Distribution

5. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 Inch Through 63 Inch, For Water Distribution

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Firm with at least three years of successful installation experience on projects with sanitary sewer work similar to that required for project.
- B. Codes and Standards:
 1. Plumbing and Compliance: Comply with applicable portions of National Standard Plumbing Code pertaining to selection and installation of sanitary sewer materials and products.
 2. Comply with standards and requirements of municipality and other agencies having jurisdiction. The Municipality's standard sanitary sewer details and specifications are referenced and included as part of the Contract Documents. If a discrepancy occurs between these details and specifications notify Architect / Engineer of all such conditions prior to commencing work or ordering materials.
- C. Obtain and pay required fees, assessments and other costs for permits, inspections, and testing required by authorities having jurisdiction.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate reference to Construction Drawings for all sanitary sewer / combined / storm sewer structure, clean out, bend locations and elevations for piping with sizes, location, and elevations of any penetrations. Submit to Engineer for review and approval a minimum of four (4) weeks prior to installation date.
- B. Product Data: Provide data of pipe materials, pipe fittings, and accessories per construction plan details and/or as specified herein. Manufacturer's Certificate: Certify that products meet or exceed specified or local requirements.
- C. Project Record Documents:
 1. Accurately record actual locations of pipe runs, connections, cleanouts, and invert elevations.
 2. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 PROJECT CONDITIONS

- A. Coordinate work with termination of sanitary sewer connection outside building and connection to municipal sewer utility service.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Comply with construction plan details, all Local Municipal standards / County standards and/or requirements. The municipal and/or county standard sanitary sewer details sheets and/or detailed specifications are referenced and considered part of the Contract Documents. If any discrepancy occurs between these standard details and these specifications – Notify Project Architect / Engineer of such conditions prior to commencing work or ordering material.

2.2 SEWER PIPE, FITTINGS, AND JOINTS

- A. PVC (Polyvinyl Chloride) Sewer Pipe and Fittings: ASTM D 3034, SDR 23.5, for solvent cement or elastomeric gasket joints.
 - 1. Solvent Cement: ASTM D 2564
 - 2. Gaskets: ASTM F 477, elastomeric seal
 - 3. Sizes: 15 inches and smaller

- B. PVC (Polyvinyl Chloride) Sewer Pipe and Fittings: ASTM F 679, T-1 wall thickness, bell, and spigot, for elastomeric gasket joints.
 - 1. Gaskets: ASTM F 477, elastomeric seal
 - 2. Sizes: 18 to 36 inches

- C. ABS (Acrylonitrile-Butadiene-Styrene) Sewer Pipe and Fittings: ASTM D 2751, for solvent cement or elastomeric gasket joints.
 - 1. SDR 35 for 3 to 6 inches
 - 2. SDR 42 for 8 to 12 inches
 - 3. Solvent Cement: ASTM D 2235
 - 4. Gaskets: ASTM F 477, elastomeric seal
 - 5. Sizes: 12 inches and smaller

- D. Composite (Truss) Sewer Pipe: Either PVC or ABS, ASTM D 2680 composite walls separated with spacers (truss) of same material as pipe. Voids between walls filled with insulating concrete. Joint's solvent cement, Type SC, or mechanical seal, Type OR.
 - 1. Sizes: 8 inches and larger

- E. Force Main: - **NOT REQUIRED FOR THIS PROJECT**
 - 1. High-Density Polyethylene Pipe (HDPE): AWWA C901 and C906, ASTM D3035, SDR 11 for 150 psi pressure rating.
 - a. Fittings: Molded, AWWA C901 or C906.
 - b. Joints: Butt fusion, ASTM D2657, flanged gasket joints at interface
 - 2. Polyvinyl Chloride Pipe (PVC): For less than 4 inches in diameter, ASTM D2241 for push-on or solvent weld joints, and for pipe 4 inches in diameter and larger, AWWA C900, Class 150 with push-on joints.
 - a. Joints/Fittings: Push-on, ASTM D3139 with ASTM F477 gaskets.
 - b. Solvent Cement: ASTM D2564.
 - 3. Ductile Iron Pipe (DIP): ASTM A746, Class 50, inside nominal diameter as shown on the drawings, bell, and spigot end.
 - a. Ductile Iron Pipe Joint Device: AWWA C111, rubber gasket joint devices.

2.3 PIPE ACCESSORIES

- A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene-ribbed gasket for positive seal.

- B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps, etc.

2.4 CLEANOUTS AND MANHOLES

- A. Manholes shall conform to local municipal / county standard detail sheets and construction standards.

- B. Lid and Frame: Provide traffic grade and rated covers and frames where cleanouts and manholes are within pavement, with current local municipal / county standards and/or generic "SANITARY SEWER" manufactured or cast into the cover if not stated on standard details.

2.5 IDENTIFICATION

- A. Plastic Underground Warning Tapes: Polyethylene plastic tape, 6 inches wide by 4 mils thick, solid green in color with continuously printed caption in black letter "CAUTION - SEWER LINE BURIED BELOW."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which sanitary sewers are to be installed. Notify Owner's Representative in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- B. Verify that trench cut, and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on Construction Drawings.

3.2 PREPARATION

- A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation, throughout the length of the pipe.
- B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with bedding material shown to indicated level.
- C. Shape bottom of trench to fit bottom of pipe. Fill unevenness with compacted bedding material. Dig bell holes at each pipe joint to relieve the bells of all loads and to ensure continuous bearing of the pipe barrel on the foundation.
- D. Remove large stones or other hard matter that could damage pipe or impede consistent backfilling or compaction.

3.3 BEDDING

- A. Excavate trench and place bedding material in accordance with Section 02300.

3.4 INSTALLATION - PIPE

- A. Join and install PVC pipe as follows:
 - 1. Elastomeric joints in accordance with ASTM D 3212
 - 2. Solvent cement in accordance with ASTM D 2855 and ASTM F 402
 - 3. Install in accordance with ASTM D 2321
- B. Join and install ABS pipe as follows:
 - 1. Elastomeric joints in accordance with ASTM D 3212
 - 2. Solvent cement in accordance with ASTM D 2855 and ASTM F 402
 - 3. Install in accordance with ASTM D 2321
- C. Join and install Composite (Truss) pipe with elastomeric seals and install in accordance with ASTM D 2321 and manufacturer's recommendations.
- D. Join different types of pipe with standard manufactured couplings and fittings.

- E. Install type and class of pipe as shown on the drawings. Pipes shall be laid and maintained to the required line and grade with necessary fittings, bends, manhole risers, cleanouts and other appurtenances placed at the required locations. The pipe shall be installed with uniform bearing under the full length of the barrel of the pipe. The pipe shall be inspected for defects and cracks before being lowered into the trench. Defective, damaged, or unsound pipe, or pipe that has had its grade disturbed after laying shall be taken up and replaced. Commence installation at lowest point with the bell end upgrade.
- F. No pipe shall be laid in water or when trench conditions are unsuitable for work.
- G. Pipe connecting to manholes or other structures shall terminate flush inside of the structure wall.
- H. Joints for PVC and CISP shall be thoroughly lubricated with an approved lubricant before pipe sections are slipped together. Open ends shall be fully protected with a stopper to prevent earth or other material from entering the pipe during construction. Carefully free interior of the pipe from dirt, cement and other deleterious material as the work progresses.
- I. Maintain separation of potable water main from sewer piping at crossings a minimum of 10 feet horizontal and 18 inches vertical.
- J. Install HDPE piping and fittings to AWWA C901 and C906. Butt fusion welded per ASTM D3261.
- K. Route pipe in straight line parallel to roads, buildings and adjacent utilities and as shown on the drawings.
- L. Form and place concrete for thrust blocks at each elbow of pipe force main. See construction drawing for details of construction.
- M. Backfill trench in accordance with Section 02300.

3.5 INSTALLATION – CLEANOUTS AND MANHOLES

- A. General: Install manholes complete with accessories as indicated. Form continuous concrete or split pipe section channels and benches between inlets and outlet. Set tops of frames and covers flush with finish surface where manholes occur in pavements. Elsewhere, set tops 3 inches above finish surface, unless otherwise indicated.
- B. Form bottom of excavation clean and smooth to correct elevation.
- C. For cleanouts, form, and place cast-in-place concrete base pad with provision for sanitary sewer pipe to be installed to proper elevations.
- D. For manholes, construct inverts according to the following guidelines:
 - 1. Invert channel shall be smooth and accurately shaped to a semicircular bottom to match with the inside of the adjacent sewer section.
 - 2. Invert channels and structure bottoms shall be shaped with mortar and lean concrete.
 - 3. Changes in size and grade of invert shall be made gradually and evenly.
 - 4. Changes in the direction of the sewer entering branch or branches shall have a true curve of as large a radius as the manhole will permit.
- E. For manholes, provide manhole rings, frame, and cover as shown on the construction drawings.

- F. Install cleanouts and extend to grade as indicated. Set cleanout frame and cover in concrete, 18 inches by 18 inches by 12 inches deep, except in concrete pavement.
 - 1. Set top of cleanout flush in pavement.
 - 2. Set top of cleanout one inch above earth grade.

3.6 TAP CONNECTIONS

- A. Make connection to existing piping, so that finished work will conform as nearly as practicable to requirements specified for new work. Use connection as acceptable to municipality having jurisdiction.
- B. Take care while making tap connections to prevent concrete or debris from entering existing piping. Remove debris, concrete, or other extraneous material, which may accumulate.
- C. Do not disrupt service during tap; maintain continuous service so others served by system will be unaffected.

3.7 INSTALLATION OF IDENTIFICATION

- A. Install continuous plastic underground warning tape during back filling of trench for underground sanitary sewer piping. Locate 6 to 8 inches below finished grade, directly over piping.

3.8 FIELD QUALITY CONTROL

- A. Pipes and joints shall not be completely backfilled until after inspection, testing, and approval by the Owner and local jurisdiction.
- B. Prior to testing for leakage, the pipe trench shall be backfilled to at least the spring line of the pipe. If required to prevent pipe movement during testing, additional backfill shall be added leaving the pipe joints uncovered to permit inspection.
- C. Exfiltration Test
 - 1. Each section of sewer line between successive manholes shall be tested by closing the lower end of the sewer to be tested and the inlet sewer of the upper manhole, using stoppers.
 - 2. Fill the manhole and pipe with water to a point which produces a maximum of 3 feet of head above the invert of the sewer at the center of the upper manhole; or if groundwater is present, 3 feet of head above the average adjacent groundwater level.
 - 3. The allowable leakage shall be 200 gal/inch of pipe diameter/mile/day
- D. Infiltration Test
 - 1. If excessive ground water is encountered in the construction of a section of the sewer, the exfiltration test shall not be used.
 - 2. The upper and lower ends of the sewer to be tested shall be closed sufficiently to prevent the entrance of water.
 - 3. Pumping of ground water shall be discontinued for at least 3 days; then infiltration shall be tested.
 - 4. Infiltration into each section of sewer between adjoining manholes shall not exceed that allowed for the exfiltration test, except that head conditions shall be a maximum of 6 feet.
- E. The Exfiltration Test may be limited to the manholes only when the authority having jurisdiction does not require the test and the construction manager waives the test. The Infiltration Test will always be required when excessive ground water is encountered in addition to the air test.

- F. Air Test: Gravity systems shall be air tested between manholes at 3.5 psi for 5 minutes per ASTM F1417 for plastic pipes.

- G. Deflection Test:
 - 1. Deflection tests shall be conducted on all plastic pipe using a mandrel with a diameter equal to 95 percent of the inside diameter of the pipe. The test shall be performed without mechanical pulling devices.
 - 2. Allowable Deflection: Maximum allowable pipe deflection shall not exceed 5 percent of nominal inside diameter.
 - 3. Mandrel: Mandrel, go/no-go, device shall be cylindrical in shape and constructed with either 9 or 16 evenly spaced arms or prongs. Mandrels with fewer arms will be rejected as not sufficiently accurate. Contact length of mandrel's arms shall equal or exceed nominal inside diameter of sewer to be inspected. Critical mandrel dimensions shall carry tolerance of 0.01-inch maximum. Contractor shall provide mandrel and necessary equipment for mandrel test.
 - 4. Procedure: Mandrel shall be hand-pulled through flexible pipe sewer lines no earlier than 30 days after trench has been completely backfilled. Sections of sewer not passing mandrel shall be uncovered and re-bedded, re-rounded, or replaced to satisfaction of Owner or governing agency. Repaired section shall be retested.

- H. Hydrostatic Test: Force main piping shall be hydrostatically tested at 150 psi in accordance with AWWA C 600.

- I. Provide measuring devices, meters, water, materials, and labor for making the required tests.

- J. Tests shall be conducted in the presence of the Construction Manager or his designee. Test data shall be submitted to the Engineer for review and approval.

3.9 FINAL ACCEPTANCE

- A. Secure inspection of agency having jurisdiction and make appropriate corrective measures as required to obtain final acceptance.

END OF SECTION 33 30 00

SECTION 33 40 00

STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Storm sewer drainage piping, fittings, and accessories.
 - 2. Storm drainage structures.

- B. Related Requirements
 - 1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
 - 2. Section 31 10 00 - Site Clearing
 - 3. Section 01 56 39 - Tree and Plant Protection
 - 4. Section 31 20 00 - Earthmoving
 - 5. Section 31 25 00 - Erosion and Sedimentation Controls
 - 6. Section 31 37 00 - Rip-Rap Protection
 - 7. Section 33 11 00 - Water Utility Distribution Piping
 - 8. Section 33 30 00 - Sanitary Sewerage Utilities
 - 9. Section 33 05 00 - Manholes and Structures

1.2 REFERENCED STANDARDS

- A. All work under this section shall be completed in general conformance with construction plan details, all Local Municipal / County standards; or per applicable Michigan Department of Transportation's (MDOT's) standard specifications for construction, standard plans, construction manual, quality assurance procedures manual (current editions), and as specified herein.

- B. American Association of State Highway and Transportation Officials (AASHTO)
 - 1. AASHTO M190 - Bituminous Coated Corrugated Metal Culvert Pipe and Arches
 - 2. AASHTO M252 - Corrugated Polyethylene Drainage Tubing, 3 to 10 Inch Diameter
 - 3. AASHTO M294 - Corrugated Polyethylene Drainage Tubing, 12 to 60 Inch Diameter
 - 4. AASHTO M198 - Joints for Circular Sewer and Culvert Pipe Using Flexible Watertight Gaskets
 - 5. AASHTO H170 – Reinforced Concrete Culvert, Storm Drain and Sewer Pipe

- C. ASTM International (ASTM)
 - 1. ASTM A74 - Cast Iron Soil Pipe and Fittings
 - 2. ASTM A185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
 - 3. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 - 4. ASTM A746 - Ductile Iron Gravity Sewer Pipe
 - 5. ASTM A760 - Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.
 - 6. ASTM A796 - Structural Design of Corrugated Steel Pipe, Pipe-Arches, And Arches for Storm and Sanitary Sewers and Other Buried Applications.
 - 7. ASTM A798 - Factory-Made Corrugated Steel Pipe for Sewers and Other Applications.
 - 8. ASTM A929 - Steel Sheet, Metallic-Coated by The Hot-Dip Process for Corrugated Steel Pipe.
 - 9. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
 - 10. ASTM C150 - Portland Cement
 - 11. ASTM C206 - Finished Hydrated Lime
 - 12. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

13. ASTM C564 - Rubber Gasket for Cast Iron Soil Pipe and Fittings
14. ASTM C969 - Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
15. ASTM D3034 - Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings
16. ASTM D3212 - Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
17. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe
18. ASTM F949 – Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings

- D. American Concrete Institute (ACI)
1. ACI 301 - Structural Concrete for Buildings

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Firm with at least three (3) years of successful installation experience on projects with storm sewer work similar to that required for project.
- B. Codes and Standards:
1. Plumbing Code Compliance: Comply with all applicable portions of National Plumbing Standard Plumbing Code pertaining to selection and installation of storm sewer materials and products.
 2. Comply with standards and requirements of Municipality and other agencies having jurisdiction. The current City of Detroit standard storm sewer details and specifications are referenced and included as part of the Contract Documents. If a discrepancy occurs between these details and specifications notify Architect / Engineer of all such conditions prior to commencing work or ordering materials.
- C. Contractor to obtain and pay required fees, assessments, and other cost for permits, inspections, and testing required by authorities having jurisdiction.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate reference to Construction Drawings for all storm manholes, drainage structures, catch basin, inlet structure locations, elevations piping with sizes, locations, and elevations of penetrations. Submit to Engineer for review and approval a minimum of four (4) weeks prior to installation date.
- B. Product Data: Provide data on pipe materials, pipe fittings, and accessories. Manufacturer's Certificate: Certify that products meet or exceed specified local requirements.
- C. Project Record Documents:
1. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.
 2. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 PROJECT CONDITIONS

- A. Coordinate work with termination of storm sewer connection outside building including connection to municipal storm sewer system.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. General: Provide pipe materials, weight/class and other characteristics as indicated on construction plans with compatible fittings and accessories of same material and weight/class as pipe, with joining method specified.
- B. Reinforced Concrete Sewer Pipe and Fittings: ASTM C 76, Class IV, Wall B, for rubber gaskets.
 - 1. Rubber Gaskets: ASTM C 443, rubber
 - 2. Sizes: 12 inches and larger
- C. PVC (Polyvinyl Chloride) Sewer Pipe and Fittings: ASTM D 3034, SDR 23.5, for solvent cement or elastomeric gasket joints.
 - 1. Solvent Cement: ASTM D 2564
 - 2. Gaskets: ASTM F 477, elastomeric seal
 - 3. Sizes: 15 inches and smaller
- D. PVC (Polyvinyl Chloride) Sewer Pipe and Fittings: ASTM F 679, T-1 wall thickness, bell, and spigot, for elastomeric gasket joints.
 - 1. Gaskets: ASTM F 477, elastomeric seal
 - 2. Sizes: 18 to 36 inches
- E. Composite (Truss) Sewer Pipe: Either PVC or ABS, ASTM D 2680 composite walls separated with spacers (truss) of same material as pipe. Voids between walls filled with insulating concrete. Joint's solvent cement, Type SC, or mechanical seal, Type OR.
 - 1. Sizes: 8 inches and larger
- F. Bar Screens: Circular steel plate frame of outside diameter to suit inside diameter of pipe, with 1/2-inch diameter bars at 6 inches O.C. each way.

2.2 UNDERDRAINAGE PIPE AND FITTINGS

- A. General: Furnish drainage pipe complete with bends, reducers, adapters, couplings, collars, and joint materials.
- B. Non-Perforated Polyvinyl Chloride (PVC) Pipe and Fittings: ASTM D 3034, SDR 35, bell-and-spigot ends, for gasketed joints.
 - 1. Gaskets: ASTM F 477, elastomeric seal
- C. Perforated Polyvinyl Chloride (PVC) Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.
- D. Perforated Polyethylene (PE) Pipe and Fittings: AASHTO M 252 or ASTM F 405, corrugated, for coupled joints, complete with geotextile filters.
 - 1. Provide with non-woven geotextile screening sock over all tubing
 - 2. Couplings: Manufacturer's standard, band type
 - 3. Size: 4-inch diameter

2.3 DRAINAGE STRUCTURES

- A. Manholes: Conform to Section 33 05 00.
- B. Grates and Frame: Provide in accordance with details shown on Drawings.
 - 1. Provide heavy duty grates, with maximum slot width of 1-1/8"

2. Acceptable Manufacturers:
 - a. Neenah Foundry
 - b. East Jordan Iron Works

- C. Cast-In-Place concrete for drainage structures including manholes, inlets, catch basins, collars, support blocks, headwalls and paved ditches shall conform to ACI 301.
 1. Compressive Strength: 3500 psi at 28 days
 2. Reinforcement: ASTM A615, grade 40 or 60 deformed reinforcing bars, and ASTM A185 for wire fabric

- D. Cement Mortar used for paving inverts, filling lift holes, joints, patching and anchoring castings shall consist of one-part Portland cement, type I, ASTM C150, 1/4-part hydrated lime, ASTM C206 and 2-1/2 parts clean, well-graded sand and water free of suspended matter, alkali, and containing no industrial or domestic waste.

2.4 IDENTIFICATION

- A. Plastic Underground Warning Tapes: Polyethylene plastic tape, 6 inches wide by 4 mils thick, solid green in color with continuously printed caption in black letter "CAUTION - SEWER LINE BURIED BELOW."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Installer must examine areas and conditions under which storm sewers are to be installed. Notify Engineer / Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

- B. Verify that trench cut, and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Grade trench bottom to provide a smooth, firm, stable and rock-free foundation, throughout the length of the pipe.

- B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with bedding material shown to the indicated level.

- C. Shape bottom of trench to fit bottom of pipe. Fill unevenness with compacted bedding material. Ensure continuous bearing of the pipe barrel on the foundation.

- D. Remove large stones or other hard matter that could damage piping or impede consistent backfilling or compaction.

- E. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.3 INSTALLATION - PIPE

- A. Join concrete pipe and fittings with rubber gaskets in accordance with ASTM C 443 and install piping in accordance with applicable provisions of ACPA "Concrete Pipe Installation Manual".
- B. Join and install PVC pipe as follows:
 - 1. Elastomeric joints in accordance with ASTM D 3212
 - 2. Solvent cement in accordance with ASTM D 2855 and ASTM F 402
 - 3. Install in accordance with ASTM D 2321
- C. Join and install Composite (Truss) pipe with elastomeric seals and install in accordance with ASTM D 2321 and manufacturer's recommendations.
- D. Join different types of pipe with standard manufactured couplings and fittings.
- E. The pipe shall be inspected for defects and cracks before being lowered into the trench, piece by piece. Any defective, damaged, or unsound pipe or any pipe that has had its grade disturbed after laying shall be taken up and replaced. Open ends shall be protected with a stopper to prevent earth or other material from entering the pipe during construction. The interior of the pipe shall be free from dirt, excess water and other foreign materials as the pipe laying progresses and left clean at the completion of the installation.
- F. Excavate pipe trench and place bedding material in accordance with Section 02300.
- G. Install pipe in accordance with manufacturer's written recommendations.
- H. Installation shall commence at the lowest point for each segment of the route. RCP shall be laid with the groove or bell end upstream. Riveted CSP shall be placed with the inside circumferential laps pointing downstream. Repair damaged bituminous coating on CSP by applying bituminous material conforming to AASHTO M190.
- I. Lay pipe to the required line and slope gradients with the necessary fittings, bends, manhole, risers, and other appurtenances placed at the required location as noted on Drawings.
- J. Do not displace or damage pipe when compacting.
- K. No pipe shall be laid in water or when trench conditions are unsuitable for such work.
- L. Joints:
 - 1. Joints shall be constructed as described herein and in accordance with manufacturer's installation instructions for soil-tight joints.
 - 2. For RCP, the joint surface shall be cleaned and washed with water, if necessary, before the joints are made. For tongue and groove joints in smaller sizes, make joints butting the inside of the bell with a cement mortar before joining. The inside joint shall be wiped clean of excess mortar by brush, or a squeegee drawn through the pipe as the laying operations progress. In the larger diameters, which permit the entry of a man, annular space between pipe sections shall be completely filled with mortar and finished off smooth with the inside surface of the pipe.
 - 3. PVC fittings shall be attached to the pipe by solvent welding according to the manufacturer's recommendations.

3.4 INSTALLATION – MANHOLES, CATCH BASINS, INLETS, AND JUNCTION BOXES

- A. Drainage structures shall be constructed in accordance with details shown on Drawings and in accordance with Section 33 05 00 as applicable.

- B. Precast Sections:
 - 1. Precast section with bases shall be installed in accordance with Section 02300 and 02536 or as shown on drawings.
 - 2. Pipe openings shall be aligned to that of the pipe entering and leaving the manhole, etc. Pipe shall be properly aligned with connections to manholes, etc. as shown on the drawings.

- C. Invert channels shall be smooth and accurately shaped to a semicircular bottom conforming to the inside of the adjacent sewer section. Invert channels and structure bottoms shall be shaped with cement mortar. Changes in size and grade of invert shall be made gradually and evenly. Changes in direction of the sewer entering branch or branches shall have a true curve of as large a radius as the manhole will permit.

- D. Frames and Covers:
 - 1. Frames and covers shall be set to the proper elevation. The frames shall be firmly embedded in mortar approximately 1 inch thick and aligned to fit the top section of the structure.
 - 2. Bricks set in mortar used to adjust the frame to finished grade shall be limited to no more than four courses.
 - 3. Adjustment rings used to make adjustments in grade shall be made with the initial ring embedded in mortar and the exterior of the rings parged with mortar not less than 1/2 inch thick. No adjustment made in this manner shall exceed 8 inches.

- E. Concrete cradles shall be constructed as shown on the drawings and as needed when crossing over and under sewer pipe or utility lines. Concrete shall be 3,000 psi mix with a minimum thickness of 6 inches.

3.5 SUBDRAINS

- A. Sub-drains and/or under-drains shall be installed in accordance with the details and at the locations shown on the drawings

3.6 TAP CONNECTIONS

- A. Make connection to existing piping, so that finished work will conform as nearly as practicable to requirements specified for new work. Use connection as acceptable to agencies having jurisdiction.

- B. Take care while making tap connections to prevent concrete or debris from entering existing piping. Remove debris, concrete or other extraneous material that may accumulate.

- C. Do not disrupt service during tap; maintain continuous service so others served by system will be unaffected.

3.7 INSTALLATION OF IDENTIFICATION

- A. Install continuous plastic underground warning tape during back filling of trench for underground storm sewer piping. Locate 6 to 8 inches below finished grade, directly over piping.

3.8 INSPECTION AND TESTING

- A. General:

1. Storm sewer systems and culverts, upon completion or at such time as directed, shall be cleaned, inspected, and tested. The system or culvert shall have a true grade and line. Actual elevations shall be within 0.08 feet of the elevations given on the drawings.
 2. After completion of the Work, or any part thereof, the job shall be tested to determine that it has been installed in accordance with the drawings and specifications. In general, the Work shall prove to be in good condition, installed in accordance with the drawings and specifications and ready for use.
- B. Cleaning and Testing: Visibly inspect and remove all debris and obstructions from storm pipe. Test for infiltration and exfiltration by hydrostatic testing per ASTM C969. Manholes and pipe shall conform to ASTM C969 leakage criteria.
- C. Alignment Test: After backfilling has been placed and compacted to a depth not less than one foot above top of pipe, a visual inspection shall be made by flashing a light between manholes. Any displacement or misalignment of invert shall be corrected.

3.9 FINAL ACCEPTANCE

- A. Secure inspection of agency having jurisdiction and make appropriate corrective measures as required to obtain final acceptance.

END OF SECTION 33 40 00

SECTION 33 46 13.13

FOUNDATION DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Foundation drainage work as shown on drawings. Coordinate with structural design drawings and geotechnical report prepared by Soil Engineer for additional requirements, recommendations and/or direction for use and installation as necessary for project.
- B. Related Sections:
 - 1. Section 02 00 00 - Existing Conditions - General Information/Site Construction.
 - 2. Section 31 20 00 - Earthmoving.
 - 3. Section 33 40 00 - Storm Drainage Utilities.

1.2 REFERENCED STANDARDS

- A. All work under this section shall be completed in general conformance with construction plan details, all Local Municipal / County standards; or per applicable Michigan Department of Transportation's (MDOT) standard specifications for construction, standard plans, construction manual, quality assurance procedures manual (current editions), and as specified herein.

1.3 SUBMITTALS

- A. Certification: Submit certification by Contractor and foundation drainage system Installer that installed materials conform to specified requirements and system was successfully checked and tested prior to covering with drainage fill.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Perform foundation drainage work in compliance with applicable requirements of governing authorities having jurisdiction.

PART 2 – PRODUCTS

2.1 DRAINAGE PIPE AND FITTINGS

- A. General: Furnish drainage pipe complete with bends, reducers, adapters, couplings, collars, and joint materials.
- B. Non-Perforated Polyvinyl Chloride (PVC) Pipe and Fittings: ASTM D 3034, SDR 35, bell-and-spigot ends, for gasketed joints.
 - 1. Gaskets: ASTM F 477, elastomeric seal
- C. Perforated Polyvinyl Chloride (PVC) Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.
- D. Perforated Polyethylene (PE) Pipe and Fittings: ASTM F 405, corrugated, for coupled joints, complete with geotextile filters.
 - 1. Couplings: Manufacturer's standard, band type

2.2 SOIL MATERIALS

- A. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense composite.
- B. Drainage Fill: Pea gravel, maximum 1/2-inch size, or MDOT aggregate 6A.
- C. Drainage Fill: Uniformly graded mixture of natural or crushed gravel or crushed stone, and natural sand with 100 percent passing a 1-1/2-inch sieve, 30 to 60 percent passing a 1/2-inch sieve, and 0 to 8 percent passing a No. 4 sieve.
- D. Granular Backfill: Clean, natural, coarse bank run sand, conforming to requirements for MDOT Class II or ASTM C 33, No. 67 materials; 100% passing a 1-inch sieve and retained on a No. 8 sieve.
- E. Filtration/Separation Fabric: Manufacturer's non-woven geotextile fabric of polypropylene or polyester fibers, or a combination thereof.
 - 1. Manufacturer/Product: Provide one of the following:
 - a. Amoco Construction Fabrics; No. 4553
 - b. Mirafi, Inc.; No. 180N

PART 3 - EXECUTION

3.1 EXECUTION

- A. Examine areas and conditions under which foundation drainage is to be performed. Notify Owner's Representative in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in an acceptable manner.

3.2 INSTALLATION

- A. Under floor Drainage System: Excavate after subgrade material has been compacted but before drainage course has been placed. Provide a clear horizontal distance between pipe and trench wall on both sides not less than two times diameter of pipe and sufficient depth to allow 4 inches compacted impervious fill unless subgrade is sufficiently impervious. Place not less than 4 inches impervious fill material on subgrade compact. Grade impervious fill to required slope.
 - 1. Use non-perforated or perforated PVC pipe and fittings as indicated on drawings
- B. Foundation Drainage System: After concrete footings have been cured and forms removed, place impervious fill material on the subgrade adjacent to bottom of footing unless shown at different elevation. Place and compact impervious fill to dimensions indicated, or if not indicated, not less than 6 inches deep and 12 inches wide. Grade impervious fill to required slope.
 - 1. Use perforated pipe and fittings as indicated on drawings.
- C. Filtration/Separation Fabric: Lay fabric into excavation in direct contact with adjacent subgrade. Allow sufficient fabric to encapsulate entire drainage profile lapping not less than 6 inches at top and 12 inches at edges. After placement of final drainage fill material, wrap and lap.
- D. Drainage Fill: Place supporting layer of drainage fill over filtration/separation fabric where drainage pipe is to be laid to compacted depth of not less than 4 inches.
 - 1. After testing drain lines, place additional drainage fill material to a 4-inch depth around sides and top of drainage pipe unless greater depth shown.

- E. Laying Drainage Pipe: Lay drainage pipe solidly bedded in drainage fill material. Provide full bearing of drainage pipe sections throughout their length, to true grades and alignment, and continuous slope in direction of flow.
 - 1. Lay drainage pipe with perforations down and joints tightly closed in accordance with pipe manufacturer's recommendations. Provide collars and couplings as required.

- F. Testing Drainage Lines: Test or check lines before backfilling to assure free flow. Remove obstructions, replace damaged components, and retest system until satisfactory.

- G. Fill to Grade: Refer to Section 02300.
 - 1. Place granular fill material in trench to within 18 inches of grade.
 - 2. Place minimum 18 inches of impervious fill at grade over foundation drainage system. Slope away from building structure to minimize infiltration of surface runoff.

END OF SECTION 33 46 13.13

SECTION 33 46 16.13

SUBDRAINAGE PIPING

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Excavation, filter material sub-drains and connection to outlets.
 - 2. Complete installation of sub-drains including all related fittings, joints, and connections.

- B. Related Sections:
 - 1. Section 02 00 00 - Existing Conditions - General Information/Site Construction.
 - 2. Section 31 20 00 – Earthmoving.
 - 3. Section 32 12 17 - Porous Asphalt Paving.

1.2 REFERENCED STANDARDS

- A. All work under this section shall be completed in general conformance with construction plan details, all Local Municipality / County standards; or applicable Michigan Department of Transportation's (MDOT) standard specifications for construction, standard plans, construction manual, MDOT's quality assurance procedures manual (current editions), and as specified herein.

1.3 QUALITY ASSURANCE

- A. The Manufacturer or supplier of any of the materials incorporated in the sub-drainage system Work shall, upon request of Owner or Contractor, furnish certified evidence that all material tests and inspections have been performed and that the product has been manufactured in compliance with the applicable Specifications.

1.4 PRODUCT DELIVERY AND STORAGE

- A. Proper implements, tools and facilities shall be provided and used for unloading and distributing materials along the line of Work. Any pipe or fitting damaged in transportation or handling shall be rejected and immediately removed from the job Site.

- B. The Contractor shall be responsible for the safe storage of all material intended for the Work and shall take all necessary precautions to prevent damage to materials, equipment, and Work.

1.5 JOB CONDITIONS

- A. All required excavation and trenching Work shall be based upon unclassified soil material and the Contractor shall assume sole responsibility for the completion of this Work regardless of the nature of materials encountered during the course of the Work. Owner will not be liable for any costs whatsoever associated with, but not limited to, the presences of rock, peat, subterranean streams, or other difficult or unanticipated sub-surface phenomena.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Aggregate filter material for use in the sub-drainage system shall conform to MDOT designation 34R Aggregate as listed in Section 902.06 of the Standard Specification for Construction
- B. Filter fabric material shall be a non-woven filter fabric such as Mirafi 140N, Supac 4.5 NP or equal.
- C. Perforated sub-drain pipe shall be polyvinyl chloride (PVC) pipe conforming to ASTM 2751 or corrugated polyethylene pipe conforming to ASTM F-405. Joints for PVC pipe shall be prefabricated couplings with solvent welds. Joints for corrugated polyethylene pipe shall be push-on locking joints conforming to ASTM F-405.

PART 3 – EXECUTION

3.1 EXCAVATION

- A. Perform all excavation and trenching to dimensions and elevations indicated on Drawings and specified for the Sub-Drain System.
 - 1. Open no more trench in advance of pipe laying than is necessary to expedite Work.
 - 2. Care shall be taken not to excavate below the depths indicated on the Drawings, where excessive or unauthorized excavation takes place, the over depths shall be backfilled to the proper grade with compacted bedding material as determined by the Soils Engineer.
- B. All excavated material from trenches for Sub-Drain System is to be removed from the job Site and disposed of legally.
- C. When wet excavation is encountered, the trench shall be de-watered and kept free from water until the pipe has been laid and backfilled with Aggregate filter material.

3.2 SUBDRAINAGE SYSTEMS

- A. Sub-drainage systems shall be installed in locations and of the size indicated on the Drawings.
- B. Grade trench bottom and pipe inserts by measuring with a rod from overhead grade line, centerline batter boards or laser.
- C. Each Section of pipe shall be inspected before being lowered into the trench. Defective, damaged, or unsound pipe shall be rejected and removed from the Site.
- D. When the trench has been excavated to the required depth, the filter fabric will be placed so that it is free of wrinkles or irregularities. The aggregate filter material and pipe will then be placed as indicated in the Drawings.

3.3 OUTLETS

- A. The Sub-Drainage System shall be provided with a suitable outlet to allow the system to drain freely at all times.
- B. If outlet is to be a ditch, the invert shall be installed so that storm water runoff will not backup into this system. If this is not possible, a backflow gate shall be installed.
 - 1. The use of a suitable end section shall be installed at each ditch outlet.
- C. If outlet is to an existing storm sewer system, the storm sewer will be tapped using accepted procedures and equipment so as not to damage the storm sewer. Once the sub-drain is connected to the storm sewer, the joint shall be grouted with mortar.

END OF SECTION 33 46 16.13

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes grounding electrodes and conductors; bonding methods and materials; conduit and equipment supports, anchors and fasteners; and nameplates and wire markers including firestopping.

1.2 SYSTEM DESCRIPTION

- A. Grounding systems use metal underground pipe and driven ground rod as grounding electrodes. Grounding system connections use mechanical fasteners or exothermic welds.
- B. Select materials, sizes, and types of anchors, fasteners, and supports to carry loads of equipment and raceway, including weight of wire and cable in raceway. Anchor and fasten electrical products to building elements and finishes as follows:
 - 1. Concrete Structural Elements: Expansion anchors and preset inserts.
 - 2. Steel Structural Elements: Beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners.
 - 3. Concrete Surfaces: Self-drilling anchors and expansion anchors.
 - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Toggle bolts and hollow wall fasteners.
 - 5. Solid Masonry Walls: Expansion anchors and preset inserts.
 - 6. Sheet Metal: Sheet metal screws.
 - 7. Wood Elements: Wood screws.
- C. Identify Electrical components as follows:
 - 1. Nameplate for each electrical distribution and control equipment enclosure.
 - 2. Wire marker for each conductor at panelboard gutters, pull boxes, and outlet and junction boxes.
- D. Firestopping Materials: Comply with requirements of Section 07 84 00.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's catalog data for grounding electrodes and connections; for fastening components; and nameplates, labels, and markers.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

- A. Product Description: Copper or copper-clad steel, 1/2 inch (13 mm) diameter rod electrode, 10 feet (3000 mm) in length.

2.2 NAMEPLATES

- A. Product Description: Engraved three-layer laminated plastic nameplate, black letters on white background or embossed adhesive tape, with white letters on black background.
- B. Letter Size:
 - 1. 1/8 inch letters for identifying individual equipment and loads.
 - 2. 1/4 inch letters for identifying grouped equipment and loads.

2.3 WIRE MARKERS

- A. Product Description: Cloth tape, split sleeve, or tubing type wire markers with circuit or control wire number permanently stamped or printed.

2.4 FIRESTOPPING

- A. Firestopping Materials: Comply with requirements of Section 07 84 00.

2.5 FIRESTOPPING ACCESSORIES

- A. Installation Accessories: Comply with requirements of Section 07 84 00.

PART 3 EXECUTION

3.1 EXISTING WORK

- A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- B. Provide temporary wiring and connections to maintain existing systems in service during construction.
- C. When performing work on energized equipment or circuits, use personnel experienced and trained in similar operations.
- D. Remove, relocate, and extend existing installations to accommodate new construction.
- E. Repair adjacent construction and finishes damaged during demolition and extension work.

3.2 INSTALLATION

- A. Install rod electrodes at locations indicated.
- B. Fabricate supports from structural steel or formed steel members.
- C. Install sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- D. Install nameplate parallel to equipment lines. Secure nameplate to equipment front using screws or rivets.

3.3 INSTALLATION - FIRESTOPPING

- A. Firestopping Materials: Comply with requirements of Section 07 84 00.

END OF SECTION

SECTION 28 31 00

FIRE ALARM & SPRINKLER ALARM SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish, Install. And design new fire alarm control panel & remote annunciator panel.
- B. Fire Alarm/Smoke Alarm signaling appliances.
- C. Sprinkler alarm signaling appliances.
- D. Fire Alarm Contractor must design system and coordinate with requirements of the Fire Protection Contractor and system designed by the Fire Protection Contractor.
- E. Fire Alarm Contractor must coordinate with the Electrical Contractor.

1.2 REFERENCES

- A. NFPA 70 - National Electrical Code.
- B. NFPA 72 - Installation, Maintenance, and Use of Protective Signaling Systems.
- C. NFPA 72G - Notification Appliances for Protective Signaling Systems.
- D. NFPA 72H - Guide for Test Procedures for Protective Signaling Systems.
- E. 2009 International Fire Code (IFC)
- F. 2009 Michigan Mechanical Code (MMC).

1.3 SYSTEM DESCRIPTION

- A. Sprinkler System Supervision and Alarm: NFPA 72, manual and automatic local fire alarm system with connections to central station.
- B. A full fire alarm system in accordance with NFPA 72 is not required.
- C. Smoke Alarms are required in Use Group R-2 Sleeping Areas in accordance with NFPA 72, IFC 907.2.11.2.
- D. Sprinkler Supervision and alarms are required in accordance with NFPA 13 and the 2009 International Fire Code, Section 903.4.

1. All valves controlling the water supply for automatic sprinkler systems, temperatures, critical air pressures, and water flow switches shall be electrically supervised by a listed fire alarm control unit.
 2. Monitoring: Alarm, supervisory, and trouble signals shall be distinctly different and shall be automatically transmitted to an approved supervising station or, when approved by the fire code official, shall sound an audible signal at a constantly attended location.
 3. Alarms: Approved audible devices shall be connected to every sprinkler system. Such sprinkler water-flow alarm devices shall be activated by water-flow equivalent to the flow of a single sprinkler of the smallest orifice size installed in the system. Alarm devices shall be provided on the exterior of the building in an approved location.
- D. Single or multiple station smoke alarms shall be installed and maintained in Use Group R-2 Occupancies: on the ceiling or wall outside of each separate sleeping area in the immediate vicinity of bedrooms; and in each room used for sleeping purposes. (In accordance with IFC 907.2.11.)
- E. Fire Alarm/Sprinkler Alarm System shall be designed and constructed by the Fire Alarm/Sprinkler Alarm contractor in accordance with the referenced codes, Fire Protection system designed by the Fire Protection Contractor, and these specifications.
- F. Duct Detectors are required at in Return Air Systems with a design capacity greater than 2,000 cfm, in accordance with the 2009 Michigan Mechanical Code Section 606.2.
1. Duct smoke detectors shall be provided at each Return Air System, located in a Return Air Duct or Plenum upstream of any filters, exhaust air connections, and outdoor air connections.
 2. Upon Activation, the smoke detector shall shut down all operational capabilities of the air distribution system in accordance with listing & labeling of appliances used in the system.

1.4 SUBMITTALS

- A. Shop Drawings: Provide annunciator layout, panel locations, duct detectors, and system wiring diagram showing each device and wiring connection required.
- B. Product Data: Provide electrical characteristics and connection requirements.
- C. Test Reports: Indicate satisfactory completion of required tests and inspections.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of products.

1.5 PROJECT RECORD DOCUMENTS

- A. Record actual locations of control panel, remote annunciator panel, initiating devices, signaling appliances, and end-of-line devices.

1.6 OPERATION AND MAINTENANCE DATA

- A. Operation Data: Operating instructions.
- B. Maintenance Data: Maintenance and repair procedures.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of Project.
- B. Installer: Company specializing in installing the products specified in this section with minimum three years documented experience, and certified by State of Michigan as fire alarm installer.

1.8 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70, NFPA 13, 2009 Michigan Mechanical Code, and the 2009 International Fire Code.
- B. Furnish products listed and classified by UL, FM, or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

1.9 MAINTENANCE SERVICE

- A. Furnish service and maintenance of sprinkler alarm system for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Simplex
- B. Manufacturer must be as required by the City of Westland – Verify.

2.2 FIRE ALARM CONTROL PANEL

- A. Fire Alarm Control Panel: Modular construction with surface wall-mounted enclosure. Match existing system and tie in to existing Control Panel as required.
- B. Remote Annunciator Panel: Modular construction with fully recessed enclosure. Match existing system and tie in to Control Panel as required.
- C. Power supply: Adequate to serve control panel modules, remote annunciators, door holders, relays, and alarm signaling devices. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for 5 minutes.

- D. System Supervision: Component or power supply failure places system in trouble mode.
- E. Initiating Device Circuits: Supervised zone module with alarm and trouble indication; occurrence of single ground or open condition places circuit in trouble mode but does not disable that circuit from initiating an alarm.
- F. Indicating Appliance Circuits: Supervised march time signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode but does not disable that circuit from signaling an alarm.
- G. Remote Station Signal Transmitter: Electrically supervised digital alarm communicator transmitter, capable of transmitting alarm and trouble signals over telephone lines to central station receiver.
- H. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts for each detection zone to provide accessory functions specified.
- I. Provide TROUBLE ACKNOWLEDGE, DRILL, and ALARM SILENCE switch.
- J. Trouble Sequence of Operation: System or circuit trouble places system in trouble mode, which causes the following system operations:
 - 1. Visual and audible trouble alarm indicated by zone at fire alarm control panel.
 - 2. Visual and audible trouble alarm indicated at remote annunciator panel.
 - 3. Trouble signal transmitted to central station.
 - 4. Manual acknowledge function at fire alarm control panel silences audible trouble alarm; visual alarm is displayed until initiating failure or circuit trouble is cleared.
- K. Alarm Sequence of Operation: Actuation of initiating device places circuit in alarm mode, which causes the following system operations:
 - 1. Sound and display local fire alarm signaling devices with march time signal.
 - 2. Transmit zone-coded signal to central station.
 - 3. Indicate location of alarm zone on fire alarm control panel and on remote annunciator panel.
- L. Alarm Reset: System remains in alarm mode until manually reset with key-accessible reset function; system resets only if initiating circuits are out of alarm mode.
- M. Lamp Test: Manual lamp test function causes alarm indication at each zone at fire alarm control panel and at annunciator panel.
- N. Drill Sequence of Operation: Manual drill function causes alarm mode operation as described above.
- O. Zoning: As indicated.

2.4 SIGNALING APPLIANCES

- A. Alarm Bells: NFPA 72G, electric vibrating, 8 inch bell with operating mechanism behind dome. Sound Rating: 81 dB at 10 feet . Provide integral strobe lamp and flasher

with red lettered "FIRE" on white lens. Location on exterior wall by Fire Department connection.

- B. Alarm Lights: NFPA 72G, strobe lamp and flasher with red lettered "FIRE" on white lens.
- C. Alarm Horn: NFPA 72G, surface type fire alarm horn. Sound Rating: 87 dB at 10 feet . Provide integral strobelamp and flasher with red lettered "FIRE" on white lens.
- D. Remote Annunciator: Provide supervised remote annunciator including audible and visual indication of fire alarm by zone, and audible and visual indication of system trouble. Install in fully recessed enclosure.

2.5 FIRE ALARM WIRE AND CABLE

- A. Fire Alarm Power Branch Circuits: Building wire as specified in NFPA 70.
- B. Initiating Device and Indicating Appliance Circuits: Building wire as specified in NFPA 70. Power limited fire-protective signaling cable classified for fire and smoke characteristics, copper conductor, 300 volts insulation rated 105 degrees C, suitable for use in air handling ducts, hollow spaces used as ducts, and plenums.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Use 16 AWG minimum size conductors for fire alarm detection and signal circuit conductors. Install wiring in conduit.
- C. Mount end-of-line device in box with last device or separate box adjacent to last device in circuit.
- D. Make conduit and wiring connections to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels.

3.2 FIELD QUALITY CONTROL

- A. Test in accordance with NFPA 72H and local fire department requirements.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems.
- B. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

3.4 FIRE ALARM WIRE AND CABLE COLOR CODE

- A. Provide fire alarm circuit conductors with insulation color coded as follows, or using colored tape at each conductor termination and in each junction box.
- B. Power Branch Circuit Conductors: Black, red, white.
- C. Initiating Device Circuit: Black, red.
- D. Detector Power Supply: Violet, brown.
- E. Signal Device Circuit: Blue (positive), white (negative).
- F. Municipal Trip Circuit: Orange, orange.
- G. Municipal Fire Alarm Loop: Black, white.

3.5 DEMONSTRATION

- A. Provide systems demonstration.
- B. Demonstrate normal and abnormal modes of operation, and required responses to each.

END OF SECTION

SECTION 27 00 00
COMMUNICATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes arrangement with Telephone Utility Company and Internet/Cable Company for service and premises telephone and internet pathways, and premises wiring including firestopping.
- B. Project includes coordinating services with other municipal facilities during construction and installing new stand alone services for Fire Station.
- C. In general, equipment and construction shall include Rack, Patch Panels, Switches; Cables, and construction to network standards.
- D. Provide intercom and speakers as indicated on electrical drawings.

1.2 SYSTEM DESCRIPTION

- A. Service entrance from Telephone Utility Company and Internet/Cable Service Company.
- B. Telephone Utility Company: Frontier Communications to be verified with Owner.
- C. Internet/Cable Utility Company: Charter Communications or Comcast to be verified with Owner.
- D. Service Entrance Pathway: Empty raceway from point of Telephone Utility connection at overhead pole to building service terminal backboard.
- E. Backbone Pathway: Conform to EIA/TIA 569 using conduit, sleeves, and slots as indicated on Drawings.
- F. Horizontal Pathway: Conform to EIA/TIA 569, using raceway, backboards, and cabinets.
- G. Entrance Wiring: By Telephone Utility Company and Internet/Cable Company.
- H. Backbone Wiring: By Telephone Utility Company. Complete from entrance equipment to telephone backboard using backbone cables.
- I. Horizontal Wiring: By Electrical Contractor, in coordination with Owner, complete from telephone panel and cable termination to each outlet using horizontal cables.
- J. Firestopping Materials: Comply with requirements of Section 07 84 00.

1.3 SUBMITTALS

A. Product Data: Submit catalog data for each termination device, cable, and outlet device.

PART 2 PRODUCTS

2.1 TELEPHONE TERMINATION BACKBOARDS

A. Material: Plywood.

B. Size: 4 x 4 feet, As required by Utility Company at location as shown on Drawings, 3/4 inch thick.

2.2 TELEPHONE OUTLET JACKS

A. Manufacturers:

1. Pass and Seymour
2. Panduit
3. Substitutions: Permitted.

B. Product Description: Conform to EIA/TIA 568 requirements for cable connectors for specific cable types.

2.3 BACKBONE CABLE

A. Product Description: EIA/TIA 570, 100-ohm, unshielded twisted pair cable with 25 pairs, 22 AWG copper conductor. Plenum rated.

2.4 HORIZONTAL CABLE

A. Product Description: EIA/TIA 570, 100-ohm, unshielded twisted pair cable with 4 pairs, 24 AWG copper conductor. Plenum rated.

2.5 COMPUTER/INTERNET WIRING

A. Product Description: Category 5 wiring. Plenum rated.

2.6 FIRESTOPPING

A. Firestopping Materials: Comply with requirements of Section 07 84 00.

2.7 FIRESTOPPING ACCESSORIES

A. Installation Accessories: Comply with requirements of Section 07 84 00.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install pathways in accordance with EIA/TIA 569.
- B. Install wire and cable in accordance with EIA/TIA 570.
- C. Finish paint termination backboards with durable white enamel prior to installation of telephone equipment.
- D. Install termination backboards plumb, and attach securely to building wall at each corner. Install cabinet trim plumb.
- E. Install pull wire or polyethylene pulling string in each empty telephone conduit over 10 feet (3 m) in length or containing bend.
- F. All Computer/Internet wiring to be pulled to the server location.
- G. All final device connections by Owner or Owner's consultant.
- H. Provide free-standing rack for network equipment and patch panels.

3.2 INSTALLATION - FIRESTOPPING

- A. Firestopping Materials: Comply with requirements of Section 07 84 00.

END OF SECTION

SECTION 26 50 00

LIGHTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes interior luminaires, lamps, ballasts, and accessories.

1.2 SUBMITTALS

- A. Product Data: Submit dimensions, ratings, and performance data.
- B. Samples: Submit two color chips 3 x 3 inch (75 x 75 mm) in size illustrating luminaire finish color as indicated in luminaire schedule on Drawings.

PART 2 PRODUCTS

2.1 EMERGENCY LIGHTING UNITS

- A. Manufacturers: As listed in the Lighting Fixture Schedule, refer to Electrical Drawing EL-600. Alternate manufacturers shall submit a request two weeks prior to bid and include a written list of deviations from this specification to be considered for approval.
- B. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- C. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- D. Battery:
 - 1. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- F. Provide low-voltage disconnect to prevent battery damage from deep discharge.
- G. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.
- H. Where indicated, provide units with integral time delay to maintain emergency illumination for 15 minutes after restoration of normal power source.
- I. Accessories:
 - 1. Provide compatible accessory mounting brackets where indicated or required to complete installation.

2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
3. Provide compatible accessory wire guards where indicated.
4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

2.2 EXIT SIGNS

- A. Manufacturers: As listed in the Lighting Fixture Schedule, refer to Electrical Drawing EL-600. Alternate manufacturers shall submit a request two weeks prior to bid and include a written list of deviations from this specification to be considered for approval.
- B. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
 1. Number of Faces: Single- or double-face as indicated or as required for installed location.
 2. Directional Arrows: As indicated or as required for installed location.
- C. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.
 1. Self-Powered Exit Signs:
 - a. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
 - b. Battery: Sealed, maintenance-free, nickel cadmium unless otherwise indicated.
 - c. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
 - d. Provide low-voltage disconnect to prevent battery damage from deep discharge.
 - e. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

2.3 LED LUMINAIRES

- A. Manufacturers: As listed in the Lighting Fixture Schedule, refer to Electrical Drawing EL-600. Alternate manufacturers shall submit a request two weeks prior to bid and include a written list of deviations from this specification to be considered for approval.
- B. Provide products that comply with requirements of NFPA 70.
- C. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- D. Provide products listed, classified, and labeled as suitable for the purpose intended.
- E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

- F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- H. Recessed Luminaires:
 - 1. Ceiling Compatibility: Comply with NEMA LE 4.
 - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
 - 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
- I. LED Luminaires:
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. Tested in accordance with IES LM-79 and IES LM-80.
 - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.4 EMERGENCY LIGHTING UNITS

- A. Manufacturers: As listed in the Lighting Fixture Schedule, refer to Electrical Drawing EL-600. Alternate manufacturers shall submit a request two weeks prior to bid and include a written list of deviations from this specification to be considered for approval.
- B. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- C. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- D. Battery:
 - 1. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- F. Provide low-voltage disconnect to prevent battery damage from deep discharge.
- G. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.
- H. Where indicated, provide units with integral time delay to maintain emergency illumination for 15 minutes after restoration of normal power source.
- I. Accessories:
 - 1. Provide compatible accessory mounting brackets where indicated or required to complete installation.

2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
3. Provide compatible accessory wire guards where indicated.
4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

2.5 BALLASTS AND DRIVERS

A. Manufacturers:

1. General Electric Company/GE Lighting
2. Lutron Electronics Company, Inc
3. OSRAM Sylvania, Inc
4. Philips Lighting North America Corporation
5. Substitutions: See Section 016000 - Product Requirements.
6. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.
7. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. Ballasts/Drivers - General Requirements:

1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

C. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.
 - a. Wall Dimmers: See Section 262726.
 - b. Daylighting Controls: See Section 260923.

PART 3 EXECUTION

3.1 EXISTING WORK

- A. Disconnect and remove abandoned luminaires, lamps, poles, and accessories.
- B. Extend existing luminaire installations using materials and methods compatible with existing installations, or as specified.
- C. Clean and repair existing luminaires to remain or to be reinstalled.

3.2 INSTALLATION

- A. Install suspended luminaires using pendants supported from swivel hangers.

- B. Locate recessed ceiling luminaires as indicated on Electrical Drawings and reflected ceiling plan.
- C. Install surface mounted ceiling luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

3.3 ADJUSTING

- A. Aim and adjust luminaires.
- B. Relamp luminaires, lighting units, and exit signs with failed lamps at Substantial Completion.

3.4 SCHEDULES

- A. Refer to Lighting Fixture Schedule on Electrical Drawing Sheet EL-600.

END OF SECTION

SECTION 26 20 00

LOW-VOLTAGE ELECTRICAL TRANSMISSION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Enclosed switches and circuit breakers.
 - 2. Enclosed controllers and contactors.
 - 3. Panelboards and load centers.
 - 4. Fuses.

1.2 SUBMITTALS

- A. Product Data: Submit catalog data showing products with specified features.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Spare Parts
 - 1. Furnish three spare fuses of each Class, size, and rating installed.
- B. Extra Stock Materials
 - 1. Furnish two of each panelboard key.

PART 2 PRODUCTS

2.1 ENCLOSED FUSIBLE SWITCH

- A. Manufacturer List:
 - 1. Cutler-Hammer.
 - 2. General Electric.
 - 3. Hubbell Inc.
- B. Substitution Limitations:
 - 1. Substitutions permitted.
- C. Furnish materials in accordance with the 2023 National Electric Code.
- D. Description: NEMA KS 1, Type GD or HD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position.
- E. Materials:
 - 1. Fuse clips: Designed to accommodate NEMA FU 1, Class R or J fuses.
 - 2. Enclosure: NEMA KS 1, Type to meet conditions.

2.2 ENCLOSED NONFUSIBLE SWITCH

- A. Manufacturer List:
 - 1. Cutler-Hammer.
 - 2. General Electric.
 - 3. Hubbell Inc.
 - 4. Schneider Electric.
- B. Substitution Limitations:
 - 1. Substitutions permitted.
- C. Furnish materials in accordance with the 2023 National Electric Code.
- D. Description: NEMA KS 1, Type GD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position.
- E. Materials:
 - 1. Enclosure: NEMA KS 1, Type to meet conditions.

2.3 MOLDED CASE CIRCUIT BREAKER

- A. Furnish materials in accordance with the 2023 National Electric Code.
- B. Description: Enclosed, molded-case circuit breaker conforming to UL 489.
- C. Materials:
 - 1. Enclosure: UL 489, Type to meet conditions.

2.4 MANUAL MOTOR CONTROLLER

- A. Furnish materials in accordance with the 2023 National Electric Code.
- B. Description: NEMA ICS 2, AC general-purpose, Class A, manually operated, full-voltage controller with overload element, red pilot light, and push button operator.
- C. Materials:
 - 1. Enclosure: NEMA ICS 6, Type to meet conditions of installation.

2.5 FRACTIONAL-HORSEPOWER MANUAL MOTOR CONTROLLER

- A. Manufacturer List:
- B. Furnish materials in accordance with the 2023 National Electric Code.
- C. Description: NEMA ICS 2, AC general-purpose, Class A, manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light, and toggle operator.

- D. Materials:
 - 1. Enclosure: NEMA ICS 6, Type to meet conditions of installation.

2.6 AUTOMATIC MOTOR CONTROLLERS

- A. Furnish materials in accordance with the 2023 National Electric Code.
- B. Description: NEMA ICS 2, AC general-purpose magnetic or solid state Class A controller for induction motors rated in horsepower.
- C. Operation:
 - 1. Control Voltage: 120 volts, 60 Hertz.
- D. Materials:
 - 1. Product Options and Features:
 - a. Cover Mounted Pilot Devices: NEMA ICS 5, standard duty type.
 - b. Pilot Device Contacts: NEMA ICS 5, Form Z, rated A150.
- E. Assembly or Fabrication:
 - 1. Combination Controllers: Combine motor controllers with disconnect in common enclosure, using motor circuit protector conforming to UL 489, with integral instantaneous magnetic trip in each pole. Obtain IEC Class 2 coordinated component protection.
 - 2. Enclosure: NEMA ICS 6, Type to meet conditions of installation.

2.7 GENERAL PURPOSE CONTACTORS

- A. Furnish materials in accordance with the 2023 National Electric Code.
- B. Description: NEMA ICS 2, AC general purpose magnetic contactor.
- C. Operation:
 - 1. Coil operating voltage: 120 volts, 60 Hertz.
- D. Materials:
 - 1. Poles: To match circuit configuration and control function.
 - 2. Cover Mounted Pilot Devices: NEMA ICS 5, standard-duty type with Form Z contacts, rated A150.
- E. Assembly or Fabrication:
 - 1. Combination Contactors: Combine contactors with thermal magnetic circuit breaker conforming to UL 489, with integral thermal and instantaneous magnetic trip in each pole.
 - 2. Enclosure: NEMA ICS 6, Type to meet conditions.

2.8 LIGHTING CONTACTORS

- A. Furnish materials in accordance with the 2023 National Electric Code.
- B. Description: NEMA ICS 2, magnetic lighting contactor.
 - 1. Configuration: Electrically held or Mechanically held, 2 or 3 wire control.

- C. Operation:
 - 1. Coil operating voltage: 120 volts, 60 Hertz.
- D. Materials:
 - 1. Poles: To match circuit configuration and control function.
 - 2. Contact Rating: Match branch circuit overcurrent protection, considering derating for continuous loads.
 - 3. Cover Mounted Pilot Devices: NEMA ICS 5, standard-duty type with Form Z contacts, rated A150.
- E. Assembly or Fabrication
 - 1. Combination Contractors: Combine contractors with thermal magnetic circuit breaker conforming to UL 489, with integral thermal and instantaneous magnetic trip in each pole.
 - 2. Enclosure: NEMA ICS 6, Type to meet conditions.

2.9 DISTRIBUTION PANELBOARDS

- A. Manufacturer List:
 - 1. Cutler-Hammer.
 - 2. General Electric.
 - 3. Schneider Electric.
 - 4. Siemens.
- B. Substitution Limitations:
 - 1. Substitutions permitted.
- C. Furnish materials in accordance with the 2023 National Electric Code.
- D. Description: NEMA PB 1, circuit breaker type panelboard.
- E. Operation:
 - 1. Controllers:
 - a. Control Voltage: 120 volts, 60 Hertz.
 - b. Cover Mounted Pilot Devices: NEMA ICS 5, standard duty type.
 - c. Pilot Device Contacts: NEMA ICS 5, Form Z, rated A150.
- F. Materials:
 - 1. Panelboard bus: Copper.
- G. Assembly or Fabrication:
 - 1. Fusible Switch Assemblies: NEMA KS 1, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Furnish interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate NEMA FU 1, Class R or J fuses.
 - 2. Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Furnish circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
 - 3. Controllers: NEMA ICS 2, AC general-purpose Class A controller for induction motors rated in horsepower.

4. Enclosure: NEMA PB 1, Type to meet conditions.
5. Cabinet Front: Surface type, fastened with hinged door with flush lock, metal directory frame.

H. Finishes

1. Cabinet Front: Manufacturer's standard gray enamel.

2.10 BRANCH CIRCUIT PANELBOARDS

A. Manufacturer List:

1. Cutler-Hammer.
2. General Electric.
3. Schneider Electric.
4. Siemens.

B. Substitution Limitations:

1. Substitutions permitted.

C. Furnish materials in accordance with the 2023 National Electric Code.

D. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

E. Material:

1. Panelboard Bus: Copper.

F. Assembly or Fabrication

1. Molded Case Circuit Breakers: UL 489, bolt-on or plug-on type thermal magnetic trip circuit breakers, with common trip handle for poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers where scheduled. Provide UL Class 760 arc ault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers.
2. Enclosure: NEMA PB 1, Type to meet conditions.
3. Cabinet Front: Surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock keyed alike.

G. Finishes

1. Cabinet Front: Manufacturer's standard gray enamel.

2.11 FUSES

A. Manufacturer List:

1. Bussman.

B. Substitution Limitations:

1. Substitutions permitted.

C. Furnish materials in accordance with the 2023 National Electric Code.

D. Description:

1. Dimensions and Performance: NEMA FU 1, Class as specified or as indicated on Drawings.

E. Operation:

1. Voltage: Rating suitable for circuit phase-to-phase voltage.

F. Materials:

1. Main Service Switches: Class RK1 (time delay).
2. Power Load Feeder Switches: Class RK1 (time delay).
3. Motor Load Feeder Switches: Class RK1 (time delay).
4. Lighting Load Feeder Switches: Class RK1 (time delay).
5. Other Feeder Switches: Class RK1 (time delay).
6. General Purpose Branch Circuits: Class RK1 (time delay).
7. Motor Branch Circuits: Class RK1 (time delay).
8. Lighting Branch Circuits: Class G.

2.12 ACCESSORIES:

A. Automatic Motor Controllers

1. Motor Management Relay:
 - a. Manufacturer List:
 - 1) General Electric.
 - 2) Eaton Cutler-Hammer.
 - 3) Schneider Electric.
 - b. Substitution Limitations:
 - 1) Substitutions permitted.
 - c. Furnish materials in accordance with the 2023 National Electric Code.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install distribution equipment plumb.
- B. Select and install overload heater elements in motor controllers to match installed motor characteristics.
- C. Install panelboards and load centers in accordance with NEMA PB 1.1.
- D. Provide typed or neatly handwritten circuit directory for each branch circuit panelboard and load center.

3.2 ADJUSTING

- A. Adjust operating mechanisms for free mechanical movement.
- B. Torque bolted bus connections in accordance with manufacturer's instructions after placing switchgear.

C. Adjust settings in accordance as directed by Architect/Engineer.

3.3 CLEANING

A. Clean existing distribution equipment to remain or to be reinstalled.

3.4 DEMONSTRATION

A. Demonstrate operation of switches, circuit breakers, motor controllers, and contactors.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes building wire and cable, conduit and tubing, surface raceway, boxes, wiring devices, wiring connectors, and connections.

1.2 SYSTEM DESCRIPTION

- A. Wiring Products:
1. Solid conductor for feeders and branch circuits 10 AWG and smaller.
 2. Stranded conductors for control circuits.
 3. Conductor not smaller than 12 AWG for power and lighting circuits.
 4. Conductor not smaller than 14 AWG for control circuits.
 5. Increase wire size in branch circuits to limit voltage drop to a maximum of 3 percent.
- B. Wiring Methods:
1. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway, nonmetallic-sheathed cable, armored cable, or metal clad cable.
 2. Exposed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway, nonmetallic-sheathed cable, armored cable, or metal clad cable.
 3. Above Accessible Ceilings: Use only building wire, Type THHN/THWN insulation, in raceway, nonmetallic-sheathed cable, armored cable, or metal clad cable.
 4. Wet or Damp Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway, direct burial cable, armored cable, or metal clad cable.
 5. Exterior Locations: Use only building wire, Type THHN/THWN or XHHW insulation, in raceway, direct burial cable, service-entrance cable, armored cable, or metal clad cable.
 6. Underground Locations: Use only building wire, Type THHN/THWN insulation, in raceway, direct burial cable, service-entrance cable, armored cable, or metal clad cable.
- C. Conductor sizes are based on copper unless indicated as aluminum or "AL". When aluminum conductor is substituted for copper conductor, size to match circuit requirements, terminations, conductor ampacity and voltage drop.
- D. Raceway and boxes are located as indicated on Drawings, and at other locations where required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements.

E. Raceway Products:

1. Underground More than 5 Feet outside Foundation Wall: Use rigid steel conduit, thickwall nonmetallic conduit and thin-wall nonmetallic conduit. Use cast metal boxes or nonmetallic handhole.
2. Underground Within 5 Feet outside Foundation Wall: Use rigid steel conduit, thickwall nonmetallic conduit and thin-wall nonmetallic conduit. Use cast metal boxes.
3. In or Under Slab on Grade: Use rigid steel conduit, thickwall nonmetallic conduit and thin-wall nonmetallic conduit. Use cast metal boxes.
4. Outdoor Locations, Above Grade: Use rigid steel conduit and electrical metallic tubing. Use cast metal outlet, pull, and junction boxes.
5. In Slab Above Grade: Use rigid steel conduit, electrical metallic tubing, and thickwall nonmetallic conduit. Use cast metal boxes.
6. Wet and Damp Locations: Use rigid steel conduit, electrical metallic tubing, thickwall nonmetallic conduit and, nonmetallic tubing. Use cast metal or nonmetallic outlet, junction, and pull boxes. Use flush mounting outlet box in finished areas.
7. Concealed Dry Locations: Use rigid steel conduit, electrical metallic tubing, thickwall nonmetallic conduit and nonmetallic tubing. Use sheet-metal boxes. Use flush mounting outlet box in finished areas. Use hinged enclosure for large pull boxes.
8. Exposed Dry Locations: Use rigid steel conduit, electrical metallic tubing and thickwall nonmetallic conduit. Use sheet-metal boxes. Use flush mounting outlet box in finished areas. Use hinged enclosure for large pull boxes.

F. Minimum Raceway Size: 1/2 inch (13 mm) unless otherwise specified.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's catalog information for each wiring device.

1.4 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

B. Perform Work in accordance with the 2023 National Electric Code.

PART 2 PRODUCTS

2.1 SURFACE METAL RACEWAY

A. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway, with manufacturer's standard enamel finish. Furnish manufacturer's standard accessories; match finish on raceway.

2.2 SURFACE NONMETALLIC RACEWAY

- A. Description: Fiberglass channel with fitted cover, suitable for use as surface raceway, with manufacturer's standard finish. Furnish manufacturer's standard accessories, finish to match raceway.

2.3 WIREWAY

- A. Product Description: General purpose or Raintight type wireway with hinged or screw cover and manufacturer's standard enamel finish.

2.4 WALL SWITCHES

- A. Single Pole Switch:
 - 1. Cooper Wiring Device.
 - 2. Hubbell, Inc.
 - 3. Leviton Manufacturing Company.
 - 4. Substitutions: Permitted.
- B. Double Pole Switch:
 - 1. Cooper Wiring Devices.
 - 2. Hubbell, Inc.
 - 3. Leviton Manufacturing Company.
 - 4. Substitutions: Permitted.
- C. Three-way Switch:
 - 1. Cooper Wiring Devices.
 - 2. Hubbell, Inc.
 - 3. Leviton Manufacturing Company.
 - 4. Substitutions: Permitted.
- D. Color: White.

2.5 RECEPTACLES

- A. Single Convenience Receptacle:
 - 1. Cooper Wiring Devices.
 - 2. Hubbell, Inc.
 - 3. Leviton Manufacturing Company.
 - 4. Substitutions: Permitted.
- B. Duplex Convenience Receptacle:
 - 1. Cooper Wiring Devices.
 - 2. Hubbell, Inc.
 - 3. Leviton Manufacturing Company.
 - 4. Substitutions: Permitted.
- C. GFCI Receptacle:
 - 1. Cooper Wiring Devices.

2. Hubbell, Inc.
3. Leviton Manufacturing Company.
4. Substitutions: Permitted.

D. Color: White.

2.6 WALL PLATES

- A. Manufacturers:
1. Cooper Wiring Devices.
 2. Hubbell, Inc.
 3. Leviton Manufacturing Company.
 4. Substitutions: Permitted.
- B. Decorative Cover Plate: Brushed Stainless Steel.
- C. Jumbo Cover Plate: Brushed Stainless Steel.
- D. Weatherproof Cover Plate: Gasketed Stainless steel plate with hinged or threaded and gasketed device cover.

2.7 MULTIOUTLET ASSEMBLY

- A. Manufacturers:
1. Cooper Wiring Devices.
 2. Hubbell, Inc.
 3. Leviton Manufacturing Company.
 4. Substitutions: Permitted.
- B. Multioutlet Assembly: Sheet metal channel with fitted cover, with pre-wired receptacles, suitable for use as multioutlet assembly. Furnish manufacturer's standard enamel finish.
- C. Receptacles: NEMA WD 6, type 5-15R, single receptacle.
- D. Receptacle Spacing: 6 inches (150 mm) on center.
- E. Fittings: Furnish manufacturer's standard couplings, elbows, outlet and device boxes, and connectors.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Route raceway and cable to meet Project conditions.
- B. Set wall mounted boxes at elevations to accommodate mounting heights indicated.

- C. Adjust box location up to 10 feet prior to rough-in when required to accommodate intended purpose.
- D. Do not install flush mounting box back-to-back in walls; install boxes with minimum 24 inches separation.
- E. Install wall plates on flush mounted switches, receptacles, and blank outlets.

END OF SECTION

SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes wet pipe sprinkler system; Dry Pipe System in attic space above Apparatus Room #136; fire department connections; and Sprinkler System Supervision and Alarms system; including firestopping of sprinkler system components.
- B. System shall be designed and built by the fire protection contractor. Drawings and specifications are guides only to outline the performance requirements.
- C. Coordination with the Fire Alarm Contractor and Electrical Contractor is required.

1.2 SYSTEM DESCRIPTION

- A. Sprinkler System: Conform to the following criteria:
 - 1. The Turnout Gear #125, Laundry/Workroom #127, EMS Storage #135 and the Apparatus Room #136, the open Mezzanine Area and Access Passages are to be protected by a system of Automatic Sprinklers designed and installed in accordance with the requirements of NFPA - 13 for an Ordinary Hazard, Group I Classification.
 - 2. The Attic of the Apparatus Room #136 shall be protected by a Dry Pipe Fire Suppression System designed and installed in accordance with NFPA requirements.
 - 3. The Fire Protection Contractor shall be responsible for the entire system design, approval and installation and shall submit to the Architect/Engineer for record design drawings and hydraulic calculations bearing the approval of the Local Fire Authority.
 - 4. Design system to NFPA 13 - 2016 in accordance with the 2015 International Fire Code.
 - 5. System performance to achieve NFPA 13 Ordinary Hazard, Group I occupancy requirements.
 - 6. Comply with UL Standards.
- B. Firestopping Materials: Comply with requirements of Section 07 84 00 - Firestopping.
- C. Coordination with the Fire/Sprinkler Alarm system specified in Section 28 31 00 Fire Alarm & Sprinkler Alarm Systems.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate detailed, pipe layout, supports, components, accessories, sizes, and hydraulic calculations.

- B. Product Data: Submit data for pipe materials used, valves, manufacturer's catalog sheet for equipment indicating rough-in size, finish, accessories, and capacity.
- C. Manufacturer's Certificate: Certify system has been tested and meets or exceeds code requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of sprinkler heads.
- B. Operation and Maintenance Data: Submit description of components of system, servicing requirements, record drawings, inspection data, and parts lists.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with:
 - 1. Sprinkler Systems: NFPA 13 - 2016 and the 2015 International Fire Code - Chapter 9 (Fire Protection Systems).
- B. Design fire suppression system under direct supervision of Professional Engineer or NICET III certified engineering technologist experienced in design of this Work and licensed in State of Michigan.

1.6 WARRANTY

- A. Furnish one year manufacturer warranty for fire protection system.

PART 2 PRODUCTS

2.1 PIPE AND TUBE

- A. Manufacturers:
 - 1. Wheatland.
 - 2. American Tube.
 - 3. Bull Moose.
 - 4. Substitutions: Permitted.
- B. Steel Pipe: ASTM A53/A53M, Grade B, ASTM A135, or ASME B36.10M, Schedule 10 or 40 black.
 - 1. Steel Fittings: ASME B16.9, wrought steel, butt welded; ASME B16.25, butt weld ends; ASTM A234/A234M, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded.
 - 2. Cast Iron Fittings: ASME B16.1, flanges and fittings; ASME B16.4, threaded fittings.
 - 3. Malleable Iron Fittings: ASME B16.3, threaded type; ASTM A47/A47M.
 - 4. Mechanical Grooved Couplings: Malleable iron housing, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers.

- C. Steel Pipe: ASTM A135 Grade A, ULC threadable thin wall, black.
 - 1. Cast Iron Fittings: ASME B16.1, flanges and fittings; ASME B16.4, threaded fittings.
 - 2. Malleable Iron Fittings: ASME B16.3 threaded type. ASTM A47/A47M.

- D. Copper Tubing: ASTM B75 (ASTM B75M), ASTM B88 (ASTM B88M), or ASTM B251 (ASTM B251M), Type M or L drawn.
 - 1. Fittings: ASME B16.18, cast bronze, or ASME B16.22, wrought copper and bronze, solder joint, pressure type.
 - 2. Joints: AWS A5.8, silver braze. ASTM B32, Alloy Grade Sb5 tin-antimony solder.
 - 3. Mechanical Grooved Couplings: Ductile iron housing with alkyd enamel paint coating clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers.

- E. Cast Iron Pipe: AWWA C151.
 - 1. Fittings: AWWA C110, standard thickness.
 - 2. Joints: AWWA C111, rubber gasket with 3/4 inch (19 mm) diameter rods.
 - 3. Mechanical Grooved Couplings: Malleable iron housing, "C" shaped composition sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

2.2 GATE VALVES

- A. Furnish materials in accordance with NFPA 13 - 2016 and the 2015 Michigan Plumbing Code.
- B. Up to and including 2 inches (50 mm): Bronze body and trim, rising stem, hand wheel, solid wedge or disc, threaded ends.
- C. Over 2 inches (50 mm): Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, hand wheel, OS&Y, solid bronze or cast iron wedge, flanged or grooved ends.

2.3 BUTTERFLY VALVES

- A. Furnish materials in accordance with NFPA 13 - 2016 and the 2015 Michigan Plumbing Code.
- B. Bronze body, stainless steel disc, resilient replaceable seat, threaded ends, extended neck, hand wheel and gear drive and integral indicating device , and built-in tamper switch.
- C. Iron body, iron or bronze disc, EPDM seat, wafer, lug, or grooved ends, extended neck, hand wheel and gear drive, integral indicating device, and internal or external tamper switch.

2.4 CHECK VALVES

- A. Furnish materials in accordance with NFPA 13 - 2016 and the 2015 Michigan Plumbing Code.
- B. Up to and including 2 inches (50 mm): Bronze body and swing disc, rubber seat, threaded ends.
- C. Over 2 inches (50 mm): Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, grooved ends with automatic ball check.

- D. 4 inches (100 mm) and Over: Iron body, bronze disc with stainless steel spring, resilient seal and grooved or flanged ends.

2.5 DRAIN VALVES

- A. Furnish materials in accordance with NFPA 13 - 2016 and the 2015 Michigan Plumbing Code.
- B. Bronze compression stop with nipple and cap or plug.
- C. Brass ball valve with nipple and cap or plug.

2.6 SPRINKLERS

- A. Furnish materials in accordance with NFPA 13 - 2016 and the 2015 Michigan Plumbing Code.
- B. Suspended Ceiling Type: Semi-recessed pendant type with chrome plated finish, and matching escutcheon.
- C. Exposed Area Type: Standard upright type with brass finish.
- D. Sidewall Type: Semi-recessed horizontal sidewall type chrome plated finish with matching escutcheon.
- E. Guards: Finish to red or chrome as required.
- F. Match products in the existing Medical Center.

2.7 SPRINKLER PIPING SPECIALTIES

- A. Furnish materials in accordance with NFPA 13 - 2016 and the 2015 Michigan Plumbing Code.
- B. Wet Pipe Sprinkler Riser Valve: Check type valve with drain and pressure gauge.
- C. Electric Alarm: Electrically operated red enameled 8 inch bell with weather proof back box.
- D. Water Flow Switch: Vane type switch with two contacts.

2.8 FIRE DEPARTMENT CONNECTION

- A. Furnish materials in accordance with NFPA 13 - 2016 and the 2015 Michigan Plumbing Code.
- B. Type: Surface mounted wall type with brass finish. Threads to match Fire Department requirements.
- C. Outlets: Two-way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.
- D. Drain: 1/2 inch automatic drip, to outside or drain.

- E. Label: "Sprinkler - Fire Department Connection." (Red Aluminum Plate).

2.9 FIRESTOPPING

- A. Firestopping Materials: Comply with requirements of Section 07 84 00.
- B. Furnish materials in accordance with the 2015 Michigan Building Code and 2015 International Fire Code.
- C. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

2.10 FIRESTOPPING ACCESSORIES

- A. Installation Accessories: Comply with requirements of Section 07 84 00.

2.11 SPRINKLER SYSTEM SUPERVISION AND ALARMS (BY ELECTRICAL OR FIRE ALARM CONTRACTOR).

- A. A complete fire alarm system is required for this project. Smoke alarms are required in sleeping areas.
- B. Provide Sprinkler Alarm and supervision in accordance with the 2015 International Fire Code Section 903.4 and specification Section 28 31 00 – Fire & Sprinkler Alarm Systems.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance NFPA 13 - 2016 and the 2015 International Fire Code.
- B. Ream pipe and tube ends to full inside diameter. Remove burrs and bevel plain end ferrous pipe.
- C. Remove scale and foreign material, inside and outside, before assembly.
- D. Install sleeves where penetrating footings, floors, or walls. Seal pipe and sleeve penetration to maintain fire resistance equivalent to fire separation of footings, floors, or walls.
- E. Install pipe runs to minimize obstruction to other work. Offset around ductwork.
- F. Install piping in concealed spaces above finished ceilings.
- G. Install gate or butterfly valves for shut-off or isolating service.
- H. Install drain valves at main shut-off valves, low points of piping and apparatus.

- I. Connect system to water source ahead of domestic water connection with double check valve or reduced pressure back flow preventer assembly. Plumbing Contractor to install and test. Fire Protection Contractor to provide.
- J. Install heads to coordinate with reflected ceiling plan. Center in two directions in ceiling tiles.
- K. Protection:
 - 1. Apply temporary tape or paper cover to sprinkler heads to protect from painting.
 - 2. Protect concealed sprinkler head cover plates from painting.
 - 3. Painting Contractor to remove protection after completion of painting.
- L. Install drain piping from tank to nearest floor drain.
- M. Interface sprinkler system with building control system. (By Electrical Contractor).
- N. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of fire department wrench handle.
- O. Flush entire piping system of foreign matter.
- P. Hydrostatically test entire system. Schedule test to be witnessed by Fire Marshall, or authority having jurisdiction, and Owner's insurance underwriter.

3.2 INSTALLATION - FIRESTOPPING

- A. Firestopping Materials: Comply with requirements of Section 07 84 00.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Identification for Plumbing Piping and Equipment.
 - 2. Sleeves.
 - 3. Mechanical sleeve seals.
 - 4. Formed steel channel.
 - 5. Firestopping relating to plumbing work.
 - 6. Firestopping accessories.
 - 7. Coordination with requirements for commissioning specified in Section 01 91 00 – Commissioning.

1.2 SYSTEM DESCRIPTION

- A. Firestopping Materials: Comply with requirements of Section 07 84 00 - Firestopping.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for piping and equipment identification list of wording, symbols, letter size, and color coding for pipe identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- B. Product Data for Pipe and Equipment Identification: Submit for mechanical identification manufacturers catalog literature for each product required.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with 2015 Michigan Plumbing Code

PART 2 PRODUCTS

2.1 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

- A. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
- B. Plastic Nameplates: Laminated three-layer plastic with engraved black letters on light background color.
- C. Plastic Tags: Laminated three-layer plastic with engraved black letters on light background color, minimum 1-1/2 inches (38 mm) diameter.
- D. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener. Color and Lettering: Conform to ASME A13.1.
- E. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Color and Lettering: Conform to ASME A13.1.
- F. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.

2.2 SLEEVES

- A. Sleeves for Pipes through Non-fire Rated Floors: 18 gage (1.2 mm) thick galvanized steel.
- B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage (1.2 mm) thick galvanized steel.
- C. Sealant: Acrylic or Silicone; refer to Section 07 90 00.

2.3 MECHANICAL SLEEVE SEALS

- A. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.4 FORMED STEEL CHANNEL

- A. Manufacturers:
 - 1. Allied Tube & Conduit Corp.
 - 2. B-Line Systems
 - 3. Unistrut Corp.
 - 4. Substitutions: Permitted.
- B. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
- C. Product Description: Galvanized 12 gage (2.8 mm) thick steel. With holes 1-1/2 inches (38 mm) on center.

2.5 FIRESTOPPING

- A. Firestopping Materials: Comply with requirements of Section 07 84 00.
- B. Furnish materials in accordance with the 2015 Michigan Building Code.

2.6 FIRESTOPPING ACCESSORIES

- A. Installation Accessories: Comply with requirements of Section 07 84 00.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive sleeves.

3.2 INSTALLATION - PIPING AND EQUIPMENT IDENTIFICATION

- A. Install plastic nameplates with adhesive.
- B. Install plastic tags with corrosion resistant metal chain.

3.3 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with mechanical sleeve seals.
- B. Set sleeves in position in forms. Provide reinforcing around sleeves.
- C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- D. Extend sleeves through floors 1 inch (25 mm) above finished floor level. Caulk sleeves.

- E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing or firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- F. Install chrome plated steel escutcheons at finished surfaces.

3.4 INSTALLATION - FIRESTOPPING

- A. Firestopping Materials: Comply with requirements of Section 07 84 00.

END OF SECTION

SECTION 22 07 00
PLUMBING INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plumbing piping insulation, jackets and accessories.
 - 2. Plumbing equipment insulation, jackets and accessories.

1.2 SUBMITTALS

- A. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- B. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

- A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
- D. Perform Work in accordance with the 2015 Michigan Plumbing Code.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- B. Maintain temperature before, during, and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
 - 1. CertainTeed.
 - 2. Knauf.

3. Johns Manville.
4. Owens-Corning.
5. Substitutions: Permitted.

B. Furnish materials in accordance with the 2015 Michigan Plumbing Code.

2.2 PIPE INSULATION

- A. Glass Fiber Insulation shall be ANSI/ASTM C547; k value of 0.24 at 75⁰F; non-combustible and used on domestic hot and cold water lines, roof drains.
1. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.

2.3 PIPE INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.
- C. Piping 2 inches diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.
- D. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.
- E. Adhesives: Compatible with insulation.

2.4 EQUIPMENT INSULATION

- A. Flexible Mineral Fiber blanket shall be ASTM C553; k value of 0.24 at 75⁰F; 2.0 lb/cu ft density and used on air separators. The thickness shall be not less than 1".
- B. Rigid Mineral Fiber board shall be ASTM C612; k value of 0.24 at 75⁰F; 6.0 lb/cu ft density and used on domestic hot water storage tanks. The thickness shall be not less than 1 1/2".
- C. Cellular glass shall be ASTM C552; k value of 0.35 at 75⁰F; 8.0 lb/cu ft density.

2.5 EQUIPMENT INSULATION JACKETS

- A. PVC Plastic Equipment Jacket:
1. Product Description: ASTM D1785, sheet material, off-white color.
 2. Service Temperature Range: -40⁰F to 150⁰F.
 3. Water Vapor Transmission: ASTM E96/E96M; 0.002 perm-inches.
 4. Thickness: 10 mil (0.25 mm).
 5. Connections: Pressure sensitive color matching vinyl tape.
- B. Vapor Retarder Jacket:
1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
 2. Water vapor transmission: ASTM E96/E96M; 0.02 perm-inches.

2.6 EQUIPMENT INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Adhesives: Compatible with insulation.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify piping and equipment has been tested before applying insulation materials.
- B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

- A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
- B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07 84 00 for penetrations of assemblies with fire resistance rating greater than one hour.
- C. Piping Systems Conveying Fluids Below Ambient Temperature:
 - 1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
 - 2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 - 3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.
- D. Glass Fiber Board Insulation:
 - 1. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
 - 2. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
 - 3. Cover wire mesh or bands with cement to a thickness to remove surface irregularities.
- E. Hot Piping Systems less than 140⁰F:
 - 1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
 - 3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.
- F. Inserts and Shields:
 - 1. Piping 1-1/2 inches diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
 - 2. Piping 2 inches diameter and Larger: Install insert between support shield and piping and under finish jacket.
 - a. Insert Configuration: Minimum 6 inches (150 mm) long, of thickness and contour matching adjoining insulation; may be factory fabricated.
 - b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.

- 3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.
- G. Insulation Terminating Points:
 - 1. Condensate Piping: Insulate entire piping system and components to prevent condensation.
- H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

3.3 INSTALLATION - EQUIPMENT

- A. Factory Insulated Equipment: Do not insulate.
- B. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
- C. Equipment Containing Fluids Below Ambient Temperature:
 - 1. Insulate entire equipment surfaces.
 - 2. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
 - 3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 - 4. Finish insulation at supports, protrusions, and interruptions.
- D. Equipment Containing Fluids 140°F or less:
 - 1. Do not insulate flanges and unions, but bevel and seal ends of insulation.
 - 2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
 - 3. Finish insulation at supports, protrusions, and interruptions.
- E. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.
- F. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

3.4 SCHEDULES

- A. Water Supply Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches (mm)
Domestic Hot Water Supply and Recirculation	P-1	1-1/4 inches (32 mm) and smaller	0.5 (13)
		1-1/2 inches (40 mm) and larger	1.0 (25)

Domestic Cold Water	P-1	1-1/4 inches (32 mm) and smaller	0.5 (13)
		1-1/2 inches (40 mm) and larger	1.0 (25)

B. Drainage Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches (mm)
Sanitary Sewer Piping (horizontal and vertical above ground within building when PVC piping is used)	P-1	All sizes	0.5 (13)

C. Equipment Insulation Schedule:

EQUIPMENT	INSULATION TYPE	INSULATION THICKNESS inches (mm)
Domestic Hot Water Storage Tanks	E-1	1.5 (40)

END OF SECTION

SECTION 22 10 00
PLUMBING PIPING AND PUMPS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe hangers and supports.
 - 2. Pipe and pipe fittings.
 - 3. Valves.
 - 4. Piping specialties.
 - 5. Plumbing drainage specialties.
 - 6. Plumbing supply specialties.
 - 7. Pumps.
 - 8. Coordination with requirements for commissioning as specified in Section 01 91 00 – Commissioning.

1.2 SUBMITTALS

- A. Product Data:
 - 1. Pipe Hangers and Supports: Submit manufacturers catalog data including load carrying capacity.
 - 2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
 - 3. Plumbing drainage specialties: Submit manufacturers catalog information with sizes, capacities, rough-in requirements, service sizes, and finishes.
 - 4. Plumbing supply specialties: Submit manufacturers catalog information with sizes, capacities, rough-in requirements, service sizes, and finishes.
 - 5. Pumps: Include capacities, pump curves, equipment performance, and electrical characteristics.
- B. Pipe Hangers and Supports: Design data, indicate pipe sizes, load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- C. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit spare parts lists and maintenance procedures.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with the 2015 Michigan Plumbing Code.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. Carpenter & Paterson Inc.
 - 2. DecoShield Systems Inc.
 - 3. Globe Pipe Hanger Products Inc.
 - 4. Substitutions: Permitted.
- B. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
- C. Conform to ASME B31.9, ASTM F708, MSS SP 58, MSS SP 69, or MSS SP 89.
- D. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (13 to 38 mm): Malleable iron or Carbon steel, adjustable swivel, split ring.
- E. Hangers for Pipe Sizes 2 inches (50 mm) and Over: Carbon steel, adjustable, clevis.
- F. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- G. Wall Support for Pipe Sizes to 3 inches (75 mm): Cast iron hook.
- H. Wall Support for Pipe Sizes 4 inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
- I. Vertical Support: Steel riser clamp.
- J. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- K. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

2.2 PIPES AND TUBES

- A. Sanitary Sewer Piping, Buried Within 5 Feet (1500 Mm) of Building and Sanitary Sewer Piping, above Grade:
 - 1. PVC Pipe: ASTM D2665 or ASTM D3034 SDR 26, polyvinyl chloride (PVC) material.
 - a. Fittings: PVC, ASTM D2665 or ASTM D3034.
 - b. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- B. Water Piping, Buried Within 5 Feet (1500 Mm) of Building:
 - 1. Ductile Iron Pipe: AWWA C151 with ductile iron fittings rubber gasket joints and 3/4 inch (19 mm) diameter rods.
- C. Water Piping, above Grade:
 - 1. Copper Tubing: ASTM B88 (ASTM B88M), Type M, or L, drawn, with cast brass or wrought copper fittings and Grade 95TA solder joints.
 - 2. Galvanized Steel Pipe (Cold Water Only Sizes 4 inch (100 mm) and Larger): ASTM A53/A53M, Grade B, Schedule 40 with cast iron fittings and grooved mechanical couplings.
- D. Storm Water Piping, Buried Within 5 Feet (1500 Mm) of Building and Storm Water Piping, above Grade:
 - 1. PVC Pipe: ASTM D2665 or ASTM D3034 SDR 26, polyvinyl chloride (PVC) material.
 - a. Fittings: PVC, ASTM D2665 or ASTM D3034.
 - b. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

- E. Equipment Drains and Overflows:
 - 1. Steel Pipe: ASTM A53/A53M, Grade B, Schedule 40 black steel, malleable iron or forged steel fittings, threaded or welded joints.
 - 2. Copper Tubing: ASTM B88 (ASTM B88M), Type M, or L, drawn, cast brass, wrought copper or mechanically extracted fittings, lead free solder joints.
 - 3. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26, PVC fittings, solvent weld joints.
- F. Flue and Combustion Air Piping:
 - 1. PVC Pipe: ASTM D1785, Schedule 40, polyvinyl chloride (PVC) material.
 - a. Fittings: ASTM D2466, Schedule 40, PVC.
 - b. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement. Prime joints with a contrasting color.
 - 2. PVC Pipe: ASTM D1785, Schedule 80, polyvinyl chloride (PVC) material.
 - a. Fittings: ASTM D2467, Schedule 80, PVC.
 - b. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement. Prime joints with a contrasting color.
 - 3. CPVC Pipe: ASTM F441/F441M, Schedule 40, chlorinated polyvinyl chloride (CPVC) material.
 - a. Fittings: ASTM F438, CPVC, Schedule 40, socket type.
 - b. Joints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement. Prime joints with a contrasting color.

2.3 VALVES

- A. Manufacturers:
 - 1. American Valve.
 - 2. Red-White Valve Corp.
 - 3. Substitutions: Permitted.
- B. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
- C. For drinking water service, provide valves complying with NSF 61.
- D. Gate Valves:
 - 1. Up to 2 inches (50 mm): Bronze body, bronze trim, non-rising stem, hand wheel, inside screw, double wedge disc, soldered or threaded.
 - 2. Over 2 inches (50 mm): Iron body, bronze trim, rising stem, hand wheel, OS&Y, solid wedge, flanged or grooved ends.
- E. Ball Valves:
 - 1. Up to 2 inches (50 mm): Bronze or stainless-steel, one-piece body, chrome plated brass ball, Teflon seats and stuffing box ring, lever handle, solder or threaded ends.
 - 2. Over 2 inches (50 mm): Cast steel flanged body, chrome plated steel ball, Teflon seat and stuffing box seals and lever handle.
- F. Plug Valves:
 - 1. Up to 2 inches (50 mm): Bronze body, bronze tapered plug, non-lubricated, Teflon packing, threaded ends.
 - 2. Over 2 inches (50 mm): Cast iron body and plug, pressure lubricated, Teflon packing, flanged ends.
- G. Butterfly Valves:

1. 2 inches (50 mm): Bronze body, stainless steel disc, resilient replaceable seat, threaded ends, extended neck, 10-position lever handle.
2. Over 2 inches (50 mm): Iron body, chrome plated iron disc, resilient replaceable seat, wafer or lug ends, extended neck, 10 position lever handle.

H. Swing Check Valves:

1. Up to 2 inches (50 mm): Bronze body and swing disc, solder or threaded ends.
2. Over 2 inches (50 mm): Iron body, bronze trim, swing disc, renewable disc and seat, flanged ends.

I. Spring Loaded Check Valves:

1. Iron body, bronze trim with threaded, wafer or flanged ends and stainless steel spring with renewable composition disc.

J. Relief Valves:

1. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

2.4 PIPING SPECIALTIES

A. Flanges, Unions, and Couplings:

1. Pipe Size 2 inches (50 mm) and Under: Malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.
2. Pipe Size Over 2 inches (50 mm): Forged steel flanges for ferrous piping; bronze flanges for copper piping; preformed neoprene gaskets.
3. Grooved and Shouldered Pipe End Couplings: Malleable iron housing, C-shape elastomer composition sealing gasket, steel bolts, nuts, and washers.
4. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Strainers:

1. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
2. Size 2 inches (50 mm) and Under: Threaded brass or iron body for 175 psig (1,200 kPa) working pressure, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.
3. Size 2-1/2 inch (65 mm) to 4 inch (100 mm): Flanged iron body for 175 psig (1,200 kPa) working pressure, Y pattern with 3/64 inch (1.2 mm) stainless steel perforated screen.
4. Size 5 inch (125 mm) and Larger: Flanged iron body for 175 psig (1,200 kPa) working pressure, basket pattern with 1/8 inch (3.2 mm) stainless steel perforated screen.

C. Flexible Connectors:

1. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
2. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches (230 mm) long with copper tube ends; for maximum working pressure 500.

2.5 PLUMBING DRAINAGE SPECIALTIES

A. Floor Drains:

1. Manufacturers:
 - a. Watts FD-100-A and FD-100-L.
 - b. Zurn
 - c. Substitutions: Permitted.

2. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
3. Floor Drain (FD-1): Epoxy coated cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

B. Cleanouts:

1. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
2. Finished Floor: Lacquered cast iron body with anchor flange, reversible clamping collar, and adjustable nickel-bronze round scored cover in service areas and round depressed cover to accept floor finish in finished floor areas.
3. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

2.6 PLUMBING SUPPLY SPECIALTIES

A. Backflow Preventers:

1. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
2. Reduced Pressure Backflow Preventers: ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; pressure relief valve located between check valves; third check valve opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.
3. Double Check Valve Assemblies: ASSE 1015 or AWWA C510; bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

B. Water Hammer Arrestors:

1. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
2. Stainless steel construction, bellows or Copper construction, piston type To PDI WH 201, pre-charged suitable for operation in temperature range -100 to 300 degrees F (-73 to 149 degrees C) and maximum 250 psi (1700 kPa) working pressure.

C. Thermostatic Mixing Valves:

1. Manufacturers:
 - a. Delta: R2300-MIX
 - b. Substitutions: Permitted.
2. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
3. With check valve, volume control shut-off valve on outlet, stem type thermometer on outlet, strainer stop check on inlet, mounted in lockable cabinet of 16 gage (1.5 mm) prime coated steel.
4. Conform to ASSE 1070 to temper water to maximum 110 degrees F (43 degrees C).

D. Hose Bibbs/Hydrants:

1. Manufacturers:
 - a. Woodford Model B67
 - b. Substitutions: Permitted.
2. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
3. Wall Hydrant: Non-freeze, self-draining type with chrome plated, lockable recessed box, hose thread spout, removable key, and vacuum breaker.

2.7 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:

1. Taco In-Line Circulator
 2. Substitutions: Permitted.
- B. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
- C. Construction: Bronze casing, bronze impeller, alloy steel shaft with integral thrust collar and two oil-lubricated bronze-sleeve bearings and mechanical seal.
- 2.8 ELECTRICAL CHARACTERISTICS AND COMPONENTS
- A. Electrical characteristics.
1. 120 volts, single phase, 60 Hz.
- B. Disconnect Switch: Factory mount in control panel.
- 2.9 MOTORS
- A. Furnish materials in accordance with the 2015 National Electric Code.
- B. Motor Type: NEMA MG 1.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavate.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside piping before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION - INSERTS

- A. Install inserts for placement in concrete forms.
- B. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.4 INSTALLATION - PIPING SYSTEMS

- A. Install dielectric connections wherever jointing dissimilar metals.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Route piping parallel to building structure and maintain gradient.
- D. Install piping to maintain headroom. Group piping to conserve space. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

- F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- G. Sleeve pipe passing through partitions, walls and floors.
- H. Install piping system allowing clearance for installation of insulation and access to valves and fittings.
- I. Install identification on piping systems including underground piping. Refer to Section 22 05 00.
- J. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

3.5 INSTALLATION - VALVES

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install gate, ball, or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- C. Install ball, or butterfly valves for throttling, bypass, or manual flow control services.
- D. Provide lug end butterfly valves adjacent to equipment when functioning to isolate equipment.
- E. Install spring loaded check valves on discharge of pumps.
- F. Install plug valves for throttling service. Install non-lubricated plug valves only when shut-off or isolating valves are also installed.
- G. Install 3/4 inch (20 mm) gate or ball drain valves at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest drain.

3.6 INSTALLATION - PIPING SPECIALTIES

- A. Provide drain and hose connection with valve on strainer blow down connection.
- B. Test backflow preventers in accordance with ASSE 5013.
- C. Install Work in accordance with the 2015 Michigan Plumbing Code.

3.7 INSTALLATION - PLUMBING SUPPLY PIPING

- A. Install water piping in accordance with ASME B31.9.
- B. Excavate and backfill in accordance with Section 31 20 00.
- C. Establish elevations of buried piping outside the building to obtain not less than 5 ft of cover.
- D. Provide support for utility meters in accordance with requirements of utility companies.
- E. Slope water piping and arrange to drain at low points.
- F. Install piping from relief valves, back-flow preventers and drains to nearest floor drain.
- G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatories and sinks.
- H. Provide water service complete with approved reduced pressure or double check back-flow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.
- I. Install flow controls in water circulating systems as indicated on Drawings.

- J. Disinfecting of Domestic Water Systems:
 - 1. Prior to starting, verify system is complete, flushed and clean.
 - 2. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
 - 3. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.
 - 4. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.
 - 5. Maintain disinfectant in system for 24 hours.
 - 6. When final disinfectant residual tests less than 25 mg/L, repeat treatment.
 - 7. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.
 - 8. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.
- K. Install Work in accordance with the 2015 Michigan Plumbing Code.

3.8 INSTALLATION - PLUMBING DRAINAGE PIPING

- A. Install bell and spigot pipe with bell end upstream.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Install with clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Establish elevations of buried piping outside building to provide not less than 4 ft of cover.
- F. Install piping penetrating roofed areas to maintain integrity of roof assembly.
- G. Excavate and backfill in accordance with Section 31 20 00.
- H. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Maintain gradients.
- I. Test drainage piping in accordance with local code requirements.
- J. Install Work in accordance with the 2015 Michigan Plumbing Code.

3.9 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as scheduled.
- B. Install hangers with minimum 1/2 inch (13 mm) space between finished covering and adjacent work.
- C. Place hangers within 12 inches (300 mm) of each horizontal elbow.
- D. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment.
- E. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- F. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- G. Support riser piping independently of connected horizontal piping.
- H. Provide copper plated hangers and supports for copper piping.

- I. Design hangers for pipe movement without disengagement of supported pipe.
- J. Prime coat exposed steel hangers and supports. Refer to Section 09 90 00. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.10 INSTALLATION - PUMPS

- A. Install line size shut-off valve and strainer on pump suction. Install line size check valve, shut-off valve, and balancing valve on pump discharge.

3.11 SERVICE CONNECTIONS

- A. Install sanitary, storm sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and verify proper slope for drainage and proper cover to avoid freezing.

3.12 SCHEDULES

- A. Pipe Hanger Spacing:

PIPE MATERIAL	MAXIMUM HANGER SPACING Feet (m)	HANGER ROD DIAMETER Inches (mm)
Cast Iron (All Sizes)	5 (1.5)	5/8 (15)
Cast Iron (All Sizes) with 10 foot (3 m) length of pipe	10 (3)	5/8 (15)
CPVC, 1 inch (25 mm) and smaller	3 (0.9)	1/2 (13)
CPVC, 1-1/4 inches (32 mm) and larger	4 (1.2)	1/2 (13)
Copper Tube, 1-1/4 inches (32 mm) and smaller	6 (1.8)	1/2 (13)
Copper Tube, 1-1/2 inches (38 mm) and larger	10 (3)	1/2 (13)
PVC (All Sizes)	4 (1.2)	3/8 (9)
Steel, 3 inches (75 mm) and smaller	12 (3.7)	1/2 (13)
Steel, 4 inches (100 mm) and larger	12 (3.7)	5/8 (15)

END OF SECTION

SECTION 22 15 00

GENERAL SERVICE COMPRESSED-AIR SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Compressed air piping.
 - 2. Unions and flanges.
 - 3. Valves.
 - 4. Strainers.
 - 5. Pipe hangers and supports.
 - 6. Flexible connectors.
 - 7. Relief valves.
 - 8. Compressed air outlets.
 - 9. Air compressor.
 - 10. Compressed air dryer.
 - 11. Air receiver.
 - 12. Air pressure reducing valve.
 - 13. Pressure regulators.
 - 14. Compressed air filters.
 - 15. Hose connectors.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate piping system schematic with electrical and connection requirements general assembly of components, mounting and installation details, and general layout of control and alarm panels.
- B. Product Data:
 - 1. Piping: Submit data on pipe materials, fittings, and accessories.
 - 2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
 - 3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
 - 4. System Components: Submit manufacturers catalog information including capacity, component sizes, rough-in requirements, and service sizes. When applicable, include electrical characteristics and connection requirements.
 - 5. Compressors: Submit type, capacity, and performance characteristics. Include electrical characteristics and connection requirements.
- C. Product Data: Submit manufacturers catalog literature with capacity, weight, and electrical characteristics and connection requirements.
- D. Manufacturer's Installation Instructions: Submit hoisting and setting requirements, starting procedures.

- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of equipment piping, valves, outlets and components.
- B. Operation and Maintenance Data: Submit assembly views, lubrication instructions, replacement part numbers and availability.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ASME B31.1 and B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.
- B. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.
- C. Perform Work in accordance with 2015 Michigan Plumbing Code.

1.5 WARRANTY

- A. Furnish standard manufacturer warranty for pumps, compressors, refrigerated dryers and valves excluding packing.

PART 2 PRODUCTS

2.1 COMPRESSED AIR PIPING

- A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.
 - 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, forged steel welding type.
 - 2. Joints: Threaded for pipe 2 inch (50 mm) and smaller; welded for pipe 2-1/2 inches (65 mm) and larger.
- B. Copper Tubing: ASTM B88 (ASTM B88M), Type [M] [L] [K] drawn.
 - 1. Fittings: ASME B16.18 cast copper alloy or ASME B16.22, wrought copper and bronze.
- C. Copper Tubing: ASTM B88 (ASTM B88M), Type L, drawn.
 - 1. Copper Press Fittings: Conforming to ASME B16.18 cast copper alloy or ASME B16.22, wrought copper and bronze with Nitrile O-ring seals.
 - 2. Joints: Compression type made with manufacturer's tool.
- D. Copper Tubing: ASTM B88 (ASTM B88M), Type L, annealed.
 - 1. Fittings: ASME B16.26 cast bronze.
 - 2. Joints: Flared.
- E. Polyethylene Pipe: ASTM D2513, SDR 11.5.

1. Fittings: ASTM D2683 or ASTM D2513 socket type.
2. Joints: Fusion welded.

2.2 UNIONS AND FLANGES

- A. Unions for Pipe 2 inches (50 mm) and Smaller:
1. Ferrous Piping: Class 150, malleable iron, threaded.
 2. Copper Piping: Class 150, bronze unions with [soldered] [brazed joints].
 3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
 4. Stainless Steel Piping: 300 psig (2070 kPa), threaded type with compression type ends.
- B. Flanges for Pipe 2-1/2 inches (65 mm) and Larger:
1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
 2. Copper Piping: Class 150, slip-on bronze flanges.
 3. Gaskets: 1/16 inch (1.6 mm) thick preformed neoprene gaskets.

2.3 GATE VALVES

- A. Manufacturers:
1. DeZurik
 2. Substitutions: Permitted.
- B. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
- C. 2 inches (50 mm) and Smaller: MSS SP 80, Class 150, bronze body, bronze trim, threaded bonnet, non-rising stem, solid wedge disc, alloy seat rings, solder or threaded ends.

2.4 BALL VALVES

- A. Manufacturers:
1. Apollo
 2. Substitutions: Permitted.
- B. Furnish materials in accordance with 2015 Michigan Plumbing Code.
- C. 2 inches (50 mm) and Smaller: MSS SP 110, Class 150, bronze, two-piece body, type 316 stainless steel ball, full port, teflon seats, blow-out proof stem, threaded ends, lever handle.

2.5 BUTTERFLY VALVES

- A. Manufacturers:
1. DeZurik
 2. Substitutions: Permitted.
- B. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
- C. 2-1/2 inches (65 mm) and Larger: MSS SP 67, Class 150.

1. Body: Cast or ductile iron, wafer ends, stainless steel stem, extended neck.
2. Disc: Aluminum bronze.
3. Seat: Resilient replaceable Buna N.
4. Handle and Operator: 10 position lever handle. Furnish gear operators for valves 8 inches (200 mm) and larger, and chain-wheel operators for valves mounted over 8 feet (2400 mm) above floor.

2.6 CHECK VALVES

A. Horizontal Swing Check Valves:

1. Manufacturers:
 - a. DeZurik
 - b. Substitutions: Permitted.
2. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
3. 2 inches (50 mm) and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, bronze disc, threaded ends.
4. 2-1/2 inches (65 mm) and Larger: MSS SP 71, Class 125, cast iron body, bolted cap, bronze or cast iron disc, flanged ends.

2.7 STRAINERS

- A. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
- B. 2 inch (50 mm) and Smaller: Y pattern, ASTM B62 bronze body, threaded ends, Class 150, 1/16 inch (1.6 mm) stainless steel perforated screen.
- C. 2-1/2 inch (65 mm) and Larger: Y pattern, ASTM A126 cast iron body, flanged ends, Class 125, with 1/8 inch (3.2 mm) stainless steel perforated screen.

2.8 PIPE HANGERS AND SUPPORTS

A. Manufacturers:

1. Anvil
 2. Substitutions: Permitted.
- B. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
 - C. Conform to ASME B31.9.
 - D. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (13 to 38 mm): Malleable iron, adjustable swivel, split ring.
 - E. Hangers for Pipe Sizes 2 inches (50 mm) and Larger: Carbon steel, adjustable, clevis.
 - F. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - G. Wall Support for Pipe Sizes 3 inches (76 mm) and Smaller: Cast iron hooks.

- H. Wall Support for Pipe Sizes 4 inches (100 mm) and Larger: Welded steel bracket and wrought steel clamp.
- I. Vertical Support: Steel riser clamp.
- J. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- K. Copper Pipe Support: Copper-plated, carbon steel ring.

2.9 FLEXIBLE CONNECTORS

- A. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
- B. 2 inches (50 mm) and Smaller: Corrugated bronze hose with single layer of bronze exterior braiding, Schedule 40 black steel ends; maximum working pressure 190 psig, threaded or soldered connections.
- C. 2-1/2 inches (65 mm) and Larger: Corrugated stainless steel hose with single layer of stainless steel exterior braiding, Class 150 flanged ends; maximum working pressure 190 psig.

2.10 RELIEF VALVES

- A. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
- B. Relief Valves: Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

2.11 COMPRESSED AIR OUTLETS

- A. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
- B. Compressed Air Outlets: Quick Connector: 3/4 inch brass, snap on connector with self closing valve, Style A or as indicated on drawings.

2.12 AIR COMPRESSOR

- A. Manufacturers:
 - 1. Quincy QT-5-80V Pro Package; 17.2 acfm @ 175 psi; 80 gallon tank; 5 hp; 208 volt/3 phase; with QRHT 125 Compact High Temperature Dryer.
 - 2. Substitutions: Permitted.
- B. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
- C. Controls:
 - 1. Pressure Switch: Line voltage contactor to break at 100 psi (690 kPa) with minimum differential of 20 psi (138 kPa).

- D. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box.
- E. Disconnect Switch: Factory mount in control panel.
- F. Cord and Plug: Furnish unit with 6 foot cord and plug for connection to electric wiring system including grounding connector.

2.13 AIR PRESSURE REDUCING VALVE

- A. Manufacturers:
 - 1. Watts
 - 2. Substitutions: Permitted.
- B. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
- C. Air Pressure Reducing Valve: Consisting of automatic reducing valve and bypass, and low pressure side relief valve and gage.
- D. Valve Capacity: Reduce pressure from 200 psi (1380 kPa) to 30 psi (207 kPa), adjustable upward from reduced pressure.

2.14 PRESSURE REGULATORS

- A. Manufacturers:
 - 1. Watts
 - 2. Substitutions: Permitted.
- B. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
- C. Pressure Regulators: Diaphragm operated, bronze body, direct acting, spring loaded, manual pressure setting adjustment, rated for 250 psig (1725 kPa) inlet pressure.

2.15 COMPRESSED AIR FILTERS

- A. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
- B. Mechanical Separation Filter: 2 stage. Furnish with deflector plates, resin impregnated ribbon type filters with 40 micron (0.040 mm) thick edge filtration and drain valve.

2.16 HOSE CONNECTORS

- A. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
- B. Hose Connectors: Corrugated stainless steel tubing with stainless steel wire braid covering and ends welded to inner tubing.
- C. Working Pressure: 250 psig (1725 kPa) minimum.

- D. End Connections:
 - 1. 2 inches (50 mm) and Smaller: Threaded steel pipe nipple.
 - 2. 2-1/2 inches (65 mm) and Larger: Class 150 Flanges.

PART 3 EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.2 INSTALLATION - HANGERS AND SUPPORTS

- A. Install hangers and supports in accordance with ASME B31.1.

3.3 INSTALLATION - ABOVE GROUND PIPING - COMPRESSED AIR SYSTEMS

- A. Install drip connections with valves at low points of piping system.
- B. Install take-off to outlets from top of main, with shut off valve after take off. Slope take-off piping to outlets.
- C. Install compressed air couplings, female quick connectors, and pressure gages where outlets are indicated on Drawings.
- D. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.
- E. Cut pipe and tubing accurately and install without springing or forcing.
- F. Slope piping in direction of flow.
- G. Stainless Steel Pipe with press-type Joints: Square cut ends to plus or minus 0.030 inches (0.76 mm) tolerance. Remove burrs and clean ends. Fully insert tubing into fitting and mark pipe ends to ensure full insertion into coupling or fitting during assembly. Press joint using manufacturer's tool with proper sized jaw.
- H. Copper Pipe with press-type Joints: Remove burrs and clean ends. Fully insert tubing into fitting and mark pipe ends to ensure full insertion into coupling or fitting. Check alignment against mark to assure tubing is fully inserted. Press joint using manufacturer's tool.
- I. Install pipe sleeves where pipes and tubing pass through walls, floors, roofs, and partitions. Refer to Section 22 05 00.

- J. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section 07 84 00.
- K. Install pipe identification in accordance with Section 22 05 00.
- L. Except where indicated, install manual shut off valves with stem vertical and accessible for operation and maintenance.
- M. Install strainers on inlet side of pressure reducing valves. Install pressure reducing valves with bypasses and isolation valves to allow maintenance without interruption of service.
- N. Install strainers on inlet side of pressure regulators.

3.4 INSTALLATION - EQUIPMENT

- A. Install air compressor on concrete housekeeping pad, minimum 3-1/2 inches high and 6 inches larger than compressor base on each side, as indicated on drawings. Refer to Section 03 30 00.
- B. Install air compressor unit on vibration isolators. Level and bolt in place.
- C. Install air valve and drain connection on horizontal casing.
- D. Install line size shut-off valve and check valve on compressor discharge.
- E. Install replaceable cartridge type filter silencer for each compressor.
- F. Install shut-off valve on water inlet to after cooler. Pipe drain to floor drain.
- G. Install condensate drain piping to nearest floor drain.
- H. Install bypass with valves around air dryer. Use factory insulated inlet and outlet connections.
- I. Provide bypass with valves, around receivers.

3.5 FIELD QUALITY CONTROL

- A. Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.1.
- B. Verify for atmospheric pressure in piping systems, other than system under test.
- C. Test system with dry compressed air or dry nitrogen with test pressure in piping system at 50 psi (345 kPa).

3.6 CLEANING

- A. Blow systems clear of free moisture and foreign matter.

3.7 SCHEDULES

PIPE HANGER SPACING		
PIPE SIZE Inches (mm)	MAXIMUM HANGER SPACING Feet (m)	HANGER ROD DIAMETER Inches (mm)
1/2 (12)	7 (2.1)	3/8 (9)
3/4 (20)	7 (2.1)	3/8 (9)
1 (25)	7 (2.1)	3/8 (9)
1-1/4 (32)	7 (2.1)	3/8 (9)
1-1/2 (38)	9 (2.7)	3/8 (9)
2 (50)	10 (3)	3/8 (9)
2-1/2 (65)	11 (3.4)	1/2 (13)

END OF SECTION

SECTION 22 30 00
PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Domestic Water heaters (DWH-1).
 - 2. Coordination with commission requirements specified in Section 01 91 00 – Commissioning.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's literature for plumbing equipment.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit literature and parts list.

1.4 QUALITY ASSURANCE

- A. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1 when tested in accordance with DOE 10 CFR.
- B. Perform Work in accordance with the 2015 Michigan Plumbing Code.

PART 2 PRODUCTS

2.1 COMERCIAL GAS WATER HEATERS

- A. Manufacturers:
 - 1. A.O.Smith Model No. BTH-120A Mxi Cyclone
 - 2. Substitutions: Permitted.
- B. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
- C. Automatic, natural gas fired, vertical storage type:
 - 1. Storage: 60-gals capacity.
 - 2. Input: 120,000 Btuh.
 - 3. Recovery rate: 138 gph with 100 degrees F temperature rise.
 - 4. Maximum working pressure: 150 psi (1000 kPa).
- D. Tanks: Welded steel ASME labeled pressure vessel; glass lined, with ASME rated temperature and pressure relief valve.

- E. Controls: Automatic immersion water thermostat with adjustable temperature range, automatic reset high limit thermostat, gas pressure regulator, burner with 100 percent safety shut-off pilot and thermocouple, intermittent electronic ignition and automatic flue damper and power vent.

2.2 EXPANSION TANK

- A. Manufacturers:
 - 1. Watts Model No. DETA 12
 - 2. Substitutions: Permitted.
- B. Furnish materials in accordance with the 2015 Michigan Plumbing Code.
- C. Expansion Tank features:
 - 1. ASME Section VIII Construction.
 - 2. Fixed Butyl Bladder (FDA approved).
 - 3. Precharged to 40 psi (Field Adjustable).
 - 4. Bladder Integrity Monitor.
 - 5. Complies with NSF/ANSI Standard 61.
- D. Tanks: Expansion tanks are ASME fixed bladder type pre-charged for fresh potable hot water applications. They are designed to accept the expanded volume of hot water keeping the system pressure below the relief valve setting. The water is contained in a butyl bladder.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install Work in accordance with the 2015 Michigan Building Code.
- B. Install water heaters in accordance to AGA, and UL requirements. Coordinate with plumbing piping and related fuel piping, gas venting and electrical work to achieve operating system.
- C. Clean and flush tanks after installation. Keep openings sealed until pipe connections are made.

3.2 SCHEDULES

- A. Water Heaters:

Drawing Code	DWH-1
Manufacturer & Model	A.O.Smith Model BTH-120A Mxi Cyclone
Input	120,000 BTUH
Recovery	138 GPH at 100 °F Temp. Rise
Storage Capacity	60 GAL

END OF SECTION

SECTION 22 42 00
COMMERCIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other sections of these specifications, apply to this Section.

1.2 SUMMARY

- A. This Section includes plumbing fixtures and related components.

1.3 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

1.4 SUBMITTALS

- A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- C. Maintenance Data: For plumbing fixtures to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with the 2015 Michigan Plumbing Code.
- B. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities, Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act" about plumbing fixtures for people with disabilities.

- E. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.
- F. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- G. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- H. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- I. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Hand Sinks: NSF 2 construction.
 - 2. Stainless-Steel Fixtures Other Than Service Sinks: ASME A112.19.3M.
 - 3. Vitreous-China Fixtures: ASME A112.19.2M.
 - 4. Water-Closet, Flushometer Trim: ASSE 1037.
- J. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - 1. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
 - 2. Faucet Hose: ASTM D 3901.
 - 3. Faucets: ASME A112.18.1M.
 - 4. Hose-Connection Vacuum Breakers: ASSE 1011.
 - 5. Hose-Coupling Threads: ASME B1.20.7.
 - 6. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 - 7. NSF Materials: NSF 61.
 - 8. Pipe Threads: ASME B1.20.1.
 - 9. Supply and Drain Fittings: ASME A112.18.1M.
- K. Comply with the following applicable standards and other requirements specified for shower faucets:
 - 1. Combination, Pressure-Equalizing and Thermostatic-Control Anti-scald Faucets: ASSE 1016.
 - 2. Thermostatic-Control Anti-scald Faucets: ASTM F 444 and ASSE 1016.
- L. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
 - 1. Atmospheric Vacuum Breakers: ASSE 1001.
 - 2. Brass and Copper Supplies: ASME A112.18.1M.
 - 3. Manual-Operation Flushometers: ASSE 1037.
 - 4. Plastic Tubular Fittings and Piping: ASTM F 409.
 - 5. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.
- M. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Floor Drains: ASME A112.21.1M.
 - 2. Hose-Coupling Threads: ASME B1.20.7.
 - 3. Off-Floor Fixture Supports: ASME A112.6.1M.

4. Pipe Threads: ASME B1.20.1.
5. Plastic Toilet Seats: ANSI Z124.5.
6. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 COORDINATION

- A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. For fixture descriptions in other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection subject to compliance with requirements; provide products by the manufacturers specified.
 1. Where there is a model number shown, the design is based on that manufacturer and model.

2.2 WATER CLOSET: **WC-1**, Handicapped accessible, Floor mounted

- A. Bowl shall be floor mounted, vitreous china closet with elongated rim, 1½" spud, china bolt caps; manufactured by American Standard Madera model, with Sloan Royal 111 flush valve. The water closet and flush valve shall be rated at 1.6 gallons per flush.
- B. Acceptable Manufacturers
 1. American Standard **Madera Model 3043.001**
 2. Kohler
 3. Eljer
- C. Seat shall be solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover; manufactured by American Standard model 5901110T.
- D. Support shall be matching adjustable face plate type with floor support.

2.3 WATER CLOSET: **WC-2**, Floor mounted

- A. Bowl shall be floor mounted, vitreous china closet with elongated rim, 1½" spud, china bolt caps; manufactured by American Standard Madera model, with Sloan Royal 111 flush valve. The water closet and flush valve shall be rated at 1.6 gallons per flush.
- B. Acceptable Manufacturers
 1. American Standard **Madera Model 2234.001**
 2. Kohler
 3. Eljer
- C. Seat shall be solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover; manufactured by American Standard model 5901110T.
- D. Support shall be matching adjustable face plate type with floor support.

2.4 URINAL: **UR-1**

- A. Urinal shall be wall mounted vitreous china with washout flushing action and integral flush spreader with concealed carrier.
- B. Acceptable Manufacturers:
 - 1. American Standard **Washbrook Model 6590.001**
 - 2. Kohler
 - 3. Eljer
- C. Top spud flush valve shall be Sloan Royal 186-1 Flush Valve. The urinal and flush valve shall be rated at 1.0 gallons per flush.
- D. Support shall be matching adjustable with bottom bearing plate.

2.5 LAVATORY: **L-1**, Handicapped accessible.

- A. Wall hanging, Vitreous China, with 4" center drilling on center.
- B. Acceptable Manufacturers:
 - 1. American Standard **Lucerne Model 355.012**
 - 2. Kohler
 - 3. Eljer
- C. Trim shall be as manufactured by American Standard "Reliant 3", Model # 7385.050 4" center, Lever Handle w/grid drain.
- D. Accessories
 - 1. Lavatory Insulation Kit
 - a. Provide the following: Safety covers consisting of molded closed-cell vinyl construction 1/8" thick nominal, white color for tail piece, valves, p-trap and supply piping. Furnish with weep hole and angle valve access covers. Manufacturer: Truebro Lav-Guard.
 - 2. Lavatories designated as barrier-free shape shall be supplied with under counter thermostatic blending valve.

2.6 LAVATORY: **L-2**.

- A. Countertop Drop-in, Vitreous China lavatory, with 4" center drilling on center.
- B. Acceptable Manufacturers:
 - 1. American Standard **Rondalyn Model 491.019**
 - 2. Kohler
 - 3. Eljer
- C. Trim shall be as manufactured by American Standard "Reliant 3", Model # 7385.050 4" center, Lever Handle w/grid drain.
- D. Accessories
 - 1. Lavatory Insulation Kit
 - a. Provide the following: Safety covers consisting of molded closed-cell vinyl construction 1/8" thick nominal, white color for tail piece, valves, p-trap and supply piping. Furnish with weep hole and angle valve access covers. Manufacturer: Truebro Lav-Guard.

2.7 SINK: **S-1**

- A. Counter-mounting, Single Bowl, Stainless-steel fixture.
 - 1. Products:
 - a. Dayton Products, Inc.
 - b. Elkay Manufacturing Co., **Model LR1716C**
 - c. Just Manufacturing Co.
 - d. Kohler Co.
 - e. Moen, Inc.
 - f. Sterling Plumbing Group, Inc.
 - 2. Sink Dimensions: 17" x 16" x 7-5/8", 18 gauge.
 - 3. Faucet: Elkay **Model LK500GN04T4C**.
 - 4. Drain: Elkay **Model LK18B** & P-trap **Model LK500**.
 - 5. Drain Piping: NPS 1¹/₂ (DN 40) chrome-plated cast-brass trap, 0.045" (1.1 mm) thick tubular brass waste to wall, and wall escutcheons.

2.8 KITCHEN SINK: **S-2**

- A. Counter-mounting, Equal Double Bowl, stainless-steel fixture.
 - 1. Products:
 - a. Dayton Products, Inc.
 - b. Elkay Manufacturing Co., **Model LR3321**
 - c. Just Manufacturing Co.
 - d. Kohler Co.
 - e. Moen, Inc.
 - f. Sterling Plumbing Group, Inc.
 - 2. Sink Dimensions: 33" x 21-1/4" x 7-7/8", 18 gauge.
 - 3. Number of Compartments: Two.
 - 4. Faucet: Elkay **Model LKHA1041-CR**.
 - 5. Drain: Type 304 stainless steel cup strainer with removable stainless steel basket with locking shell. Basket fitted with rubber stopper on bottom.
 - 6. Drain Piping: NPS 1¹/₂ (DN 40) chrome-plated cast-brass trap, 0.045" (1.1 mm) thick tubular brass waste to wall, and wall escutcheons.

2.9 SHOWER: **SH-1**

- A. Shower valve and head system.
- B. Acceptable Manufacturers:
 - 1. Symmons **Temptrol, Model C-96-1-x**
 - 2. American Standard
 - 3. Kohler
 - 4. Chicago
- C. Trim: Chrome plated brass

2.10 JANITOR'S SINK: **SS-1**

- A. Acceptable Manufacturers:
 - 1. Crane Plumbing / Fiat Products.
 - 2. Stern Williams, **Model MTB-2424**
 - 3. Florestone Products Co.
 - 4. Town & Country
- B. Sink shall be a floor mounted precast terrazzo, chrome plated strainer.
- C. Faucet: Service sink faucet with stops in shanks, vacuum breaker, hose-thread outlet, and pail hook. Cast brass body with rough brass finish, 4" wrist blade handles, ½" NPS inlets, rigid spout with wall brace, Chicago Faucets **Model 897-RCF**.

2.11 LAUNDRY TUB: **LT-1**

- A. Heavy duty, polypropylene, single bowl, laundry tub with four legs complete with chrome plated faucet with 4" centerset, 4" blade handles, 6-3/4" swing spout, aerator and hose adaptor, drain, p-trap and supplies.
- B. Nominal Dimensions: 20" x 23-7/8"
- C. Acceptable Manufacturers:
 - 1. Fiat Model **TAT1**
 - 2. Mustee

2.12 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Guard: Manufactured, plastic covering for hot and cold-water supplies and trap and drain piping and complying with ADA requirements.
 - 1. Manufacturers:
 - a. TruBro
 - b. Zurn
 - c. Similar as approved

2.13 FIXTURE SUPPORTS

- A. Urinal Support: Urinal carrier with fixture support plates and coupling with seal and fixture bolts, hardware matching fixture and bearing plates. Include steel uprights with feet.
 - 1. Manufacturers:
 - a. Josam
 - b. Mifab
 - c. Smith
 - d. Wade
 - e. Zurn, 1222 Series

2.14 FOOD WASTE DISPOSER

- A. Batch feed, household, food-waste disposer. Include 115-V ac, 1725 rpm, 3/4 hp motor with overload protection and reset button; 3 conductor, grounded power cord; wall switch; corrosion-resistant chamber with jam-resistant, cutlery or stainless steel grinder or shredder; NPS 1½ (DN 40) outlet; quick-mounting, stainless steel sink flange; anti-splash guard, combination

cover/stopper. The unit shall be equipped with a sound-insulated chamber and stainless-steel outer shell. Mount in Kitchen Sink S-2.

1. Manufacturers:
 - a. InSinkErator, Power Series **Model Power 15ss**
 - b. Kitchen Aid
 - c. Viking

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water, soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.
- B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIXTURE INSTALLATION

- A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.
 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 2. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-hanging fixtures with tubular waste piping attached to supports.
- F. Install counter-mounting fixtures in and attached to casework.
- G. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.
- H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
- I. Exception: Use ball valves if stops are not specified with fixture.
- J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- L. Install Flushometer valves for accessible water closets with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

- M. Install toilet seats on water closets.
- N. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- O. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.
- P. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- Q. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- R. Install escutcheons at piping wall, ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings.
- S. Set service basins in leveling bed of cement grout.
- T. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect water supplies from water distribution piping to fixtures.
- C. Connect drain piping from fixtures to drainage piping.
- D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings to match fixtures. Connect to plumbing piping.
- E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.
- F. Ground equipment.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

- A. Verify that installed fixtures are categories and types specified for locations where installed.
- B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers and controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at faucets, shower valves, and Flushometer valves to produce proper flow and stream.
- D. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Provide labor, materials, equipment, supervision, and incidental services as necessary to complete all BASIC MECHANICAL MATERIALS AND METHODS work as indicated on the Drawings and as specified herein, including, but not limited to:
 - 1. Connection of/to utilization equipment.
 - 2. Grout.
 - 3. Mechanical demolition.
 - 4. Equipment installation requirements common to equipment sections.
 - 5. Painting and finishing.
 - 6. Supporting devices for electrical components.
 - 7. Concrete equipment bases.
 - 8. Supports and anchorages.
 - 9. Cutting and patching for mechanical construction.
- B. Coordinate with and fulfill duties required by Section 01 91 00 Commissioning.
- C. Substitutions:
 - 1. The Contractor's base bid must be in accordance with the materials or products specified. Any exceptions to this must be approved in writing by the Engineer, ten (10) days or more prior to bidding.

1.3 QUALITY ASSURANCE

- A. The following items shall be performed for quality assurance:
 - 1. Perform Work to requirements of the acceptable standards of installation.
 - 2. Use personnel with appropriate experience to perform Work on all systems.
 - 3. Verify that field measurements are as shown on Drawings.
 - 4. Report all discrepancies to Engineer.
 - 5. Conform to all applicable Codes and Standards.
- B. Permits and Inspections:
 - 1. The Contractor shall obtain and pay for all required permits (temporary and permanent), fees, inspections and Certificates of Inspection for the work specified herein as required by any and all applicable laws and/or ordinances. The cost of such permits and certificates shall be included in the Contractor's bid price, unless otherwise directed. Post such permits and Inspection Certificates in a prominent place adjacent to the work.
 - 2. Deliver all certificates of final inspection or approval to the office of the Design Professional.
 - 3. Do not cover any concealed work until final inspection has been made and approval certificates obtained.

1.4 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic and rubber materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. CPVC: Chlorinated polyvinyl chloride plastic.
 - 3. PE: Polyethylene plastic.
 - 4. PVC: Polyvinyl chloride plastic.
 - 5. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 6. NBR: Acrylonitrile-butadiene rubber.

1.5 SUBMITTALS

- A. Submit sufficient copies required to ensure that the Owner has one (1) copy and the Design Professional has one (1) copy.
- B. Submit shop drawings and product data grouped to include complete submittals of related systems, products and accessories in a single submittal. Tabulated type product data sheets are to be clearly marked to indicate specific items.
- C. ALL shop drawings and product data shall be transmitted to the Design Professional within fifteen (15) working days of the Notice to Proceed.
- D. The initial Construction Progress Schedule shall be transmitted to the Design Professional in duplicate within ten (10) working days after the date established in the Notice to Proceed for the Design Professional's review.
- E. Submit shop and installation drawings, which shall serve the purpose of checking the Contractor's interpretation of the design drawings and specifications, and in correlation and coordination of the various trades, and be used by the Contractor's field workers as installation instructions. They shall include a complete schedule of materials, ductwork and equipment, which he/she intends to install for approval by the Engineer, as soon as practicable after the contract award, but in any event, prior to installing any materials or equipment. Provide operations and maintenance materials, which shall include schematic diagrams.
- F. Review submittals and coordinate with equipment furnished under other Sections prior to installation and rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

- G. In general, where specified trade names are mentioned, they are intended to indicate quality, appearance and type of construction required and not to restrict competition. The Engineer's decisions as to acceptability of substitute materials will be final and shall be binding on the Contractor.
 - H. All manufacturer's drawings, catalog cuts and specifications shall be properly identified with the Engineer's Job Title and Job Number. Each piece of equipment shall be properly identified as to its location and equipment number. Mark dimensions and values in units to match those specified.
 - I. Prepare and furnish to the Engineer three (3) bound copies "Operating and Maintenance Manual" on all equipment installed under this Contract.
 - J. Welding certificates.
 - K. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
 - L. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
 - M. Operating and Maintenance Manuals.
 - 1. When the project is substantially complete and before the project is taken over by the Owner for maintenance purposes, the Contractor shall be required to provide the Design Professional with three (3) complete sets of written instructions covering the proper operation and maintenance requirements of all equipment furnished under these specifications.
 - 2. The manual shall consist of an indexed loose-leaf binder containing the manufacturer's installation, operating, maintenance, lubrication and repair parts manual for each system component; approved shop drawings including equipment performance data and pump and fan performance curves; test and balance reports; and drawings showing rooms or areas served by each of the various heating, ventilating and air conditioning systems. Small scale drawings will be furnished by the Owner's Engineer / Architect for this purpose if desired. Should clarification be required on any of the above requirements, sample copies of acceptable manuals are available for inspection. All outsize sheets shall be recopied to provide uniformity of size.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. As indicated in each of the specification sections.
- 1.7 COORDINATION
- A. The accompanying Drawings show the arrangement, general design and extent of the work and are more or less diagrammatical with equipment in its general location, except that in certain cases the drawings may include details giving exact location and arrangement.
 - B. The Drawings are not intended to be scaled for roughing-in or to serve as shop drawings. If drawings are required for this purpose, or have to be made from field measurements, it shall be the responsibility of the Contractor to prepare such drawings.
 - C. The Plans and Specifications are intended to include all work and materials for the entire completion of the work. Any item of material, labor or detail required for proper execution and

completion of the work and omitted from either the plans and specifications or both, but obviously understood and or required to make all systems complete and operable, shall be furnished as part of the contract without additional cost even though not specified or shown.

- D. Before any work is installed, and before any equipment is fabricated or purchased, the Contractor shall consult all contract documents in addition to the Mechanical Drawings, including Architectural, Structural, Civil/Site, Electrical and others, insofar as they may affect his work or affect the location of equipment, piping or duct work; and shall be held to be thoroughly conversant with the construction problems insofar as they affect his work and to coordinate with the other trades in doing their work and locating equipment.
- E. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- F. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- G. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces.

1.8 CONFLICT BETWEEN DRAWINGS AND THESE SPECIFICATIONS

- A. The drawings and these specifications are to be treated as mutually equal. **ONE DOES NOT TAKE PRECEDENCE OVER THE OTHER.**
- B. Where there is a conflict between the drawings and the specifications, the contractor **SHALL** contact the Engineer for clarification.
- C. In the event the Engineer is not available to respond to the conflict, the contractor **SHALL ASSUME THAT THE HIGHER QUALITY ITEM SHALL BE BID.**

1.9 EXAMINATION AND ACCEPTANCE OF WORK IN PLACE

- A. Examine work in place on which specified work is dependent. Defects which may influence satisfactory completion and performance of specified work shall be corrected in accordance with the requirements of the applicable section of work prior to the commencement of the specified work. Commencement shall be construed as work in place being acceptable for satisfying the requirements of this section.

1.10 OMISSIONS

- A. The intent of these Specifications and Drawings is to secure a complete and operating job in all regards. If any major or obvious omissions exist, the Contractor shall question such items prior to submitting his/her bid; furthermore, the omission from the Drawings and Specifications of any minor detail of construction or installation, shall not relieve the Contractor from providing and installing same. Such omissions shall not entitle the Contractor to make claim for extras for materials or labor.

1.11 STRUCTURAL DIFFICULTIES

- A. Should any field conditions prevent the locating of any mechanical equipment as shown on the plans, the Contractor is required to make any minor deviations, as determined by the Engineer, without extra cost.

1.12 FIELD MEASUREMENTS

- A. Take field measurements to verify or supplement dimensions indicated.
- B. All measurements necessary for the proper installation of the work shall be taken in the field.

1.13 LAWS, REGULATIONS, CODES AND STANDARDS

- A. All work and materials shall be in conformity with all applicable Federal, State and Local Laws, codes and regulations, as well as, applicable current standards.
- B. Where the requirements of the Contract Documents exceed those of the laws, regulations and standards mentioned above, the requirements of the Contract Documents shall govern.
- C. All equipment and materials shall be listed by Underwriters Laboratories, Inc., except for classes of equipment not available with such listings.
- D. Obtain permits and inspections from the authority(ies) having jurisdiction.

1.14 REFERENCE STANDARDS

- A. The work shall comply with the requirements of the latest edition of the following standard specifications, as applicable.
 - 1. MBC: Michigan Building Code
 - 2. MPC: Michigan Plumbing Code
 - 3. MMC: Michigan Mechanical Code
 - 4. MEC: Michigan Energy Code
 - 5. MIOSHA: Michigan Regulations for Safety and Health.
 - 6. ASHRAE: Standard for the design, fabrication and installation of HVAC systems.
 - 7. SMACNA: Standard for the design, fabrication and installation of duct work.
 - 8. NPA: National Plumbing Association.
 - 9. ASME: American Society of Mechanical Engineers.
 - 10. ASTM: American Society for Testing Materials.
 - 11. ANSI: American National Standards Institute.
 - 12. UL: Underwriters Laboratories

1.15 CURRENT CHARACTERISTICS

- A. All motors 1/2 HP and greater shall be 3 Phase, 208V or 460V, 60HZ, unless otherwise noted.
- B. All motors less than 1/2 horsepower shall be single phase, 120V, 60HZ, unless otherwise noted.

1.16 ELECTRICAL CHARACTERISTICS

- A. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

- B. The mechanical contractor shall supply all starters, safety switches and other motor control equipment necessary to properly operate and control all controls for mechanical equipment shall be installed by the electrical contractor.

1.17 MAINTENANCE

- A. Contractor shall be responsible for maintenance of equipment and systems installed until final acceptance by Owner.

1.18 WARRANTIES

- A. In the event that any part of the work or equipment fails (abuse and causes beyond control of the Contractor excepted), within this period of guarantee, it shall be replaced by the Contractor at no cost to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, subject to compliance with requirements, provide products by the manufacturers specified.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Character of Work: The installation shall be executed in a workmanlike manner and shall present a neat mechanical appearance when completed.
- C. Laying Out Work
 1. Layout equipment in accordance with the contract documents and the manufacturers recommended practice including provision of adequate space for maintenance. Review layout with the Design Professional prior to installation.
 2. Check drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, notify the Design Professional before proceeding with installation.
 3. If directed by the Design Professional, the contractor shall make reasonable modifications in the layout as required to permit proper execution of the work and to prevent conflict with work of other trades.
 4. Work shall be installed so as to be readily for operation, maintenance and repair. Minor deviations from drawings may be made to accomplish this. Changes shall not be made without approval of the Construction Representative.
- D. Accessibility
 1. Access doors/panels shall be provided in all pipe chases, soffits, walls and ceilings.
 2. Coordinate the exact location with the work of other trades.
 3. Verify the exact quantity, size and location of the required access panels/doors after the installation of systems and equipment requiring access, and prior to the closure of the affected ceilings and building assemblies.

3.2 STRUCTURAL DIFFICULTIES

- A. Should any field conditions prevent the locating of any equipment as shown on the plans, the Contractor is required to make any minor deviations, as determined by the Engineer, without extra cost.

3.3 FIELD MEASUREMENTS

- A. Take field measurements to verify or supplement dimensions indicated.
- B. All measurements necessary for the proper installation of the work shall be taken in the field.

3.4 FIELD QUALITY CONTROL

- A. Site Tests
 1. Furnish all labors and equipment necessary for the completion of all tests called for in these specifications.
 2. Arrange with all authorities to complete the tests without unnecessary delays so that the work may progress as rapidly as possible. Notify the Construction Representative in advance of all tests, at least 24 hours before starting any tests.
 3. Tests shall be repeated after any defects disclosed thereby have been made good or the work replaced, if in the judgment of the Construction Representative, it is deemed necessary.
 4. Test Equipment: Instrumentation shall be provided as necessary and appropriate to perform the work. The instrument shall be factory calibrated, and shall be used with the factory-determined application factors. When reasonable doubt of accuracy exists, recalibration of any or all instrumentation shall be performed as requested by the Architect /Engineer.

3.5 CUTTING AND PATCHING

- A. No cutting or patching shall be done which is liable to impair the strength of the building, without the approval of the Engineer.
- B. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- C. All openings made by the Contractor shall be neatly patched by him after the work is done. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing fire-stopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.6 PLUMBING EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.7 PAINTING

- A. Painting of plumbing systems, equipment, and components is specified in other sections of these specifications.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4" (100 mm) larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18" (450 mm) centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000 psi (20.7 MPa), 28 day compressive strength concrete and reinforcement.

3.9 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS D1.1.

3.10 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.11 GROUTING

- A. Mix and install grout for mechanical 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. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.

- G. Place grout around anchors.
- H. Cure placed grout.

3.12 OPERATING TESTS

- A. Following the complete installation of all materials and equipment covered by these Specifications, the Contractor shall conduct operating tests on the various systems installed to demonstrate that all equipment is in proper operating condition, correctly adjusted and calibrated for satisfactory functional and operating efficiency, as outlined hereinafter.

3.13 ACCEPTANCE OF INSTALLATION

- A. The Engineer may accept an equipment system installation as substantially complete when:
 - 1. All components of a system are installed.
 - 2. All factory test(s) have been approved by the Engineer.
 - 3. All performance shop test(s) have been approved by the Engineer.
 - 4. Field start-up activities have been completed and approved by the Engineer.
 - 5. The required equipment has met the performance requirements.
 - 6. All required Owner's personnel have been trained.
 - 7. The certificate from the manufacturer stating that the installation of the equipment is satisfactory, that the unit has been satisfactorily tested, is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication, and care of the unit have been submitted.
 - 8. The O & M Manuals have been approved by the Engineer.

3.14 GUARANTEE

- A. The Contractor shall provide a written guarantee to the Owner on the work and equipment which shall be good for one (1) year or longer as may be specified hereinafter.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.

1.2 WORK INCLUDED

- A. Provide labor, materials, equipment, supervision, and incidental services as necessary to complete all TESTING, ADJUSTING AND BALANCING as indicated on the Drawings and specified herein, including, but not limited to:
 - 1. Testing, adjusting, and balancing of air systems.
 - 2. Testing, adjusting, and balancing of infrared heater systems.
 - 3. Coordination with and completion of duties required by Section 01 91 00 Commissioning.

1.3 QUALITY ASSURANCE

- A. This Specification shall provide for the services of an INDEPENDENT TEST AND BALANCE AGENCY, which specializes in the balancing and testing of heating, ventilating, and air conditioning systems; to provide testing and balancing of air moving equipment and distribution, heating equipment and distribution, all as shown on the accompanying plans and specifications; to provide sound tests. The T&B agency shall be a member of the AABC or NEBBS.
- B. Measurement, testing, adjusting and balancing of the systems shall be performed in accordance with ASHRAE Standard 111-1988. Particular attention is directed to Paragraph 8.6.2.3(a) thru (d). Air measurements in both rectangular and circular ducts may be performed using the "Log-Tchebycheff rule".
- C. Upon completion of the HVAC system, the test and balance agency shall perform the tests listed hereinafter, compile the test data, and submit seven (7) copies of the complete test data to the Engineer for evaluation and approval. The Test & Balance Agency shall comply with all standards as set forth by this national organization. All instruments used by this agency shall be accurately calibrated and maintained in good working order. If requested, the tests shall be conducted in the presence of the Engineer and a representative of the Owner.
- D. Test & Balance Agency shall visit job site twice during the progress of construction at times designated by the Engineer to assure that all facilities required for his/her performance are provided properly.
- E. Test & Balance Agency shall review and comment upon all shop drawings related to his/her work.
- F. Air and water balance and testing shall not begin until system has been completed and is in full working order. The Contractor shall put all heating, ventilating, and air conditioning systems and equipment into full operation and shall continue the operation of same during each working of testing and balancing.
- G. Test and Balance Agency shall include an extended warranty of 90 days, after completion of Test and Balance work, during which time the Engineer, at his/her discretion, may request a recheck, or resetting of any outlet, supply air fan, or exhaust fan as listed in test report. The Test & Balance Agency shall provide technicians to assist the Engineer in making any tests he/she may require during this period of time. The first thirty (30) days of this warranty period shall be designated as

the tuning period. This period shall begin after completion of the Test and Balance work and after occupancy by the Owner.

- H. During the thirty (30) day tuning period, the Contractor together with the Test and Balance agency and the Engineer, shall tune the systems, apparatus and controls to suit the Owner's requirements in his/her operations.
- I. The tuning period shall commence upon a date to be selected by the Owner's Operating Engineer and the Engineer's Representative and the period shall continue for one (1) calendar month thereafter. The Owner's operating Engineer will receive all complaints regarding the performance of the heating, ventilating, and air conditioning systems; the Contractor and the Engineer shall visit the site and call upon the Owner's Operating Engineer each day of the tuning period. The Test and Balance Agency shall be required to have a representative at the building for an average of two (2) days per week during the tuning period; these days to be determined by the Engineer. The Engineer and the Contractor shall analyze and organize the complaints and promptly affect the correction work necessary. They shall maintain a comprehensive log of the complaints, showing the time, analysis, corrective work and results.
- J. The correct function and sequence of controls shall be verified prior to the start of the measurement and testing. Refer to ASHRAE 111 Sections 10 and 11.
- K. The system shall be simulated for seasonal conditions. Pressure differential and temperature differential tests shall be made and recorded upon completion of flow tests.
- L. If opposite season operating conditions cannot be simulated, testing of systems and equipment shall be scheduled for the earliest convenient date during the opposite season, and a supplemental report of results issued.

1.4 SUBMITTALS

- A. All submittals shall conform to previous sections of these specifications. Tabulated type product data sheets are to be clearly marked to indicate specific items.
- B. Prior to commencing work, submit draft reports indicating data required. Include detailed procedures, sample report forms, and copy of AABC National Project Performance Guaranty.
- C. Submit prior to final acceptance of project and for inclusion in operating and maintenance manuals. Provide in soft cover, letter size, 3-ring binder, with index page and tabs, and cover identification. Include reduced scale drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
- D. AABC National Standards for Total System Balance NEBB forms.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Before commencing work, verify that systems are complete and operable.
- B. Report any defects of deficiencies or abnormal conditions in mechanical systems which prevent system balance.
- C. Beginning of work means acceptance of existing conditions.
- D. Recorded data shall represent actually measured or observed condition.

- E. Permanently mark settings of valves, dampers, and other adjustment devices. Set and lock memory stops.

3.2 INSTALLATION TOLERANCES

- A. Adjust air handling systems to plus or minus 5% for supply systems and plus or minus 5% for return and exhaust systems from figures indicated.

3.3 LOCATION OF BALANCING DEVICES

- A. The location of balancing devices is important in assuring accurate measurements of fluid flow and proper balancing without creating noise in the system.
- B. Air balancing dampers shall be of the single or multi-leaf type with a suitable locking quadrant. Splitters are generally not acceptable. Dampers shall be installed in all of the following by the sheet metal contractor:
 - 1. In all branch ducts of the low pressure side of the supply system and in all of the branch ducts of the return and exhaust systems. The dampers shall be located as close to the branch connection to the main as possible.
 - 2. In all take-offs to the terminal devices located as close to the take-off connection to the branch as possible. The integral damper in the terminal devices shall not be used for balancing.

3.4 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.
- B. Make air quantity measurements in ducts by traverse of entire cross-sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers.
- E. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Allow for 50% loading of filters.
- G. Adjust automatic outside air, return air, and exhaust air dampers for design conditions.
- H. Measure temperature conditions across outside air, return air, and exhaust air dampers to check leakage.
- I. Where modulating dampers are provided, take measurements and balance at extreme conditions.
- J. Test and Balance Agency shall provide not less than the following:
 - 1. Test and adjust all fan RPM to design requirements.
 - 2. Test and record all fan motor full load amperes.
 - 3. Make Pitot Tube traverse of main supply, return and exhaust ducts and obtain design CFM at all supply, return and exhaust air fans.
 - 4. Test and record system static pressure, suction and discharge.
 - 5. Test and adjust system for design re-circulated air, CFM.

6. Test and adjust system for design minimum CFM outside air by readings of return, outside and mixed air temperatures.
 7. Test and record entering air temperatures. (D.B. heating and cooling; W.B. cooling).
 8. Test and record leaving air temperatures. (D.B. heating and cooling; W.B. cooling).
 9. Adjust all main supply and return air ducts to proper design CFM.
 10. Adjust all zones and dampers to proper design CFM.
 11. Test and adjust each diffuser, grille, and register to within 5% of design requirements.
- K. Each grille, diffuser and register shall be identified as to location and area.
- L. Size, type and manufacture of diffusers, grilles, registers and all tested equipment shall be identified and listed. Manufacturer's ratings on all equipment shall be used to make required calculations.
- M. Readings and tests of diffusers, grilles and registers shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments.
- N. In cooperation with the control manufacturer's representative, setting adjustments of automatically operated dampers to operate as specified, indicated and/or noted. All controls shall be checked for proper calibrations and all controls requiring adjustment by control installers shall be listed.
- O. All diffusers, grilles, and registers shall be adjusted to minimize draft in all areas.
- P. As a part of the work, the Contractor shall make any changes in the pulleys, belts, and dampers or the addition of dampers required for correct balance as required at no additional cost to Owner.
- 3.5 INFRARED SYSTEM PROCEDURE
- A. Adjust systems to provide required or design temperatures.

END OF SECTION

SECTION 23 07 00
HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division One Specification Sections, apply to Work of this Section.

1.2 WORK INCLUDED

- A. Provide labor, materials, equipment, supervision, and incidental services as necessary to complete all HVAC INSULATION work as indicated on the Drawings and specified herein, including, but not limited to:
 - 1. Piping insulation, jackets, lining, and accessories.
 - 2. Ductwork insulation, jackets, lining, and accessories.
 - 3. Equipment insulation, covering, and accessories.
 - 4. Breeching insulation and accessories.

1.3 QUALITY ASSURANCE

- A. Use persons with experience and skill for this work.
- B. Use materials that are approved for the type and location of the installation.
- C. Use only materials that are fire resistive with a very low flame spread rating.
- D. Use materials that are suitable for use in plenum spaces.
- E. Coordinate insulation materials with pipe and duct materials.

1.4 SUBMITTALS

- A. All submittals shall conform to previous sections of these specifications. Tabulated type product data sheets are to be clearly marked to indicate specific items.
- B. Provide submittals on the following:
 - 1. Piping insulation, jackets, lining, and accessories.
 - 2. Ductwork insulation, jackets, lining, and accessories.
 - 3. Equipment insulation, covering, and accessories.
 - 4. Breeching insulation and accessories.

PART 2 - PRODUCTS

2.1 INSULATION MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Owens-Corning Fiberglass Corp.
 - 2. Certainteed Corp.
 - 3. Manville/Schuller
 - 4. Armstrong Corp.
 - 5. Knauf Corp.
 - 6. Rubatex Corp.

2.2 PIPE INSULATION

- A. Glass Fiber Insulation shall be ANSI/ASTM C547; k value of 0.24 at 75⁰F; noncombustible and used on domestic hot and cold water lines, roof drains, heating water supply and return steam and condensate lines, humidifier piping and cooling tower supply and return.
- B. Cellular foam shall be flexible, plastic; k value of 0.28 at 75⁰F and used on refrigerant hot gas and suction lines, and cold condensate lines. The insulation shall be capable of a water vapor permeability of .20 perms per inch maximum.
- C. Jackets:
 - 1. Vapor Barrier Jackets shall be Kraft reinforced foil vapor barrier with self-sealing adhesive joints.
 - 2. PVC Jackets shall be one piece, premolded type.
 - 3. Canvas jackets shall be UL listed treated cotton fabric, 6 oz/sq yd.
 - 4. Aluminum jackets shall be ASTM B209; 0.020" thick; smooth finish.
 - 5. Stainless Steel jackets shall be type 304/316 stainless steel; 0.010" thick; smooth finish.
- D. Accessories:
 - 1. Insulation bands shall be 3/4" wide; 0.010" thick galvanized steel. 0.015" thick aluminum.
 - 2. Metal Jacket bands shall be 3/8" wide; 0.015" thick aluminum. 0.010" thick stainless steel.
 - 3. Insulating cement shall be ANSI/ASTM C195; hydraulic setting for mineral wool.
 - 4. Fibrous Glass cloth shall be untreated; 9 oz/sq yd weight.

2.3 EQUIPMENT INSULATION

- A. Flexible Mineral Fiber blanket shall be ASTM C553; k value of 0.24 at 75⁰F; 2.0 lb/cu ft density and used on air separators. The thickness shall be not less than 1".
- B. Rigid Mineral Fiber board shall be ASTM C612; k value of 0.24 at 75⁰F; 6.0 lb/cu ft density and used on domestic hot water storage tanks. The thickness shall be not less than 1 1/2".
- C. Cellular glass shall be ASTM C552; k value of 0.35 at 75⁰F; 8.0 lb/cu ft density.
- D. Accessories:
 - 1. Bedding compounds shall be non-shrinking, permanently flexible, compatible with insulation.
 - 2. Vapor Barrier coating shall be non-flammable, fire resistant, polymeric resin, compatible with insulation.
 - 3. Insulating cement shall be ANSI/ASTM C195; hydraulic setting for mineral wool.
 - 4. Wire mesh shall be corrosive-resistant metal; hexagonal pattern.

2.4 DUCTWORK INSULATION

- A. Flexible Glass fiber shall be ASTM C553; commercial grade; k value of 0.29 at 75⁰F; 0.002" foil scrim facing for air conditioning ducts and used on exhaust ducts within 10 ft of exterior openings, exhaust ducts exposed to outdoor air, ventilation equipment casings, and supply ducts (cooling system). The thickness shall be not less than 1 1/2".
- B. Rigid Glass fiber shall be ASTM C612, Class 1; k value of 0.24 at 75⁰F; 0.002" foil scrim facing for air conditioning ducts and used on combustion air duct, outside air intake ducts, plenums (cooling system), return duct, return and relief ducts in mechanical rooms, and outside supply and return duct. The thickness shall be not less than 1 1/2".

- C. Indoor jackets shall be 8 oz/sq yd glass mesh; multi-purpose foil-scrim kraft; or pre-sized glass cloth, 8 oz sq/yd.
- D. Outdoor jackets shall be 0.030" PVC sheet; .016 aluminum or mastic reinforced with glass mesh.
- E. Accessories:
 - 1. Adhesives shall be waterproof fire-retardant type.
 - 2. Lagging adhesive shall be fire resistive.
 - 3. Impale anchors shall be galvanized steel, 12 gauge, self-adhesive pad.
 - 4. Joint tape shall be glass fiber cloth, open mesh.
 - 5. Tie wire shall be annealed steel, 16 gauge.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that piping, ductwork, equipment, and breeching has been thoroughly tested and approved prior to installing insulation.
- B. Clean all surfaces to be insulated for adhesives to insure proper bonding.

3.2 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions and in a workmanlike manner.
- B. Maintain ambient temperatures and conditions required by the manufacturers of the adhesive and the insulation.
- C. Continue insulation vapor barrier through penetrations.
- D. Pipe Insulation:
 - 1. Locate insulation and cover seams in least visible locations.
 - 2. Neatly finish insulation at supports, protrusions, and interruptions.
 - 3. All ends, corners, edges, etc. shall be completely secured.
 - 4. Cold pipe insulation requiring a vapor barrier shall have the vapor barrier continuous through fittings, valves, unions, flanges, strainers, and expansion joints.
 - 5. Insulation not requiring a vapor barrier shall have exposed ends beveled and sealed with mastic at unions, flanges, etc.
 - 6. Provide insert between support shield and piping, under the finish jacket, on piping 2" diameter or larger. Fabricate out of cork or other heavy density insulating material suitable for temperature, not less than 6" long, of the same thickness and contour as adjoining insulation. Shields and saddles shall be provided by piping installer.
- E. Pipe Insulation Jackets:
 - 1. Indoor, Concealed Hot Pipes shall have furnished standard factory-applied jackets with or without vapor barrier. Finish fittings, joints, and valves with glass cloth and adhesive. PVC jackets may be used.
 - 2. Indoor, Concealed Cold Pipes shall be furnished with vapor barrier jackets, factory-applied. Finish fittings, joints, and valves with glass cloth and vapor barrier adhesive.
 - 3. Indoor, exposed Pipes shall be finished with rewettable glass cloth and sized for finish painting. PVC jackets may be used.
 - 4. Exterior Applications shall be furnished with vapor barrier jackets. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

F. Equipment Insulation:

1. Apply insulation as close as possible to equipment by grooving, scoring, and beveling insulation, if necessary. Secure insulation to equipment with studs, pins, clips, adhesive, wires, or bands that will insure a tight secure installation.
2. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.
3. Cover insulation with metal mesh and finish with heavy coat of insulating cement. Flexible electrometric insulation may be finished with two coats of approved Finish reinforced with glass mesh.
4. Do not insulate over nameplate or ASME stamps. Bevel and seal insulation around such.
5. When equipment with insulation requires periodic opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage.

G. Ductwork Insulation:

1. Provide insulation with vapor barrier when air conveyed may be below ambient temperature.
2. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
3. Secure insulation without vapor barrier with staples, tape, or wires.
4. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging.
5. Seal vapor barrier penetrations by mechanical fasteners, with vapor barrier adhesive. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
6. Flexible electrometric thermal insulation may be used on exterior duct work when installed using compression fit method at joints and full adhesive coverage. Finish to be reinforced with glass mesh.

3.3 MINIMUM PIPE INSULATION

A. SERVICE WATER SYSTEMS

Fluid Temperatures	Non-circulating runouts	Circulating Mains & Runouts	Circulating Mains & Runouts	
	Up to 1"	Up to 1 1/4"	1 1/2"-2"	Over 2"
40°F-139°F	0.5"	0.5"	0.5"	1.0"

NOTES:

1. Nominal iron pipe size and insulation thickness.
2. Conductivity K =.27
3. For recirculation systems, piping heat loss shall be limited to a maximum of 17.5 Btu/h per linear ft of pipe which is based on design external temperature no lower than 65°F.
4. Design temperatures must be calculated.

3.4 DUCT INSULATION

- A. Minimum duct insulation in unconditioned or semi-conditioned attics (based upon R value of 4.0 ft²/°F/Btu/in).

<u>Description</u>	<u>Minimum thickness (Inches)</u>
Supply Air	2"
Return Air	1"
Outside Air	2"

- B. Minimum duct insulation in conditioned spaces.

<u>Description</u>	<u>Minimum thickness (Inches)</u>
Supply Air	1"
Return Air	0"
Outside Air	4"

END OF SECTION

SECTION 23 11 00
FACILITY FUEL PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe hangers and supports.
 - 2. Pipe and pipe fittings.
 - 3. Valves.

1.2 SUBMITTALS

- A. Product Data:
 - 1. Pipe Hangers and Supports: Submit manufacturers catalog data including load carrying capacity.
 - 2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
- B. Pipe Hangers and Supports: Design data, indicate pipe sizes, load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- C. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit spare parts lists and maintenance procedures.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with the 2015 International Fuel Gas Code and NFPA 54.
- B. List and label flexible connectors and hoses in accordance with UL 536.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. Michigan Hanger Co.
 - 2. Creative Systems Inc.
 - 3. Flex-Weld, Inc.
 - 4. Glope Pipe Hanger Products Inc.
 - 5. Carpenter & Paterson Inc.
 - 6. Superior Valve Co.
 - 7. Substitutions: Permitted.

- B. Furnish materials in accordance with the 2015 International Fuel Gas Code.
- C. Conform to ASME B31.9.
- D. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (13 to 38 mm): Malleable iron, adjustable swivel, split ring.
- E. Hangers for Pipe Sizes 2 inches (50 mm) and Over: Carbon steel, adjustable, clevis.
- F. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- G. Wall Support for Pipe Sizes to 3 inches (75 mm): Cast iron hook.
- H. Vertical Support: Steel riser clamp.
- I. Floor Support for Pipe Sizes to 4 inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.2 PIPES AND TUBES

- A. Natural Gas Piping, Buried:
 - 1. Steel Pipe: ASTM A53/A53M, Grade B, Schedule 40 black with polyethylene jacket and welded joints.
 - 2. Polyethylene Pipe: ASTM D2513, SDR 11.5, with socket type fittings and fusion welded joints.
- B. Natural Gas Piping, above Grade:
 - 1. Steel Pipe: ASTM A53/A53M, Grade B, Schedule 40 black, with malleable iron or forged steel fittings, screwed or welded.
 - 2. Copper Tubing: ASTM B88 (ASTM B88M), Type K, annealed with wrought copper fittings and compression joints.
 - 3. Regulator Vent Piping, Above Grade:
 - a. Indoors: Same as natural gas piping, above grade.
 - b. Outdoors: PVC pipe, tubing, and fittings, UL 651.

2.3 VALVES

- A. Manufacturers:
 - 1. American Valve.
 - 2. FMC Crosby Valve.
 - 3. Red-White Valve Corp.
 - 4. Substitutions: Permitted.
- B. Furnish materials in accordance with the 2015 International Fuel Gas Code.
- C. Gate Valves:
 - 1. Up to 2 inches (50 mm): Bronze body, bronze trim, non-rising stem, hand wheel, inside screw, double wedge disc, soldered or threaded.
- D. Globe Valves:
 - 1. Up to 2 Inches: Bronze body, bronze trim, rising stem and hand wheel, inside screw, renewable composition disc, solder or threaded ends, with back seating capacity.
- E. Ball Valves:
 - 1. Up to 2 inches (50 mm): Bronze or stainless steel one-piece body, chrome plated brass ball, Teflon seats and stuffing box ring, lever handle, solder or threaded ends.

- F. Plug Valves:
 - 1. Up to 2 inches (50 mm): Bronze body, bronze tapered plug, non-lubricated, Teflon packing, threaded ends.
- G. Swing Check Valves:
 - 1. Up to 2 inches (50 mm): Bronze body and swing disc, solder or threaded ends.
- H. Spring Loaded Check Valves:
 - 1. Iron body, bronze trim with threaded, wafer or flanged ends and stainless-steel spring with renewable composition disc.

2.4 PIPING SPECIALTIES

- A. Flanges, Unions, and Couplings:
 - 1. Pipe Size 2 inches (50 mm) and Under: Malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.
 - 2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
- B. Strainers:
 - 1. Furnish materials in accordance with the 2015 International Fuel Gas Code.
 - 2. Size 2 inches (50 mm) and Under: Threaded brass or iron body for 175 psig (1 200 kPa) working pressure, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.
- C. Flexible Connectors:
 - 1. Furnish materials in accordance with the 2015 International Fuel Gas Code.
 - 2. Corrugated stainless steel or bronze hose with single layer of stainless-steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure 500 psig.
- D. Pressure Gages:
 - 1. Furnish materials in accordance with the 2015 International Fuel Gas Code.
 - 2. Gage: ASME B40.1, UL 393 with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
 - a. Case: Steel.
 - b. Bourdon Tube: Brass.
 - c. Dial Size: 2-inch diameter.
 - d. Mid-Scale Accuracy: One percent.
 - e. Scale: Psi.
- E. Pressure Regulator: Comply with ANSI Z21.80.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavate.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside piping before assembly.

- C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION - INSERTS

- A. Install inserts for placement in concrete forms.
- B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- D. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.4 INSTALLATION - PIPING SYSTEMS

- A. Install dielectric connections wherever jointing dissimilar metals.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Route piping parallel to building structure and maintain gradient.
- D. Install piping to maintain headroom. Group piping to conserve space. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- G. Sleeve pipe passing through partitions, walls and floors.
- H. Install piping system allowing clearance for installation of insulation and access to valves and fittings.
- I. For exposed natural gas lines other than steel pipe, attach yellow pipe labels with "GAS" in black lettering, at maximum 5 foot (1500 mm) spacing.
- J. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.
- K. Where required, bend pipe with pipe bending tools in accordance with procedures intended for that purpose.

3.5 INSTALLATION - VALVES

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- C. Install globe or ball valves for throttling or manual flow control services.

3.6 INSTALLATION - PIPING SPECIALTIES

- A. Install pressure gages with pulsation dampers. Provide needle valve or ball valve to isolate each gage. Extend nipples and siphons to allow clearance from insulation.

- B. Install gages in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- C. Adjust gages to final angle, clean windows and lenses, and calibrate to zero.
- D. Install Work in accordance with the 2015 International Fuel Gas Code.

3.7 INSTALLATION - FUEL PIPING

- A. Install natural gas piping in accordance with ASME B31.2 and ASME B31.4.
- B. Install natural gas piping in accordance with NFPA 54.
- C. Size and install gas piping to provide sufficient gas to supply maximum appliance demand at pressure higher than appliance minimum inlet pressure.
- D. Provide clearance for installation of insulation and access to valves and fittings.
- E. Establish elevations of buried piping outside building to provide not less than 5 ft of cover.
- F. Provide support for utility meters in accordance with requirements of utility company.
- G. Pipe vents from gas pressure reducing valves to outdoors and terminate in weatherproof hood. Protect vent against entry of insects and foreign material.
 - 1. Minimum Vent Size: Connection size at regulator vent connection.
 - 2. Run individual vent line from each relief device, independent of breather vents.
 - 3. Breather vents may be manifolded together with piping sized for combined appliance vent requirements.
- H. Test natural gas piping in accordance with NFPA 54.
- I. Install Work in accordance with the 2015 International Fuel Gas Code.

3.8 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as scheduled.
- B. Install hangers with minimum 1/2 inch (13 mm) space between finished covering and adjacent work.
- C. Place hangers within 12 inches (300 mm) of each horizontal elbow.
- D. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5 m) maximum spacing between hangers.
- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Design hangers for pipe movement without disengagement of supported pipe.

3.9 SERVICE CONNECTIONS

- A. Install new gas service complete with gas meter and regulators. Install regulators on each line serving gravity type appliances, sized in accordance with equipment.

3.10 SCHEDULES

PIPE HANGER SPACING				
PIPE SIZE Inches (mm)	COPPER TUBING MAXIMUM HANGER SPACING Feet (m)	STEEL PIPE MAXIMUM HANGER SPACING Feet (m)	COPPER TUBING HANGER ROD DIAMETER Inches (mm)	STEEL PIPE HANGER ROD DIAMETER Inches (mm)
1/2 (12)	5 (1.5)	7 (2.1)	3/8 (9)	3/8 (9)
3/4 (20)	5 (1.5)	7 (2.1)	3/8 (9)	3/8 (9)
1 (25)	6 (1.8)	7 (2.1)	3/8 (9)	3/8 (9)
1-1/4 (32)	7 (2.1)	7 (2.1)	3/8 (9)	3/8 (9)
1-1/2 (38)	8 (2.4)	9 (2.7)	3/8 (9)	3/8 (9)
2 (50)	8 (2.4)	10 (3)	3/8 (9)	3/8 (9)

Note 1: Refer to manufacturer's recommendations for grooved end piping systems.

END OF SECTION

SECTION 23 20 00

HVAC PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe hangers and supports.
 - 2. Pipe and pipe fittings.
 - 3. Valves.
 - 4. Piping specialties.
 - 5. HVAC piping specialties.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate schematic layout of refrigeration system, including equipment, critical dimensions, and sizes.
- B. Product Data:
 - 1. Pipe Hangers and Supports: Submit manufacturers catalog data including load carrying capacity.
 - 2. Valves: Submit Manufacturers catalog information with valve data and ratings for each service.
 - 3. Piping Specialties: Submit product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each specialty.
 - 4. Pipe Expansion Products: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit spare parts lists and maintenance procedures.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with the 2015 Michigan Mechanical Code.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. Carpenter & Paterson Inc.
 - 2. Creative Systems Inc.
 - 3. Flex-Weld, Inc.
 - 4. Globe Pipe Hanger Products Inc.
 - 5. Substitutions: Permitted.
- B. Furnish materials in accordance with the 2015 Michigan Mechanical Code.
- C. Conform to ASME B31.1.
- D. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (13 to 38 mm): [Malleable iron] [Carbon steel], adjustable swivel, split ring.
- E. Wall Support for Pipe Sizes to 3 inches (76 mm): Cast iron hooks.
- F. Copper Pipe Support: Copper-plated, carbon steel ring.

2.2 PIPES AND TUBES

- A. Refrigerant Piping:
 - 1. Copper Tubing: ASTM B280, drawn, wrought copper fittings, silver/phosphorus/copper alloy brazed joints.
 - 2. Copper Tubing to 7/8 inch (22 mm) OD: ASTM B88 (ASTM B88M), Type K, annealed, cast copper fittings, flared joints.
- B. Equipment Drains and Overflows:
 - 1. Steel Pipe: ASTM A53/A53M, Grade B, Schedule 40 black steel, malleable iron or forged steel fittings, threaded or welded joints.
 - 2. Copper Tubing: ASTM B88 (ASTM B88M), Type M, drawn, cast brass, wrought copper fittings, lead free solder joints.
 - 3. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26, PVC fittings, solvent weld joints.
- C. Flue and Combustion Air Piping:
 - 1. PVC Pipe: ASTM D1785, Schedule 40, polyvinyl chloride (PVC) material.
 - a. Fittings: ASTM D2466, Schedule 40, PVC.
 - b. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement. Prime joints with a contrasting color.
 - 2. CPVC Pipe: ASTM F441/F441M, Schedule 40, chlorinated polyvinyl chloride (CPVC) material.
 - a. Fittings: ASTM F438, CPVC, Schedule 40, socket type.
 - b. Joints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement. Prime joints with a contrasting color.
 - 3. ABS Pipe: ASTM D2661, Acrylonitrile-Butadiene-Styrene (ABS) material.

- a. Fittings: ABS, ASTM D2661 or ABS, ASTM D3311.
- b. Joints: ASTM D2235, solvent weld applied after cleaning.

2.3 VALVES

- A. Manufacturers:
 1. American Valve.
 2. Red-White Valve Corp.
 3. Substitutions: Permitted.
- B. Furnish materials in accordance with 2015 Michigan Mechanical Code.
- C. Gate Valves:
 1. Up to 2 inches (50 mm): Bronze body, bronze trim, non-rising stem, hand wheel, inside screw, double wedge disc, soldered or threaded.
- D. Globe Valves:
 1. Up to 2 Inches: Bronze body, bronze trim, rising stem and hand wheel, inside screw, renewable composition disc, solder or threaded ends, with back seating capacity.
- E. Ball Valves:
 1. Up to 2 inches (50 mm): Bronze or stainless steel one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle, solder or threaded ends.
- F. Plug Valves:
 1. Up to 2 inches (50 mm): Bronze body, bronze tapered plug, non-lubricated, Teflon packing, threaded ends.
- G. Butterfly Valves:
 1. Up To 2 inches (50 mm): Bronze body, stainless steel disc, resilient replaceable seat, threaded ends, extended neck.
- H. Swing Check Valves:
 1. Up to 2 inches (50 mm): Bronze body and swing disc, solder or threaded ends.
- I. Spring Loaded Check Valves:
 1. Iron body, bronze trim with threaded, wafer or flanged ends and stainless steel spring with renewable composition disc.
- J. Relief Valves:
 1. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

2.4 PIPING SPECIALTIES

- A. Flanges, Unions, and Couplings:
 1. Pipe Size 2 inches (50 mm) and Under: Malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.

2. Grooved and Shouldered Pipe End Couplings: Malleable iron housing, C-shape elastomer composition sealing gasket, steel bolts, nuts, and washers.
 3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
- B. Strainers:
1. Furnish materials in accordance with the 2015 Michigan Mechanical Code.
 2. Size 2 inches (50 mm) and Under: Threaded brass or iron body for 175 psig (1 200 kPa) working pressure, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.
- C. Flexible Connectors:
1. Furnish materials in accordance with the 2015 Michigan Mechanical Code.
 2. Corrugated stainless steel or bronze hose with single layer of stainless steel exterior braiding, minimum 9 inches (230 mm) long with copper tube ends; for maximum working pressure 300 psig.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavate.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt, on inside and outside piping before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION - PIPING SYSTEMS

- A. Install dielectric connections wherever jointing dissimilar metals.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Route piping parallel to building structure and maintain gradient.
- D. Install piping to maintain headroom. Group piping to conserve space. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- G. Sleeve pipe passing through partitions, walls and floors.

- H. Install piping system allowing clearance for installation of insulation and access to valves and fittings.
- I. Install identification on piping systems including underground piping. Refer to Section 23 05 00.
- J. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

3.4 INSTALLATION - VALVES

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install gate, ball, or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.5 INSTALLATION - PIPING SPECIALTIES

- A. Install Work in accordance with the 2015 Michigan Mechanical Code.

3.6 INSTALLATION - REFRIGERANT PIPING

- A. Install refrigerant piping in accordance with ASME B31.5.
- B. Arrange refrigeration piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
- C. Flood refrigerant piping system with nitrogen when brazing.
- D. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.
- E. Provide replaceable cartridge filter-dryers, with isolation valves and bypass with valve.
- F. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.
- G. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.
- H. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.
- I. Fully charge completed system with refrigerant after testing.
- J. Provide electrical connection to solenoid valves.
- K. Test refrigeration system in accordance with ASME B31.5.
- L. Pressure test system with dry nitrogen to 200 psig. Perform final tests at 27 inches vacuum and 200 psig using electronic leak detector. Test to no leakage.
- M. Install Work in accordance with the 2015 Michigan Mechanical Code.

3.7 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as scheduled.
- B. Install hangers with minimum 1/2 inch (13 mm) space between finished covering and adjacent work.
- C. Place hangers within 12 inches (300 mm) of each horizontal elbow.
- D. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5 m) maximum spacing between hangers.
- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Design hangers for pipe movement without disengagement of supported pipe.

3.8 SCHEDULES

- A. Copper and Steel Pipe Hanger Spacing:

PIPE SIZE Inches (mm)	COPPER TUBING MAXIMUM HANGER SPACING Feet (m)	STEEL PIPE MAXIMUM HANGER SPACING Feet (m)	COPPER TUBING HANGER ROD DIAMETER Inches (mm)	STEEL PIPE HANGER ROD DIAMETER Inches (mm)
1/2 (12)	5 (1.5)	7 (2.1)	3/8 (9)	3/8 (9)
3/4 (20)	5 (1.5)	7 (2.1)	3/8 (9)	3/8 (9)
1 (25)	6 (1.8)	7 (2.1)	3/8 (9)	3/8 (9)

B. Plastic and Ductile Iron Pipe Hanger Spacing:

PIPE HANGER SPACING		
PIPE MATERIAL	MAXIMUM HANGER SPACING Feet (m)	HANGER ROD DIAMETER Inches (mm)
ABS (All sizes)	4 (1.2)	3/8 (9)
FRP (All Sizes)	4 (1.2)	3/8 (9)
PVC (All Sizes)	4 (1.2)	3/8 (9)

C. Refer to manufacturer's recommendations for grooved end piping systems.

END OF SECTION

SECTION 23 30 00
HVAC AIR DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.

1.2 WORK INCLUDED

- A. Provide labor, materials, equipment, supervision, and incidental services as necessary to complete all HVAC AIR DISTRIBUTION work as indicated on the Drawings and as specified herein, including, but not limited to:
 - 1. Filters.
 - 2. Ductwork and ductwork accessories.
 - 3. Flexible duct connections.
 - 4. Diffusers, boots, registers, and grilles.
 - 5. Fans
 - 6. Louvers: Specified in Section 08 91 00 - Louvers.
 - 7. Coordination with requirements for Commissioning Specified in Section 01 91 00 – Commissioning.

1.3 QUALITY ASSURANCE

- A. Sound ratings shall be AMCA 301; tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.
- B. Conform to AMCA 99 and ARI 430 for fabrication.
- C. Filter media shall be ANSI/UL 900 listed, Class I or Class II.
- D. NO FABRICATION ON THE SHEET METAL DUCTWORK OR ACCESSORIES MAY BEGIN WITHOUT THE ENGINEER'S APPROVAL OF THE SHEET METAL SHOP DRAWINGS.

1.4 SUBMITTALS

- A. All submittals shall conform to previous sections of these specifications. Tabulated type product data sheets are to be clearly marked to indicate specific items.
- B. Provide for manufactured products and assemblies in shop drawings.
- C. Product data shall include for manufactured products and assemblies.
- D. Operating and maintenance instructions shall include instructions for lubrication, filter replacement, spare parts lists, and wiring diagrams.

PART 2 - PRODUCTS

2.1 FILTERS

- A. Acceptable manufacturers:
 - 1. American Air Filter
 - 2. Farr Filters
 - 3. Air Filter Manufacturing Co.
- B. Disposable extended area panel filters shall be pleated, reinforced cotton fabric; supported and bonded to welded wire grid; enclosed in cardboard frame; nominal size 24" x 24" x 1" thick; rated 25%-30% dust spot efficiency.
- C. Disposable panel filters shall be 2" thick glass fiber blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive; nominal size 24" x 24" in cardboard frame with perforated metal retainer.
- D. Filter frames shall be galvanized steel or extruded aluminum T-section construction with necessary gasketing between frames and walls.
- E. Filter gauges shall be direct reading dial 3¹/₂" inch diameter diaphragm actuated dial in metal case, vent valves, black figures on white background, range 0-2.0" WG, 3% of full scale accuracy.

2.2 DUCTWORK

- A. Materials:
 - 1. Steel ducts shall be galvanized steel sheet, lock-forming quality.
 - 2. Flexible ducts fabric supported by helically wound spring steel wire or flat steel bands.
 - 3. Insulated flexible ducts shall be wrapped with flexible glass fiber insulation, enclosed by vapor barrier jacket.
 - 4. Sealant shall be non-hardening, water resistant, fire resistive, used alone or with tape.
- B. Metal Ductwork:
 - 1. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, except as indicated.
 - 2. Construct T's, bends, and elbows with radius of 1¹/₂ times width of duct on centerline. Where not possible, provide turning vanes.
 - 3. Increase duct sizes gradually, not exceeding 30 degrees divergence and 45 degrees convergence.
 - 4. Connect flexible ducts to metal ducts with draw bands.
 - 5. Use crimp joints with or without bead for joining round duct sizes 8" and smaller with crimp in direction of air flow.

2.3 FANS

- A. Downblast Centrifugal Roof Fans.
 - 1. Manufacturers:
 - a. Greenheck
 - b. Acme Engineering and Manufacturing Corp.
 - c. Loren Cook Company
 - d. Penn Barry Ventilation

- e. Carnes
- f. Substitutions: Not Permitted.
- 2. Furnish materials in accordance with the 2015 Michigan Mechanical Code.
- 3. Fan Unit: Downblast type; direct drive; with spun aluminum housing; resilient mounted motor; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.
- 4. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
- 5. Motor: Totally enclosed fan cooled.
- 6. Roof Curb: 12 inch high self-flashing of aluminum construction with continuously welded seams , 1 inch insulation and curb bottom, interior baffle with acoustic insulation, curb bottom, hinged curb adapter, and factory installed nailer strip.
- 7. Disconnect Switch: Factory wired, non-fusible, in fan housing for thermal overload protected motor, NEMA 250 Type 1 enclosure.
- 8. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked and line voltage motor drive, power open, spring return.

2.4 DAMPERS - GENERAL

- A. Acceptable manufacturers for all dampers listed herein:
 - 1. American Warming & Ventilating
 - 2. Hart & Cooley
 - 3. Krueger
 - 4. Penn Ventilator
 - 5. Ruskin
 - 6. Air Balance
 - 7. Carnes Co.
 - 8. Price

2.5 VOLUME CONTROL DAMPERS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- B. Fabricate splitter dampers of same material and gauge as duct to 24" size in either direction, and two (2) gauges heavier for larger sizes, secured with continuous hinge or rod, operated with minimum 1/4" diameter rod.
- C. Fabricate single blade dampers for duct sizes to 9 1/2" x 30".
- D. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12" x 72". Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- E. Except in round ductwork 12" in diameter and smaller, provide end bearings.

- F. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where width exceeds 30", provide regulator at both ends.

2.6 BACKDRAFT DAMPERS

- A. Gravity backdraft dampers furnished with air moving equipment, size 18" x 18" or smaller, may be air moving equipment manufacturer's standard construction.
- B. Fabricate multi-blade, parallel action, gravity balanced backdraft dampers of galvanized steel or extruded aluminum, with center pivoted blades linked together; with sealed edges, steel ball bearings, and plated steel pivot pin.

2.7 AIR TURNING DEVICES

- A. Multi-blade device with blades aligned in short dimension, steel or aluminum construction; with individually adjustable blades and mounting straps.
- B. Multi-blade device with radius blades attached to pivoting frame and bracket, steel or aluminum construction, with push-pull operator strap.

2.8 FLEXIBLE DUCT CONNECTIONS

- A. UL listed, fire-retardant, neoprene-coated woven glass fiber fabric to NFPA 90A; approximately 3" wide, crimped into metal edging strip.

2.9 DUCT ACCESS DOORS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Access doors smaller than 12 square inches may be secured with sash locks. Access doors with sheet metal screw fasteners are not acceptable.
- C. Locate access doors adjacent to all fire dampers and adjacent to volume control damper in bypass duct.

2.10 AIR OUTLETS

- B. Acceptable Manufacturers:
 - 1. Titus, TMA
 - 2. Krueger
 - 3. Price
 - 4. Nailor
 - 5. Acme
 - 6. Substitutions: Permitted
- C. Ceiling diffusers shall be rectangular adjustable pattern, stamped or spun, multi-core type diffuser to discharge air in 360 degree pattern, radial opposed blade splitter damper and equalizing grid; baked enamel finish.
- D. Registers/Grilles shall be streamlined and individually adjusted lades, two-way deflection; with factory clear lacquer coat finish.
- E. Return air grilles shall be 1/2" x 1/2" "egg crates" 24" x 24".
- F. Linear diffusers shall be satin finish aluminum.

- G. Louvers: Wall Louvers are specified in Section 08 91 00.

2.11 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Horsepower as indicated on drawings; 120 volts; single phase; 60Hz.
- B. Disconnect Switch: Factory Mount on Equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all devices in accordance with manufacturer's instructions.
- B. Install flexible connections specified between fan inlet and discharge ductwork. Flexible connectors shall not be in tension while running.
- C. Provide backdraft damper on discharge of exhaust fans and as indicated.
- D. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.
- E. Install filter gauge static pressure taps upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum in accessible position. Adjust and level.
- F. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal cap with spring device or screw to ensure against air leakage.
- G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- H. Connect diffusers to low pressure ducts with five (5) foot maximum length of flexible duct. Hold in place with strap or clamp.
- I. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- J. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.
- K. Provide duct access doors for inspection and cleaning before and after filters, automatic dampers, at fire dampers, and elsewhere as indicated. Provide minimum 8" x 8" size for hand access, 18" x 18" size for shoulder access.
- L. Support terminal units individually from structure. Do not support from adjacent ductwork.
- M. Check location of air outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- N. Paint ductwork visible behind air outlets and inlets matte black.
- O. Provide escutcheon plates and/or rings at all ducts penetrating furnished ceilings and walls.
- P. Paint all exposed ducts, fittings and accessories same color as equipment to which it is connected.

END OF SECTION

SECTION 23 54 00

FURNACES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Forced air furnaces with refrigerant cooling coils, and condensing units.
2. Type B double wall gas vents.
3. Coordination with requirements for commissioning specified in Section 01 91 00 – Commissioning.

1.2 RELATED SECTIONS

- A. Section 23 63 13: Air-Cooled Refrigerant Condensing Units.

1.3 SUBMITTALS

- A. Product Data: Submit dimensions, connections, arrangement, accessories, capacities, manufacturer's installation instructions and controls.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit spare parts lists.

1.5 QUALITY ASSURANCE

- A. Furnace Performance Requirements: Conform to minimum efficiency prescribed by ASHRAE 90.1 when tested in accordance with DOE 10 CFR.
- B. Cooling Performance Requirements: Energy Efficiency Rating (EER) not less than prescribed by ASHRAE 90.1 when used in combination with compressors and evaporator coils when tested in accordance with ARI 210/240.
- C. Perform Work in accordance with the 2015 Michigan Mechanical Code.

PART 2 PRODUCTS

2.1 FORCED AIR FURNACES

A. Manufacturers:

1. The Trane Company: **(Basis of Design)**
2. Carrier Corp.
3. Substitutions: Not permitted.

- B. Furnish materials in accordance with the 2015 Michigan Mechanical Code.
- C. Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating element, controls, air filter, humidifier, and accessories; wired for single power connection with control transformer.
 - 1. Air Flow Configuration: Upflow.
 - 2. Heating: Natural gas fired.
 - 3. Electric Refrigeration: Refrigerant cooling coil and outdoor package containing compressor, condenser coil and condenser fan.
 - 4. Accessories: Roof termination kit.
 - 5. Programmable Thermostat.
- D. Cabinet: Steel with baked enamel finish and access doors with safety interlock switch.
- E. Supply Fan: Centrifugal type rubber mounted with direct or belt drive, adjustable variable pitch motor pulley, multiple speed motor.
- F. Heat Exchanger: Aluminized steel.
- G. Gas Burner:
 - 1. Atmospheric type with adjustable combustion air supply.
 - 2. Gas valve, two stage capable of 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.
 - 3. Electronic pilot ignition, with hot surface igniter.
 - 4. Combustion air damper with synchronous spring return damper motor.
 - 5. Non-corrosive combustion air blower with permanently lubricated motor.
- H. Furnace Operating Controls:
 - 1. Room Thermostat: Cycles to maintain room temperature setting.
 - 2. Supply Fan Control: Energize from bonnet temperature independent of burner controls, with adjustable timed off delay and fixed timed on delay, with manual switch for continuous fan operation.
- I. Air Filters: 1 inch (25 mm) thick glass fiber, disposable type.
- J. Furnace Refrigeration Package:
 - 1. Evaporator Coil: Copper tube aluminum fin assembly, galvanized drain pan, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve, steel cabinet with baked enamel finish and insulation.
 - 2. Compressor: Hermetic, 3600 rpm, resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, motor overload protection, service valves and drier. Include time delay control to prevent short cycling and rapid speed changes.
 - 3. Refrigeration Accessories: Filter Drier, high-pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, and thermometer well (in liquid line). Furnish thermostatic expansion valves. Furnish refrigerant lines, factory cleaned, dried, pressurized and sealed, with insulated suction line.

4. Air Cooled Condenser: ARI 520; aluminum fin and copper tube coil, with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
5. Refrigeration Operating Controls:
 - a. Room Thermostat: Cycles condensing unit and supply fan to maintain room temperature setting.
 - b. Low Ambient Kit: Furnish refrigerant pressure switch to cycle condenser fan.
- K. Drain Pan: Galvanized steel or plastic drain pan with drain outlet. Match pan size to dimensions of furnace.
- L. Adjustable Room Thermostat: Low voltage, to control burner operation, heater stages in sequence with delay between stages, compressor and condenser fan and supply fan to maintain temperature setting. Include system selector switch (heat-off-cool) and fan control switch (auto-on).

2.2 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Requirements for electrical characteristics: See drawing schedule
- B. Disconnect Switch: By electrical contractor.

2.3 TYPE B DOUBLE WALL GAS VENTS

- A. Manufacturers:
 1. Trane
 2. Carrier
 3. Substitutions: Not Permitted.
- B. Furnish materials in accordance with the 2015 Michigan Mechanical Code.
 1. Fabrication: Inner pipe of sheet aluminum, and outer pipe of galvanized sheet steel, tested in compliance with UL 441.
 2. Vent Dampers: Electrically actuated, same size as draft hood collar, constructed of stainless steel or galvanized steel, with corrosion-resistant components, in compliance with ANSI Z21.66.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with NFPA 54.
- B. Install Work in accordance with the 2015 Michigan Mechanical Code and the 2015 International Fuel Gas Code.
- C. Install drain piping from cooling coils to nearest floor drain.
- D. Install refrigerant piping to remote condenser.

- E. Mount air cooled condenser-compressor package on preservative treated 4 inches x 4 inches wood timbers.
- F. Install control wiring between indoor and outdoor units and remotely mounted components.
- G. Type B double wall gas vents:
 - 1. Install continuously from appliance.
 - 2. Maintain UL listed minimum clearances from combustibles. Assemble pipe and accessories for complete installation.
 - 3. Install vent dampers, locating close to draft hood collar, and secured to breeching.
- H. Extend vent above roof in accordance with applicable code.
- I. Maximum Vent Horizontal Distance: 75 percent of vent vertical distance.
- J. Where appliance requires draft hood or barometric control device, install manufacturer furnished listed devices in accordance with manufacturer's instructions and applicable code.

END OF SECTION

SECTION 23 55 23

LOW INTENSITY GAS-FIRED RADIANT HEATERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including general and supplementary conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes gas-fired low intensity tubular radiant heaters with stainless steel tubes and reflectors.
- B. Coordination with Commissioning requirements specified in Section 01 91 00.

1.3 SUBMITTALS

- A. Product Data: For each type of gas-fired radiant heater indicated. Include rated capacities, operating characteristics, and accessories.
- B. Shop Drawings: plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring diagrams: power and control wiring.
- C. Coordination drawings: plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Illustrations showing how equipment will be attached.
 - 2. Items penetrating roof.
 - 3. Vent and gas piping connections.
- D. Operation and Maintenance Data: include in emergency, operation, and maintenance manuals.
- E. Warranty: Special warranty specified in Section 1.5.

1.4 QUALITY ASSURANCE

- A. Electrical components, devices, and accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Equipment shall be certified to the ANSI Z83.20 standard and bear the CSA certification label.

1.5 WARRANTY

- A. Warranty Period: One year on all internal components, five years on tube exchangers, and ten years on burner from date of substantial completion.

PART 2 – PRODUCTS

1. TUBULAR INFRARED HEATERS

- A. Basis-of-design product: Subject to compliance with requirements, provide Detroit Radiant Products Company; Re-Verber-Ray DX3-SS Stainless Steel Series or a comparable product by one of the following:
 - 1. Calcana, Inc.
 - 2. Modine Inc.
 - 3. Reznor/Thomas & Betts Corporation.
 - 4. Schwank Inc.
 - 5. Solaronics.
- B. Fuel type: Burner shall be designed for natural gas having characteristics same as those of gas available at project site.
- C. Combustion chamber: 4 inch O.D. 16ga. A-409 grade stainless steel (150-200MBH to allow for the operating temperature to exceed the 103°F as set forth in the ANSI Z83.20 standard) finished with a high emissivity rated, corrosion resistant, black coating with an emissivity level documented at .92 or higher.
- D. Emitter tube: 4 inch O.D. 16ga. A 304 grade stainless steel finished with a high emissivity rated, corrosion resistant, black coating with an emissivity level documented at .92 or higher.
- E. Burner type: Unit shall be a positive pressure power burner with a combustion fan upstream of the burner and exhaust gases for component longevity, maximum combustion efficiency, and energy transfer. Negative pressure (pull through) type appliances will not be allowed.
- F. Fan enclosure: Combustion fan shall be totally housed inside burner control box and not exposed. Appliances with exposed combustion/exhauster fans shall not be permitted.
- G. Burner: Stainless-steel venturi burner. The flame anchoring screen shall have a minimum temperature rating equivalent to 304 grade stainless steel. Non stainless steel burners shall not be permitted.
- H. Tube connections: The heater's combustion chamber and radiant emitter tube shall incorporate a 4 inch slip-fit, interlocking connection in which the upstream tube slides into the next tube and is held by a bolted clamp. A butted tube connection system shall not be permitted.
- I. Ignition system: Hot surface silicon carbide capable of temperatures achieving 2400 F. Igniter shall be readily accessible and serviceable without the use of tools. Spark ignition systems shall not be permitted.
- J. Reflectors: Shall be polished stainless steel with a multi-faceted design which includes reflector end caps. Reflector shall have a polished bright finish with clear visual reflection ability. (A sample will be required at time of submittal). Reflector shall have a minimum of 7 sheet metal bends in its fabrication to optimize downward radiation. Reflectors shall be rotatable from 0 to 45 degrees when required. The heater's reflector hanging system shall be designed to permit expansion while minimizing noise and/or rattles.

- K. Control box: Heater's exterior control chassis shall be constructed of corrosion resistant enameled steel.
1. The heater's top cover shall be constructed of ABS plastic material.
 2. Air intake: An air intake collar shall be supplied as part of the burner control assembly to accept a 4 inch O.D. supply duct.
 3. The heater's control compartment shall be accessible without the use of tools and serviceable while heater is operating.
 4. Outdoor modifications are required for any application that will be placed in space defined as outdoors. The rating label shall bear the outdoor certification approval.
- L. Heaters shall be equipped with a sight glass allowing a visual inspection of igniter and burner operation from the floor. Sight glass visible only at appliance level shall not be permitted.
- M. The heaters shall utilize a downstream turbulator baffle for maximum heat transfer.
- N. Heater shall be supplied with a stainless steel flexible gas connector.
- O. Burner Safety Controls:
1. Heater controls shall include a safety differential pressure switch to monitor combustion air flow, as to provide complete burner shutdown due to insufficient combustion air or flue blockage.
 2. The heater's control system shall be designed to shut off the gas flow to the main burner in the event either a gas supply or power supply interruption occurs.
 3. The heater's blower motor shall be thermally protected and the motor's impeller shall be balanced.
 4. Heater control assembly shall include two indicator lights. One indicator shall validate air flow. One indicator light shall indicate burner operation.
 5. The heater's air flow control system shall provide a 45 second pre-purge prior to initiating burner operation and a 90 second post-purge upon completion, effectively removing all products of combustion from heat exchanger and/or radiant tubes.
 6. No condensation shall form as a result of combustion in the combustion chamber or radiant tubes while at operating temperatures.
 7. Thermostat control shall be single-stage operating on 120 volts.
- P. Venting: shall be per manufacturer approval and specifications.
- Q. Thermostat: Devices and wiring are specified in Division 23, Section – 23 09 00.
1. Thermostat: single-stage, digital programmable wall-mounting type with 50 to 90°F (10 to 32° C) operating range.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install and connect gas-fired radiant heaters, associated fuel and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written installation instructions.

- B. Suspended units: suspend from substrate using chain hanger kits and building attachments.
- C. Maintain manufacturers' published clearances to combustibles.
- D. Adhere to manufacturers' installation instructions.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to gas-fired radiant heaters to allow service and maintenance. Refer to manufacturers' instructions for proper gas connection details.
- C. Gas Piping: comply with NFPA 54 and manufacturer's installation instructions.
- E. Vent Connections: adhere to manufacturers' installation instructions.
- D. Electrical Connections: Comply with applicable requirements in Division 26 Sections.
- E. Install electrical devices furnished with heaters but not specified to be factory mounted.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Obtain adjustment instructions from gas-fired radiant heater manufacturer before making any adjustments to burners or other heating components.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gas-fired radiant heaters. Refer to Division 01 Section – 01 00 00 General Requirements.
- B. Commissioning: Coordinate and perform duties required by Section 01 91 00 Commissioning.

END OF SECTION

SECTION 23 63 13

AIR-COOLED REFRIGERANT CONDENSERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Refrigerant piping specialties.
2. Condensing units.
3. Coordination with requirements for commissioning specified in Section 01 91 00 – Commissioning.

1.2 RELATED SECTIONS

- A. Section 23 54 00 – Furnaces.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate piping system layout.

- B. Product Data: Submit capacities, schematic layout of system, piping and electrical connections, manufacturers installation instructions, wiring diagram, loads on mounting feet, sound data and controls.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit spare parts list and recommended maintenance schedule.

1.5 QUALITY ASSURANCE

- A. Construction and Ratings: In accordance with ARI 210/240. Testing in accordance with ASHRAE 20.

- B. Performance Ratings: Energy Efficiency Ratio (EER) not less than prescribed by ASHRAE 90.1 when tested in accordance with ARI 210/240.

- C. Perform Work in accordance with the 2015 Michigan Mechanical Code.

PART 2 PRODUCTS

2.1 REFRIGERANT PIPING SPECIALTIES

A. Manufacturers:

1. The Trane Co. (**Basis of Design**)
2. Carrier Corp.
3. Substitutions: Not permitted.

B. Furnish materials in accordance with the 2015 Michigan Mechanical Code.

C. Diaphragm Packless Valves: UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and hand wheel, stainless steel spring, nylon seat disc, solder or flared ends.

D. Packed Angle Valves: Forged brass, forged brass seal caps with copper gasket, rising stem and seat, molded stem packing, solder or flared ends.

E. Packed Ball Valves: Two piece forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals.

F. Straight Line or Angle Line Type Strainers: Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass.

G. Straight Line, Non-Cleanable Type Strainers: Steel shell, copper plated fittings and stainless steel wire screen.

H. Globe Type Check Valves: Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc.

I. Straight Through Type Check Valves: Brass body and disc, phosphor bronze or stainless steel spring, neoprene seat.

J. Straight Through or Angle Type Pressure Relief Valves: Brass body and disc, neoprene seat, factory sealed and ASME stamped.

K. Solenoid Valves:

1. Valve: Pilot operated, copper or brass body and internal parts, synthetic seat, stainless steel stem and plunger assembly, with flared, solder, or threaded ends. Furnish stem allowing manual operation in case of coil failure.
2. Coil Assembly: UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires.

L. Flexible Connectors: Corrugated bronze hose with single layer of exterior braiding, minimum 9 inches (230 mm) long with copper tube ends.

2.2 CONDENSING UNITS

A. Manufacturers:

1. Trane (**Basis of Design**).
2. Carrier
3. Substitutions: Not permitted.

B. Furnish materials in accordance with the 2015 Michigan Mechanical Code.

C. Units: Self-contained, packaged, factory assembled and wired units for outdoor use consisting of cabinet, compressors, condensing coil and fans, integral sub-cooling coil, controls, liquid receiver.

D. Cabinet: Galvanized steel with baked enamel finish and removable access doors or panels with quick fasteners.

E. Compressor: Hermetically sealed, resiliently mounted compressor with positive lubrication, crankcase heater, cylinder unloaders with electric solenoids, motor overload protection, service valves, and filter drier.

F. Condenser:

1. Coil: Seamless copper tubing with aluminum fins.
2. Fans: Vertical discharge, direct drive axial fans, resiliently mounted with guard and motor.
3. Motors: Permanently lubricated ball bearing motors with built-in current and overload protection.

G. Controls:

1. High and low pressure cutouts for compressor, oil pressure control, non-recycling pump-down, and reset relay.
2. Low ambient controls.
3. Timer circuits to prevent rapid loading and unloading of compressor.

H. Performance: See schedule on drawing sheet M-901.

2.3 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Requirements for electrical characteristics:

1. 208 volts, single phase, 60 Hz.
2. 35 amperes maximum circuit breaker size.

B. Disconnect Switch: By electrical contractor.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install Work in accordance with 2015 Michigan Mechanical Code.
- B. Charge system with refrigerant and put system into operation, and test equipment performance.
Furnish cooling season startup, and winter season shutdown for first year of operation.
- C. Connect inlet and outlet of condensing units to piping as indicated on Drawings.

3.2 APPLICATION

- A. Install shut-off valve on each side of strainer.
- B. Install refrigerant charging valve connections in liquid line between receiver shut-off valve and expansion valve.
- C. Install flexible connectors near compressors connections.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Formwork.
 - 2. Reinforcement.
 - 3. Accessories.
 - 4. Cast-in place concrete.
 - 5. Finishing and curing.

1.2 SYSTEM DESCRIPTION

- A. Design, engineer and construct formwork, shoring and bracing in accordance with ACI 301 and ACI 318 to conform to design and the 2015 Michigan Building Code requirements to achieve concrete shape, line and dimension as indicated on Drawings.
- B. Vapor Retarder Permeance: Maximum 1 perm when tested in accordance with ASTM E96, Procedure A.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Indicate pertinent dimensioning, form materials, arrangement of joints and ties, location of bracing and temporary supports, schedule of erection and stripping.
 - 2. Indicate reinforcement sizes, spacing, location, and quantities, bending and cutting schedules, supporting and spacing devices.
 - 3. Indicate sidewalks, and slabs-on-grade.
- B. Product Data: Indicate admixtures, anchors, and bonding agents.
- C. Design Data: Submit mix designs.

1.4 QUALITY ASSURANCE

- A. Construct and erect concrete formwork in accordance with ACI 301 and ACI 318.
- B. Perform concrete reinforcing work in accordance with ACI 301, ACI 315, ACI 318 and CRSI Manual of Practice.
- C. Perform cast-in-place concrete work in accordance with ACI 301, ACI 318, ACI 305, and ACI 306.1.

PART 2 PRODUCTS

2.1 FORM MATERIALS AND ACCESSORIES

- A. Form Materials: At discretion of Contractor.
- B. Form Release Agent: Colorless mineral oil not capable of staining concrete or impairing natural bonding characteristics of coating intended for use on concrete.
- C. Slab Edge Joint Filler: ASTM D1751, Premolded asphaltic board, 1/2 inch thick.
- D. Vapor Retarder: ASTM E1745 Class A; 10 mil thick clear polyethylene film; type recommended for below grade application. Furnish joint tape recommended by manufacturer.

2.2 REINFORCEMENT MATERIALS

- A. Deformed and Plain Reinforcement: ASTM A615/A615M; 60 ksi yield strength, steel bars, unfinished.
- B. Welded Deformed Wire Fabric: ASTM A497; in flat sheets; unfinished.
- C. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for support of reinforcing; plastic tipped or non-corroding for supports in slabs forming finished ceilings or where supports are exposed to weather.
- D. Fabricate concrete reinforcement in accordance with CRSI Manual of Practice, ACI 301, ACI 318 and applicable code.
- E. Weld reinforcement in accordance with AWS D1.4.

2.3 CONCRETE MATERIALS

- A. Cement: ASTM C150, Normal-Type I Portland type.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Water: Clean and not detrimental to concrete.
- D. Air Entrainment Admixture: ASTM C260.
- E. Bonding Agent: Polymer resin emulsion; Resi-bond as manufactured by Dayton Superior.
- F. Non-shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

2.4 COMPOUNDS, HARDENERS AND SEALERS

- A. Absorptive Mats: ASTM C171, Cotton Fabric or Burlap-Polyethylene.
- B. Sealer: only where indicated on drawings and as specified in Section 09 90 00.

2.5 CONCRETE MIX

- A. Mix and deliver concrete in accordance with ASTM C94/C94M, Option C.
- B. Furnish concrete footings, piers, walls, and exterior slabs of the following strength:
 - 1. Compressive Strength 4500 psi (28 day) for slabs and footings.
 - 2. Slump four inches maximum. Unless otherwise specified or permitted.
 - 3. Maximum water-cement ratio: 0.45.
- C. Furnish concrete interior slabs of the following strength:
 - 1. Compressive Strength 4000 psi (28 day) for slabs.
 - 2. Slump four inches maximum. Unless otherwise specified or permitted.
 - 3. Maximum water-cement ratio: 0.45.
- D. Select admixture proportions for normal weight concrete in accordance with ACI 301.
- E. Add air entraining agent to concrete mix for all concrete work exposed to freezing and thawing cycles. (5% +/-1).

PART 3 EXECUTION

3.1 FORMWORK ERECTION

- A. Erect formwork, shoring and bracing to achieve design requirements.
- B. Provide bracing to ensure stability of formwork.
- C. Apply form release agent to formwork prior to placing form accessories and reinforcement.
- D. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings affected by agent.
- E. Clean forms as erection proceeds, to remove foreign matter.

3.2 INSERTS, EMBEDDED COMPONENTS, AND OPENINGS

- A. Provide formed openings where required for work to be embedded in and passing through concrete members.
- B. Coordinate work of other sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

- C. Install concrete accessories straight, level, and plumb.
- D. Place joint filler at perimeter of floor slab, penetrations, and isolation joints.

3.3 REINFORCEMENT PLACEMENT

- A. Place reinforcement, supported and secured against displacement.
- B. Ensure reinforcing is clean, free of loose scale, dirt, or other foreign coatings.
- C. Weld reinforcement in accordance with AWS D1.4.
 - 1. Do not weld crossing reinforcement bars for assembly except as permitted by Architect/Engineer.
- D. Space reinforcement bars with minimum clear spacing in accordance with ACI 301 and ACI 318 of one bar diameter, but not less than 1 inch.
- E. Maintain concrete cover around reinforcement in accordance with ACI 301 and ACI 318 and 2009 Michigan Building Code.

3.4 PLACING CONCRETE

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent.
- B. Install vapor retarder under interior slabs on grade in accordance with ASTM E1643. Lap joints minimum 6 inches and seal watertight.
- C. Repair damaged vapor retarder with vapor retarder material, lap over damaged areas minimum 6 inches and seal watertight.
- D. Separate slabs-on-grade from vertical surfaces with 1/2 inch thick joint filler, extended from bottom of slab to within 1/4 inch of finished slab surface.
- E. Place concrete continuously between predetermined expansion, control and construction joints. Do not break or interrupt successive pours creating cold joints.
- F. Place floor slabs in every-other lane-placement or saw cut pattern indicated.
- G. Where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and apply Epoxy Adhesive for bonding.
- H. Screed floors, and slabs-on-grade level. Slope slabs to floor drains where indicated on drawings.

3.5 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

- B. Remove formwork progressively and in accordance with code requirements.

3.6 FLOOR FINISHING

- A. Finish concrete floor slab surfaces in accordance with ACI 301, ACI 302.1, and ACI 302.2.
- B. Uniformly spread, screed, and float concrete.
- C. Steel trowel surfaces receiving carpeting, resilient flooring, seamless flooring, thin set quarry tile, thin set ceramic tile, or remaining exposed to view in finished construction.
- D. Maintain surface flatness, with maximum variation of 1/8 inch in 10 ft.
- E. In areas with floor drains, maintain floor level at walls and slope surfaces uniformly to drains.

3.7 CURING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
 - 1. Protect concrete footings from freezing for minimum 5 days.
 - 2. Concrete placed in temperatures below 32 degrees F shall be placed in accordance with ACI 306.1-90 (R2002) Cold Weather Concrete Specifications.
- B. Place absorptive matting, moisten, and keep damp.
- C. Immediately after placement, protect concrete from premature drying.
- D. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete for not less than 7 days.

3.8 FORMED SURFACES

- A. Provide concrete surfaces to be left exposed, and concrete walls with smooth rubbed finish.

3.9 ERECTION TOLERANCES

- A. Install reinforcement within tolerances required by ACI 301 and ACI 318 and 2015 Michigan Building Code.

3.10 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with ACI 301 and the 2015 Michigan Building Code Chapter 17.
- B. Reinforcement Inspection:

1. Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
- C. Strength Test Samples:
1. Sample concrete and make one set of four cylinders for every 75 cubic yards or less of each class of concrete placed each day and for every 5,000 square feet of surface area for slabs and walls.
- D. Field Testing:
1. Measure slump and temperature for each compressive strength concrete sample.
 2. Measure air content in air entrained concrete for each compressive strength concrete sample.
- E. Cylinder Compressive Strength Testing:
1. Test Method: ASTM C39.
 2. Test Acceptance: In accordance with ACI 301 and 2015 Michigan Building Code.
 3. Test one cylinder each at 7 days, 17 days, and 28 days.
 4. Retain one cylinder for days for testing when requested by Architect/Engineer.
 5. Dispose remaining cylinders when testing is not required.

3.11 DEFECTIVE CONCRETE

- A. Modify or replace concrete not conforming to required lines, details and elevations, as directed by Architect/Engineer.

END OF SECTION

SECTION 06 15 00

WOOD DECKING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes plywood structural wood decking.

1.2 SYSTEM DESCRIPTION

- A. Design roof live load: 20 psf with deflection limited to 1/240 of span.

1.3 SUBMITTALS

- A. Product Data: Submit technical data on plywood and wood treatment materials.
- B. Shop Drawings: Indicate deck framing system, loads and cambers, bearing details, framed openings and fasteners.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
 - 1. Wood Structural Panel Grading Agency: Certified by APA - The Engineered Wood Association.
 - 2. Wood Structural Panels: DOC PS 1 or DOC PS 2.
- B. Perform Work in accordance with the 2015 Michigan Building Code.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum 5 years documented experience.

PART 2 PRODUCTS

2.1 WOOD DECKING

- A. Manufacturers:
 - 1. Any Manufacturer complying with the performance specifications.

2.2 MATERIALS

- A. Plywood: APA Rated Sheathing, Structural I C-D INT-APA, Span Rating 48/24; ¾ inch thickness, un-sanded, exterior glue, tongue and groove edge.

2.3 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Fasteners: ASTM A153/A153M, hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
 - 2. Drywall Screws: Bugle head, hardened steel, power driven type, length to achieve full penetration of decking substrate.
 - 3. Anchors: Bolt or ballistic fastener for anchorages to steel.

2.4 SOURCE QUALITY CONTROL

- A. Section 01 00 00 - General Requirements: Testing, inspection and analysis requirements.
- B. Inspect Work performed at fabricator's facility to verify conformance to Contract Documents.
- C. When fabricator is approved by authority having jurisdiction, submit certificate of compliance indicating work performed at fabricator's facility conforms to Contract Documents.
 - 1. Specified shop inspections are not required for work performed by approved fabricator.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify support framing is ready to receive decking.

3.2 PREPARATION

- A. Coordinate placement of support items.

3.3 INSTALLATION - PLYWOOD DECKING

- A. Install decking perpendicular to framing members, with ends staggered over firm bearing. On sloped surfaces, lay decking with tongue upward.
- B. Engage plywood tongue and groove edges.
- C. Allow expansion space at edges and ends.
- D. Attach decking with drywall screws or ballistic fasteners, suitable for anchorage to cold formed steel trusses.
- E. Use sheathing clips at unsupported edges of plywood between supporting framing members.

3.4 ERECTION TOLERANCES

- A. Surface Flatness of Decking Without Load: 1/4 inch in 10 feet maximum, and 1/2 inch in 30 feet maximum.

3.5 SCHEDULES

- A. All Roof Deck: Plywood, as specified.

END OF SECTION

SECTION 05 44 00

PRE-ENGINEERED PRE-FABRICATED COLD-FORMED STEEL TRUSSES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pre-engineered cold-formed steel trusses.
- B. Cold-formed steel framing accessories.

1.2 RELATED SECTIONS

- A. Section 06 15 00 - Wood Decking.
- B. Section 05 12 00 – Structural Steel

1.3 DEFINITIONS

- A. Truss Component Manufacturer: The maker of the components that will be assembled into trusses by the Truss Manufacturer. See MANUFACTURERS for acceptable Truss Component Manufacturer.
- B. Truss Manufacturer: An individual or organization engaged in the manufacturing of trusses. See MANUFACTURERS for acceptable Truss Manufacturers.
- C. Truss Design Drawing: Written, graphic and pictorial depiction of an individual truss.
- D. Truss Design Engineer: Person who is licensed to practice engineering as defined by the legal requirements of the jurisdiction in which the building is to be constructed and who supervises the preparation of the truss design drawings. In this case, the Truss Design Engineer is the Truss Component Manufacturer.
- E. Truss Placement Diagram: Illustration identifying the assumed location of each Truss.

1.4 REFERENCES

- A. ANSI/AISI/COS/S100-12/S210-12: North American Specification for the Design of Cold-Formed Steel Structural Members, and Cold -Formed Steel Framing-Floor and Roof System Design; American Iron and Steel Institute.

- B. ANSI/AISI/COFS/S200-12: North American Standard for Cold-Formed Steel Framing - General Provisions.
- C. ANSI/AISI/COFS/S214-12: North American Standard for Cold-Formed Steel Framing - Truss Design.
- D. AISI/COFS - Practice Guide - CF06-1: Code of Standard Practice for Cold-Formed Steel Structural Framing; 2006.
- E. ASTM A 370-09 - Standard Test Methods and Definitions for Mechanical Testing of Steel Products; 2009.
- F. ASTM A 500-03a - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2003.
- G. ASTM A 653-09 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2009.
- H. CFSBCSI - Cold-Formed Steel Building Components Safety Information; Cold-Formed Steel Council (CFSC); 2008 edition with CFSB3 summary sheet insert.
- I. CFSEI Technical Note 551d - Design Guide for Construction Bracing of Cold-Formed Steel Trusses; Cold-Formed Steel Engineers Institute; February 1997.
- J. CFSEI Technical Note 551e - Design Guide for Permanent Bracing of Cold-Formed Steel Trusses; Cold-Formed Steel Engineers Institute; February 1998.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 00 00 General Requirements.
- B. Product Data: Truss Component Manufacturer's descriptive literature for each item of cold-formed metal framing and each accessory specified in this section.
- C. Truss Design Drawings: Detailed drawings prepared by Truss Manufacturer under the supervision of the Truss Design Engineer that are in accordance with AISI references. These drawings may also include referenced detail drawings germane to the trusses.
 - 1. Description of design criteria.
 - 2. Engineering analysis depicting member stresses and truss deflection.
 - 3. Truss member sizes and thicknesses and connections at truss joints.
 - 4. Truss support reactions.
 - 5. Top chord, bottom chord, and web bracing requirements.

- D. Truss Placement Diagram: Diagram that identifies the assumed location of each individually designated truss and references the corresponding Truss Design Drawing.
1. All truss-to-truss connections.
 2. All truss to structure (bearing) connections.
 3. Plan and details for the location of all permanent lateral and diagonal bracing and/or blocking required in the top chord, web, and bottom chord planes.
- E. Installation Instructions: Truss Component Manufacturer's printed instructions for handling, storage, and installation of each item of cold-formed metal framing and each accessory specified in this section.

1.6 QUALITY ASSURANCE

- A. Provide design of trusses by Truss Component Manufacturer, using design methodologies recommended in AISI references.
1. Determine mechanical properties of load bearing components by testing in accordance with ASTM A 370-09.
 2. Provide drawings by a design professional registered in the State in which project is to be constructed.
 3. Provide Truss Manufacturer's Truss Design Drawings.
- B. Pre-Installation Meeting: Meet at job site prior to scheduled beginning of installation to review requirements:
1. Attendees: Require attendance by representatives of the following:
 - a. Installer of this section.
 - b. General Contractor
 - c. Architect/Engineer
 - d. Other entities directly affecting, or affected by, construction activities of this section, including but not limited to, the following:
 - 1) Installer of truss support framing.
 - 2) Installer of mechanical systems.
 - 3) Installer of electrical systems.
 2. Review potential interface conflicts; coordinate layout and support provisions.

1.7 DELIVERY, STORAGE, AND HANDLING OF STEEL TRUSSES

- A. Pack, ship, handle, unload, and lift shop products in accordance with Truss Component Manufacturer's recommendations and in manner necessary to prevent damage or distortion.
- B. Store and protect products in accordance with Truss Component Manufacturer's recommendations and in manner necessary to prevent damage, distortion and moisture buildup.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Truss Component Manufacturer: TrusSteel Products from TrusSteel, An ITW Company; 6750 Forum Drive, Suite 305. Orlando, FL. Tel: (888) 565-9181. www.TrusSteel.com.
- B. Acceptable Truss Manufacturers: Truss components shall be fabricated into completed trusses by one of the following fabricators:
 - 1. Ultra-Span Truss Manufacturer. Contact Aegis Metal Framing, LLC at 1-888-902-3447, or www.Ultraspan.com for a list of authorized fabricators.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 00 00 General Requirements.
 - 1. All substitutions must be approved in writing by the Architect/Engineer.
 - 2. All applications for substitution must include samples and technical data.

2.2 COMPONENTS

- A. Pre-Engineered Pre-Fabricated Cold-Formed Steel Trusses: TrusSteel truss components by TrusSteel, An ITW Company, meeting specified requirements.
 - 1. Truss Type, Span, and Height: As indicated on drawings.
 - 2. Comply with requirements of the 2015 Michigan Building Code.
 - 3. Deflection Under Roof Live Loads: 1/240th of span, maximum.
 - 4. Comply with all loading and design criteria as indicated on the Structural drawings.
 - 5. Shop fabricate in accordance with Truss Design Drawings, using jiggling systems to ensure consistent component placement and alignment of components, and to maintain specified tolerances; field fabrication is strictly prohibited unless performed by authorized Truss Manufacturer using Truss Manufacturer's shop assemblers and proper jiggling systems.
 - 6. Shop fabrication of other cold-formed steel framing components into assemblies prior to erection is permitted; fabricate assemblies in accordance with shop drawings.
 - 7. Fasten connections within truss assembly with Truss Component Manufacturer's screws only and as shown on the Truss Design Drawings; welding and other fasteners are prohibited.
 - 8. Fabricate straight, level, and true, without rack, and to the tolerances specified in ANSI/AISI/COFS/S214-12.
- B. Truss Chord and Web Components: Truss components, with rolled or closed edges to minimize the danger of cutting during handling; chord and web components without rolled edges are prohibited.

1. Shapes, Sizes, and Thicknesses: As required to suit design and as indicated on shop drawings.
2. Chords: Cold-formed from ASTM A 653/A 653M galvanized steel sheet, minimum G60 coating; minimum yield strength of 33,000 psi (228 MPa)
 - a. Nominal 28 mil (22 GA) members:
 - 1) Minimum bare metal thickness: 0.0284 inch (0.72 mm).
 - 2) Maximum design thickness: 0.0299 inch (0.76 mm).
 - b. Nominal 33 mil (20 GA) members:
 - 1) Minimum bare metal thickness: 0.0329 inch (0.84 mm).
 - 2) Maximum design thickness: 0.0346 inch (0.88 mm).
 - c. Nominal 43 mil (18 GA) members:
 - 1) Minimum bare metal thickness: 0.0428 inch (1.09 mm).
 - 2) Maximum design thickness: 0.0451 inch (1.15 mm).
 - d. Nominal 54 mil (16 GA) members:
 - 1) Minimum bare metal thickness: 0.0538 inch (1.37 mm).
 - 2) Maximum design thickness: 0.0566 inch (1.44 mm).
 - e. Nominal 68 mil (14 GA) members:
 - 1) Minimum bare metal thickness: 0.0677 inch (1.72 mm).
 - 2) Maximum design thickness: 0.0713 inch (1.81 mm).
 - f. Nominal 97 mil (12 GA) members:
 - 1) Minimum bare metal thickness: 0.0966 inch (2.46 mm).
 - 2) Maximum design thickness: 0.1017 inch (2.58 mm).
3. Tube Webs: Cold-formed ASTM A500 steel structural tubing; minimum yield strength of 42,000 psi (290 MPa); minimum tensile strength of 58,000 psi (400 MPa).
 - a. Nominal 33 mil (20 GA) members:
 - 1) Minimum bare metal thickness: 0.033 inch (0.84 mm).
 - 2) Maximum design thickness: 0.035 inch (0.89 mm).
 - b. Nominal 47 mil (18 GA) members:
 - 1) Minimum bare metal thickness: 0.047 inch (1.19 mm).
 - 2) Maximum design thickness: 0.049 inch (1.24 mm).
 - c. Nominal 63 mil (16 GA) members:
 - 1) Minimum bare metal thickness: 0.063 inch (1.6 mm).
 - 2) Maximum design thickness: 0.065 inch (1.65 mm).
4. Rolled formed Webs: Cold-formed from ASTM A 653/A 653M galvanized steel sheet, minimum G60 coating; minimum yield strength of 33,000 psi (228 MPa).
 - a. Nominal 33 mil (20 GA) members:
 - 1) Minimum bare metal thickness: 0.0329 inch (0.84 mm).
 - 2) Maximum design thickness: 0.0346 inch (0.88 mm).

- b. Nominal 43 mil (18 GA) members:
 - 1) Minimum bare metal thickness: 0.0428 inch (1.09 mm).
 - 2) Maximum design thickness: 0.0451 inch (1.15 mm).
- c. Nominal 54 mil (16 GA) members:
 - 1) Minimum bare metal thickness: 0.0538 inch (1.37 mm).
 - 2) Maximum design thickness: 0.0566 inch (1.44 mm).

C. Fasteners Used in Fabricating Trusses: Fasteners as recommended by Truss Component Manufacturer, bearing stamp of Truss Component Manufacturer for ready identification.

D. Fabrication Tolerances:

- 1. Overall Length: Fabricate each cold-formed steel truss to the maximum allowable tolerance as follows:
 - a. Truss length up to 30 ft – ½” tolerance
 - b. Truss length over 30 ft – ¾” tolerance
- 2. Overall Height: Fabricate each cold-formed steel truss to the maximum allowable tolerance as follows:
 - a. Truss height up to 5 ft – ¼” tolerance
 - b. Truss height over 5 ft – ½” tolerance
- 3. Squareness: Fabricate each cold-formed steel truss to a maximum out-of-square tolerance of 1/8 inch (3mm).

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that bearing surfaces and substrates are ready to receive steel trusses.
- B. Verify that truss bearing surfaces are within the following tolerances:
 - 1. Variation from Level or Specified Plane: Maximum 1/8 inch in 10 feet (6 mm in 3 m).
 - 2. Variation from Specified Position: Maximum 1/4 inch (6 mm).
- C. Verify that rough-in utilities and chases that will penetrate plane of trusses are in correct locations and do not interfere with truss, bracing, or bridging placement.
- D. Inspect the conditions under which installation is to be performed and submit written notification if such conditions are unacceptable to installer.
 - 1. Notify Architect/Engineer within 24 hours of inspection.
 - 2. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited.

3. Beginning construction activities of this section indicates installer's acceptance of conditions.

3.2 INSTALLATION

- A. Install trusses in accordance with Truss Component Manufacturer's instructions and Truss Manufacturer's Truss Design Drawings and Truss Placement Diagram. Use the correct fasteners as previously described.
- B. Place components at spacings indicated on the Truss Design Drawings.
- C. Install all erection (temporary installation) bracing and permanent bracing and bridging before application of any loads; follow recommendations of the CFSBCSI - Cold-Formed Steel Building Components Safety Information.
- D. Install erection bracing - follow recommendations of the CFSBCSI - Cold-Formed Steel Building Components Safety Information.
 1. Provide bracing that holds trusses straight and plumb and in safe condition until decking and permanent truss bracing has been fastened to form a structurally sound framing system.
 2. All sub-contractors shall employ proper construction procedures to ensure adequate distribution of temporary construction loads so that the carrying capacity of any single truss or group of trusses is not exceeded.
- E. Install permanent bracing and bridging as shown in the Architect/Building Designer's drawings and notes and in the locations shown on the Truss Manufacturer's Truss Design Drawings.
- F. Removal, cutting, or alteration of any truss chord, web or bracing member in the field is prohibited, unless approved in advance in writing by the Architect/Engineer and the Truss Design Engineer.
- G. Repair or replace damaged chords, webs, and complete trusses as directed and approved in writing in advance by the Architect/Engineer and the Truss Component Manufacturer.

3.3 FIELD QUALITY CONTROL

- A. Perform Special Inspections and testing in accordance with the 2015 Michigan Building Code, Chapter 17. Refer to Section 01 00 00 General Requirements, for additional information.
- B. Fabricator Approval in accordance with Michigan Building Code Chapter 17; 1704.2.5.1; is required for all shop fabricated connections.

- C. Field Bolted Connections: Inspect in accordance with AISC specifications.
 - a. Visually inspect all bolted connections.
 - b. For Direct Tension Indicators, comply with requirements of ASTM F959.

- D. Field Welding:
 - a. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
 - b. Visually inspect all welds.
 - c. Ultrasonic Inspection: ASTM E164; perform on all full penetration welds.

- E. Correct defective bolted connections and welds.

END OF SECTION

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes non-load bearing formed steel stud exterior wall, bulkhead, soffit framing, formed steel framing, and bridging as needed to complete the Cold-Formed Steel Truss work.

1.2 SYSTEM DESCRIPTION

- A. Size components to withstand design loads as follows:
 - 1. Vertical Assembly: Per ASCE 7-10 and as indicated on structural drawings.
 - 2. Horizontal Roof Overhang Assembly: Wind loads per ASCE 7-10 and as indicated on the structural drawings.
- B. Maximum Allowable Deflection: 1: 360 of span.
- C. Wall System:
 - 1. Design to AISI.
 - 2. Design to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
- D. Design system to accommodate:
 - 1. Construction tolerances, deflection of building structural members, and clearances of intended openings.
 - 2. Expansion and contraction of members and building movement without damage to connections or members.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Indicate component details, framed openings, bearing, anchorage, loading, welds, type and location of fasteners, and accessories or items required of related work.
 - 2. Indicate stud, and ceiling joist layout.
 - 3. Provide calculations for loadings and stresses of framing sealed by Professional Structural Engineer registered in the State of Michigan.
- B. Product Data: Describe materials and finish, product criteria, and limitations.

1.4 QUALITY ASSURANCE

- A. Calculate structural properties of framing members in accordance with AISI.

- B. Furnish framing materials in accordance with SSMA - Product Technical Information.
- C. Perform Work in accordance with the following:
 - 1. Framing: AISI S-100, S-220, and S-240.
 - 2. Headers: AISI S-100, S-212, S-220, and S-240.
 - 3. Wall Studs: AISI S-100, S-220, and S-240.
 - 4. Lateral Design: AISI S-213
- D. Design framing under direct supervision of Professional Engineer experienced in design of this Work and licensed in the State of Michigan.
- E. Perform Work in accordance with the 2009 Michigan Building Code.

PART 2 PRODUCTS

2.1 COLD FORMED METAL FRAMING

- A. Manufacturers:
 - 1. Clark Western, 362 Structural Studs, in accordance with structural drawings.
 - 2. Marino Ware Structural Studs.
 - 3. Dietrich, Structural Studs.
 - 4. Unimast Inc. Structural Studs.
 - 5. Substitutions: Permitted.

2.2 FRAMING COMPONENTS

- A. Steel Sheet: ASTM A1003/A1003M; Structural Grade, Type H, Galvanized coating.
 - 1. Grade: As required by performance requirements or as indicated on structural drawings.
 - 2. Coating: G60.
- B. Studs: Steel sheet, formed to channel shape, solid web, size as indicated on drawings or as required by performance specifications.
- C. Track: Steel sheet, formed to channel shape; same width as studs, tight fit; solid web.

2.3 ACCESSORIES

- A. Bracing, Furring, Bridging, Plates, Gussets, Clips: Formed sheet steel, thickness determined by performance requirements specified; same finish as framing members.
- B. Screws: Hot dip galvanized, self drilling, self tapping.
- C. Anchorage Devices: Power actuated or Drilled expansion bolts.
- D. Welding: In accordance with AWS D1.1 and AWS D1.3.
- E. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20, Type I Inorganic.

2.4 FABRICATION

- A. Fabricate assemblies of sizes and profiles required; with framing members fitted, reinforced and braced.
- B. Fit and assemble in largest practical sections for delivery to site, ready for installation.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify substrate surfaces and building framing components are ready to receive work.

3.2 ERECTION OF STUDS

- A. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners or by welding at maximum 24 inches oc.
- B. Place studs at spacing as indicated on drawings. Connect studs to tracks using fastener or welding method.
- C. Construct corners using minimum three studs. Double stud at wall openings, door and window jambs.
- D. Erect load bearing studs as one piece full length. Splicing of studs is not permitted.
- E. Allow for deflection, directly below horizontal building framing for non-load bearing framing.
- F. Attach cross studs to studs for attachment of fixtures anchored to walls and for attachment of mechanical and electrical items within walls.
- G. Touch-up field welds and damaged metallic coatings surfaces with primer to match shop coating.

3.3 ERECTION OF SOFFIT FRAMING

- A. Make provisions for erection stresses. Provide temporary alignment and bracing.
- B. Place purlins as indicated on drawings. Connect joists to supports using fastener or welding method.
- C. Set components parallel and level, with lateral bracing and bridging.
- D. Locate component end bearing directly over load bearing studs or provide load distributing member to top of stud track.
- E. Touch-up field welds and damaged metallic coatings surfaces with primer to match shop coating.

3.4 TOLERANCES

- A. Maximum Variation from Indicated Position: 1/4 inch.
- B. Maximum Variation of Member from Plane: 1/4 inch.

3.5 SCHEDULE

- A. Exterior walls above masonry at eaves, as back-up to Fiber Cement Siding on plywood sheathing.
- B. Underside of roof overhang at eaves, to receive vented soffit panels.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Structural shapes.
 - 2. Channels and angles.
 - 3. Hollow structural sections.
 - 4. Structural plates and bars.
 - 5. Fasteners, connectors, and anchors.
 - 6. Grout.
 - 7. All Architecturally Exposed Structural Steel outdoors at overhead door frames, lintels, and columns to be galvanized & painted.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate sizes, spacing, and locations of structural members, openings, connections, and welded connections.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
 - 1. AISC Code of Standard Practice for Steel Buildings and Bridges.
 - 2. AISC Seismic Provisions for Structural Steel Buildings.
 - 3. RCSC Specification for Structural Joints Using High Strength Bolts.
- B. Perform Work in accordance with the 2015 Michigan Building Code.

1.4 QUALIFICATIONS

- A. Fabricator: Company specializing in performing work of this section with minimum ten years documented experience with the following current AISC Certification:
 - 1. Standard Steel Building Structures (STD).
 - 2. Conventional Steel Building Structures (SBD).
 - 3. Complex Steel Building Structures (CBD).
- B. Erector: Company specializing in performing work of this section with minimum ten years documented experience with the following current AISC Certification:
 - 1. Certified Steel Erector (CSE).
 - 2. Advanced Certified Steel Erector (ACSE).
- C. Shop Painter: Company specializing in performing work of this section with minimum ten years documented experience with the following current AISC Certification:
 - 1. Sophisticated Paint Endorsement - Enclosed (P1).

2. Sophisticated Paint Endorsement - Covered (P2).
 3. Sophisticated Paint Endorsement - Outside (P3).
- D. Welders and Welding Procedures: AWS D1.1 qualified within previous 12 months.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

- A. Structural W-Shapes: ASTM A992/A992M; Grade 50.
- B. Channels and Angles: ASTM A36/A36M.
- C. Square and Rectangular Hollow Structural Sections: ASTM A500, Grade B.
- D. Structural Pipe: ASTM A53/A53M, Grade B.
- E. Structural Plates and Bars: ASTM A36/A36M.
- F. Structural S-Shapes: ASTM A36/A36M; Grade 50.
- G. Round Hollow Structural Sections: ASTM A500/A500M, Grade B.

2.2 FASTENERS, CONNECTORS, AND ANCHORS

- A. High Strength Bolts: ASTM A325; Type 1.
 1. Finish: Unfinished.
- B. Nuts: ASTM A563 heavy hex type.
 1. Finish: Unfinished.
- C. Washers: ASTM F436; Type 1, circular.
 1. Finish: Unfinished.
- D. Anchor Rods: ASTM F1554; Grade 36.
 1. Shape: Straight.
- E. Threaded Rods: ASTM A36/A36M.
 1. Finish: Unfinished.

2.3 WELDING MATERIALS

- A. Welding Materials: AWS D1.1; type required for materials being welded.

2.4 ACCESSORIES

- A. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing minimum compressive strength of 7,000 psi at 28 days.
- B. Shop Primer: SSPC Paint 15, Type 1, red oxide for plain steel.
- C. Touch-Up Primer: Match shop primer.
 - 1. Interior Anti-Corrosive Paints: Maximum volatile organic compound content in accordance with GC-03.
 - 2. Zinc chromate type for galvanized steel.

2.5 FABRICATION

- A. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- B. Fabricate connections for bolt, nut, and washer connectors.
- C. All architecturally exposed steel shall be fabricated and erected in accordance with AISC Code of Standard Practice for Steel Buildings and Bridges, Section 10 – “Architecturally Exposed Structural Steel”; and AESS Supplement – “Architecturally Exposed Steel”; and NOMMA Guideline 1, Joint Finish 1 – No Evidence of Weld.

2.6 FINISH

- A. Prepare structural component surfaces in accordance with SSPC SP 3.
- B. Shop prime structural steel members. Do not prime surfaces that will be field welded, in contact with concrete, or high strength bolted.
- C. Architecturally Exposed Structural Steel shall be finished by qualified shop painter in accordance with paragraph 1.4, C, 3.
- D. Galvanizing: ASTM A123/A123M; hot dip galvanize after fabrication. (Exterior Exposed Steel)
- E. Galvanizing for Bolts, Connectors, and Anchors: (Exterior Exposed Steel)
 - 1. Hot-Dipped Galvanizing:
 - a. Bolts, Nuts, and Washers: ASTM F2329.
 - b. Connectors and Anchors: ASTM A153/A153M.
 - 2. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

2.7 SOURCE QUALITY CONTROL AND TESTS

- A. Shop test bolted and welded connections as specified for field quality control tests.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify bearing surfaces are at correct elevation.
- B. Verify anchors rods are set in correct locations and arrangements with correct exposure for steel attachment.

3.2 PREPARATION

- A. Furnish templates for installation of anchor rods and embedments in concrete and masonry work.

3.3 ERECTION

- A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.
- B. Field weld components as indicated on drawings.
- C. Do not field cut or alter structural members without approval of Architect/Engineer.
- D. After erection, touch up welds and abrasions to match shop finishes.

3.4 GROUT INSTALLATION

- A. Shim bearing plates and equipment supports to proper elevation, snug tighten anchor bolts.
- B. Fill void under bearing surface with grout. Install and pack grout to remove air pockets.
- C. Moist cure grout.
- D. Remove forms after grout is set. Trim grout edges to form smooth surface, splayed 45 degrees.
- E. Tighten anchor bolts after grout has cured for a minimum of 3 days.

3.5 FIELD QUALITY CONTROL

- A. Perform Special Inspections and testing in accordance with the 2015 Michigan Building Code, Chapter 17. Refer to Section 01 00 00 General Requirements, for additional information.
- B. Bolted Connections: Inspect in accordance with AISC specifications.
 - 1. Visually inspect all bolted connections.

2. For Direct Tension Indicators, comply with requirements of ASTM F959. Verify that gaps are less than gaps specified in Table 2.
- C. Welding:
1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
 2. Visually inspect all welds.
 3. Ultrasonic Inspection: ASTM E164; perform on all full penetration welds.
- D. Correct defective bolted connections and welds.

END OF SECTION