

**ADDENDUM NO. 1
TO THE
BIDDING DOCUMENTS
FOR
EECBG, MPS SOLAR ELECTRIC AND WATER HEATING PROJECTS
(SITE NO. 12) BAY VIEW H.S. - 2751 S. LENOX STREET
(SITE NO. 29) RIVERSIDE H.S. - 1615 E. LOCUST STREET
Milwaukee, Wisconsin
Project Number AR1500310020
Official Notice No. 37**

DATE: March 8, 2012

BIDS CLOSE: March 12, 2012 at 10:30 a.m. Local Time

TO ALL BIDDERS BIDDING ON THE ABOVE PROJECT:

All Bidders submitting a Bid on the above Contract shall carefully read this Addendum and give it consideration in the preparation of their Bid.

I. The following are revisions to the Specifications:

1. The following revisions shall be made to SECTION 01010 – SUMMARY OF WORK:

A. Page 01010-3, Subparagraph 2.F., add the following :

"18. All installing contractors at both sites shall be NABCEP certified.

19. Installing contractor for each installation shall coordinate with Milwaukee Shines to be present for two separate question and answer sessions with students at each project location (maximum 1-1/2 hours per session)."

2. The following revisions shall be made to SECTION 16060 - GENERAL ELECTRICAL REQUIREMENTS:

A. Page 16060-3, Paragraph 1.5 Quality Assurance, add the following:

"E. Installing contractor for non-residential solar electric system shall be NABCEP certified."

B. Page 16060-13, Article 3.10 COMMISSIONING, TESTS AND ACCEPTANCE, add the following:

"H. Include standard setup for Sun Report Web 2.0.

I. Final connection to existing communicate system by Owner.

J. Installing contractor shall coordinate with Milwaukee Shines to be present for two separate question and answer sessions with students at the project location (maximum 1-1/2 hours per session)."

3. Delete the following specification sections in their entirety and replace with new specification sections with same name and section number. Revisions within each section are indicated with track changes (bar in margin, strike-outs for deletions and underlining for additions).

"SECTION 15400 - PLUMBING GENERAL REQUIREMENTS" (A1-15400-1 thru A1-15400-19)
SECTION 15450 - PLUMBING EQUIPMENT (A1-15450-1 thru A1-15450-12)
SECTION 16800 - PHOTOVOLTAIC POWER GENERATION SYSTEM (A1-16800-1 to A1-16800-5)
SECTION 16810 PHOTOVOLTAIC POWER GENERATION SYSTEM INVERTERS" (A1-16810-1 to A1 16810-4)"

II. The following are revisions to the Drawings:

1. Delete Bay View related Drawings B-P-03, B-P-04, B-P-05, B-P-13, B-P-14, B-E-01, B-E-05, B-E-06 and replace with revised drawings attached Drawings B-P-03, B-P-04, B-P-05, B-P-13, B-P-14, B-E-01, B-E-05, B-E-06.
2. Delete Riverview related Drawings R-E-01, R-E-02, R-E-03 and replace with revised drawings attached Drawings R-E-01, R-E-02, R-E-03.
3. Revisions are indicated with "cloud" symbols.

III. Any revisions to any of the Contract Documents made by this Addendum shall be considered as the same revision to any and all related areas of the Contract Documents not specifically called out in this Addendum.

IV. The Bidder shall acknowledge receipt of this Addendum as instructed elsewhere in the transmittal.

AECOM
SHEBOYGAN, WISCONSIN

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GENERAL PLUMBING REQUIREMENTS

SECTION 15400

PLUMBING GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 SCOPE

- A. Drawings and general provisions of Contract, including Bidding Requirements, General Requirements and Conditions applying to this section.
- B. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections.
- C. Included are the following topics:
 - 1. Scope
 - 2. Related Documents
 - 3. Reference Standards
 - 4. General Description of Work
 - 5. Quality Assurance
 - 6. Substitutions
 - 7. Discrepancies
 - 8. Codes and Regulations
 - 9. Permits and Inspections
 - 10. Visiting the Site and Existing Conditions
 - 11. Temporary Utilities
 - 12. Continuity of Existing Services
 - 13. Protection of Work
 - 14. Safety Measures And Accident Prevention
 - 15. Damage
 - 16. Work by Others
 - 17. Roof Work
 - 18. Hazardous Substance - Asbestos
 - 19. Hazardous Substance - Lead Paint
 - 20. Sound Criteria
 - 21. Submittals
 - 22. Guarantees and Warranties
 - 23. Alternate Bids
 - 24. Materials and Products

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25. Access Panels and Doors
26. Identification
27. Installation
28. Demolition
29. Delivery, Storage and Handling
30. Excavation and Backfill
31. Concrete Work
32. Cutting, Patching and Painting
33. Ceiling Removal and Replacement
34. Building Access for Apparatus
35. Equipment and Panel Accessibility
36. Coordination
37. Identification
38. Cleaning of Equipment, Materials and Site
39. Lubrication
40. Factory Start-up Of Equipment
41. Training of MPS Personnel
42. Commissioning

1.2 RELATED DOCUMENTS

- A. New plans and details.
- B. Existing plans used for reference.
- C. The plans and specifications of the following divisions:
 1. Division 16000 - Electrical
- D. The following sections of Division 15400 are considered related documents:
 1. Section 15400 - Plumbing General Requirements
 2. Section 15401 - Plumbing Pipe and Pipe Fittings
 3. Section 15410 - Plumbing Valves
 4. Section 15412 - Plumbing Piping Specialties
 5. Section 15414 - Plumbing Hangers, Supports And Anchors
 6. Section 15415 - Plumbing Openings, Sleeves and Fire Stopping
 7. Section 15417 - Plumbing Motors, Starters, Disconnects and Control Wiring
 8. Section 15426 - Plumbing Systems Insulation
 9. Section 15430 - Plumbing Specialties

GENERAL PLUMBING REQUIREMENTS

10. Section 15440 - Plumbing Fixtures
11. Section 15450 - Plumbing Equipment

1.3 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in this and other sections are as follows:

1. ABMA American Boiler Manufacturers Association
2. ACPA American Concrete Pipe Association
3. AGA American Gas Association
4. AMCA Air Movement and Control Association
5. ANSI American National Standards Institute
6. ARI Air Conditioning and Refrigeration Institute
7. ASME American Society of Mechanical Engineers
8. ASSE American Society of Sanitary Engineering
9. ASTM American Society for Testing and Materials
10. AWWA American Water Works Association
11. AWS American Welding Society
12. CISPI Cast Iron Soil Pipe Institute
13. CGA Compressed Gas Association
14. CS Office Commercial Standards, Products Standards Sections, of Engineering Standards Service, NBS
15. DOC State of Wisconsin Department of Commerce
16. EPA Environmental Protection Agency
17. FS Federal Specifications, Superintendent of Documents, U.S. Government Printing Office
18. GAMA Gas Appliance Manufacturers Association
19. IAPMO International Association of Plumbing & Mechanical Officials
20. IEEE Institute of Electrical and Electronics Engineers
21. ISA Instrument Society of America
22. MCA Mechanical Contractors Association
23. MICA Midwest Insulation Contractors Association
24. MSS Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
25. NBS National Bureau of Standards
26. NEC National Electric Code
27. NEMA National Electrical Manufacturers Association

GENERAL PLUMBING REQUIREMENTS

28. NFPA National Fire Protection Association
29. NSF National Sanitation Foundation
30. PDI Plumbing and Drainage Institute
31. SMACNA Sheet Metal and Air Conditioning Contractors' National Association. Inc.
32. STI Steel Tank Institute
33. UL Underwriters Laboratories Inc.

B. These Specific Standards:

1. ACI 614 Recommended Practice for Measuring, Mixing and Placing of Concrete
2. ASTM D1557 Standard Test Method for Moisture-Density Relations of Soils
3. Standard Specifications for Road and Bridge Construction, State of Wisconsin, Dept. of Transportation
4. ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
5. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
6. UL1479 Fire Tests of Through-Penetration Fire-stops
7. UL723 Surface Burning Characteristics of Building Materials
8. NFPA 70 National Electric Code (NEC)
9. NFPA 72 Smoke Detection
10. NFPA 54 Gas Piping
11. NFPA 96 Commercial cooking equipment ventilation systems.
12. NFPA 211 Gas Vents

1.4 GENERAL DESCRIPTION OF WORK

- A. See Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).
- B. The intent of these construction documents is to indicate a 100% complete plumbing system as specified herein and as shown on the drawings.
- C. Minor demolition work is expected to be part of this project other than connection points to existing systems.
- D. The project installs a solar thermal system to preheat domestic cold water. The base bid is for a 32 collector pressurized system and the alternate bid is for a 16 collector pressurized system in lieu of the 32 collector system.
- ~~D.E.~~ Installing contractor must be a NABCEP certified installer.

GENERAL PLUMBING REQUIREMENTS

1.5 QUALITY ASSURANCE

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).
- B. Unless specifically stated elsewhere, all equipment, materials and articles incorporated in the Work are to be new and of the best grade of their respective kinds for the purpose.
- C. All equipment requiring electrical connections must be rated by some third party testing agency, such as Underwriters Laboratories.

1.6 SUBSTITUTIONS

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).

1.7 DISCREPANCIES

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).

1.8 CODES AND REGULATIONS

- A. Comply with the following codes and standards for all Plumbing work:
 - 1. Wisconsin Administrative Code
 - 2. DSPS Chapter 382 for Design, Construction, Installation, Supervision and Inspection of Plumbing
 - 3. DSPS Chapter 384 for Plumbing Products
 - 4. City of Milwaukee Code
 - 5. Department of Public Works
 - a) Milwaukee Water Works
 - b) Milwaukee Sewer Department
 - 6. Milwaukee Metropolitan Sewage Department (MMSD)

1.9 PERMITS AND INSPECTIONS

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).
- B. Furnish one (2) copies of all permits and certificates to the Construction Project Inspector who will:
 - 1. Keep one on site and turned-over to MPS at the completion of the project.
 - 2. Turn over one to the MPS Plan Room for their records.

GENERAL PLUMBING REQUIREMENTS

- C. Prior to beginning work, the Contractor shall provide one (1) set of stamped; City approved drawings to the Construction Project Inspector to be kept in the Construction Office or other agreed sites.
- D. If Section 15400 Contractor performs any of the Work, knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Engineer or the Construction Project Inspector, that Contractor then shall bear all costs associated from the violation.

1.10 VISITING THE SITE AND EXISTING CONDITIONS

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).
- B. MPS does not guarantee the integrity of existing valves and/or stops at the site. If it becomes necessary to modify existing valves or install additional valves to assure the integrity of the system during construction, it shall be the responsibility of this Contractor to pay for such modifications or additions.

1.11 TEMPORARY UTILITIES

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).

1.12 CONTINUITY OF EXISTING SERVICES

- A. Do not interrupt or change existing services without prior written approval from the Construction Project Inspector.
- B. If an interruption is required, coordinate the down-time with the Building Engineer and the Construction Project Inspector to minimize disruption of the building's activities.
- C. Refer to "Standard General Conditions of the Contract", specifically Article 23.
- D. Unless specifically stated in writing, all work involved in interrupting or changing existing services is to be done during normal working hours.
- E. To minimize disruption to the school, any interruption to the services of the school must be completed during hours when the school is unoccupied. Verify school schedule with Construction Project Inspector.
- F. This Contractor must include all fees, overtime, etc., to complete the project according to the schedule indicated.

1.13 PROTECTION OF WORK

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).

GENERAL PLUMBING REQUIREMENTS

1.14 SAFETY MEASURES AND ACCIDENT PREVENTION:

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).

1.15 DAMAGE

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).

1.16 HAZARDOUS SUBSTANCE - ASBESTOS

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).
- B. The presence, location and quantity, of known asbestos materials are contained in the MPS Management Plan, located in the Building Engineer's Office. It shall be the responsibility of all Contractors involved in this project to review this document prior to submitting their respective bid.
- C. Airborne asbestos fibers and similar dust have been determined to be hazardous to your health.

1.17 HAZARDOUS SUBSTANCE - LEAD PAINT

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).
- B. The existing building finishes may contain lead based paint, which, if improperly handled, could be a potential health hazard.

1.18 SOUND CRITERIA

- A. All equipment to be installed as part of this project shall meet or be less ~~then~~than the sound criteria indicated in individual specification sections.
- B. Refer to the ANSI Standard S12.60-2002 - Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools. Maximum background sound level of 35 dBA for classrooms less or equal to 20,000 FT³ and 40 dBA for classrooms greater than 20,000 FT³.
- C. Equipment located outside shall comply with the City of Milwaukee ordinance 80-63 through 80-74 with regards to noise.
- D. Where equipment or fixtures will not meet the City of Milwaukee noise ordinance, additional sound shielding shall be provided at no additional cost to MPS.

GENERAL PLUMBING REQUIREMENTS

1.19 SUBMITTALS

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).
- B. See Section 01300, "Submittals".
- C. See Section 01700, "Project Closeout".
- D. Shop Drawings
 - 1. Shop drawings must be sent within 30 days of receipt of the purchase order. Final (approved or conditionally approved) shop drawings must be sent within 60 days of receipt of the purchase order. Failure to meet indicated deadlines may result in rejection of equipment or fixtures and/or materials.
 - 2. Submit for all equipment, fixtures and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment, fixtures by name and/or number, as indicated in the contract documents. Include wiring diagrams of electrically powered equipment.
 - 3. **For all equipment submit complete custom tailored made shop drawings** showing all required field wiring, piping connections, all auxiliary equipment and device locations, safety device locations, etc.
 - 4. Shop drawings for equipment and fixtures must include data concerning dimensions, capacities, materials of construction, ratings, weights, manufacturer's written installation requirements, manufacturer's performance limitations, and appropriate identification.
 - 5. Before submitting electrically powered equipment, verify that the electrical power and control requirements for the equipment are in agreement with the electrical drawings and existing electrical requirements at the building.
 - 6. Not more than two weeks after award of contract, but before any shop drawings are submitted; contractor shall submit the piping system data sheet for each piping service on the project. List material type, service, ASTM number, schedule or pressure class, joint type, manufacture and model number where appropriate.
 - 7. As a minimum, submit sufficient quantities of shop drawings to allow the following distribution:
 - a) Operating and Maintenance Manuals 2
 - b) MPS Records – Joe Gorecki 1
 - c) Engineer 2
 - d) Contractor 2
 - 8. Provide additional sets of shop drawings, diagrams, etc. as required by the other Contractors.

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E. Operating And Maintenance Instructions:

1. Assemble material in three-ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment or fixtures.
2. In addition to the data indicated in the General Requirements, include the following information:
 - a) Copies of all approved shop drawings.
 - b) Copies of "Record Drawings" drawings. (See Record Drawings in this section)
 - c) Copies of Owner Purchased equipment or fixtures O&M Manuals and Shop Drawings.
 - d) Manufacturer's wiring diagrams for electrically powered equipment.
 - e) Records of tests performed to certify compliance with system requirements.
 - f) Certificates of inspection by regulatory agencies.
 - g) Temperature control record drawings and control sequences.
 - h) Parts lists for manufactured equipment or fixtures.
 - i) Valve schedules.
 - j) Lubrication instructions, including list/frequency of lubrication done during construction.
 - k) Warranties.
 - l) Additional information as indicated in the technical specification sections.

F. Record Drawings

1. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).
2. Include copies of these record drawings with the Operating and Maintenance manuals.
3. As-built record Drawing, showing dimensions, locations and depth of all buried and concealed piping, plugged outlets and equipment shall be kept up-to-date, Master copy shall be kept on the job.

1.20 GUARANTEE AND WARRANTIES

- A. All materials, components, devices, etc. provided and/or installed shall be guaranteed for a period of one year from the date of acceptance. Should any trouble develop during this period due to defective materials, components, devices, etc or faulty workmanship, this Contractor shall furnish all necessary labor and materials to correct the trouble without any cost to the Owner.
- B. All equipment and fixtures provided and/or installed shall be guaranteed for a period of one year from the date of acceptance of the work. Should any trouble develop during this period due to defective equipment, fixtures and/or components, the equipment or fixtures manufacturer or representative shall furnish all necessary components, labor, materials and replacement equipment or fixtures to correct the trouble without any cost to the Owner.

GENERAL PLUMBING REQUIREMENTS

- C. Any defective equipment, fixtures, materials, components, devices, etc. noticed at time of installation and/or during the guarantee period shall be corrected immediately to the entire satisfaction of the Owner.
- D. The guarantee date for equipment and fixtures placed in operation shall be mutually agreed to by the Contractor and the Owner.
- E. Provide extended warranties as specified in the individual technical sections.

1.21 ALTERNATE BIDS

- A. See Bid Form.
- B. For systems and equipment or fixtures specified as alternate bids, provide all associated piping, valves, specialties, accessories, insulation, water treatment, controls, control wiring, motor starters, etc.

PART 2 PRODUCTS

2.1 MATERIALS AND PRODUCTS

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).

2.2 ACCESS PANELS AND DOOR

- A. **Lay-In Ceilings**: Sufficient for access.
- B. **Concealed Spline Ceilings**: Removable sections of ceiling tile held in position with metal slats or tabs compatible with the existing ceiling system.
- C. **Metal Pan Ceilings**: Removable sections of ceiling tile held in position by a pressure fit compatible with existing ceiling system.
- D. **Plaster Walls and Ceilings**: 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public areas, U.L. listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment or fixture needing service; minimum size is 12" x 12".
- E. If access panel is to be installed in a fire rated wall or ceiling, the access panel shall have the same rating.
- F. Provide access panels and as required.

2.3 IDENTIFICATION

- 1. Equipment and Devices above accessible ceilings.
- 2. For equipment and devices above accessible ceilings, provide and install self adhesive plastic tape with ½" high black letters indicating item, on

GENERAL PLUMBING REQUIREMENTS

accessible ceiling t-bars, adjacent to item according to the following schedule:

<u>Item</u>	<u>Label</u>
Shut-off Valve	VALVE
Circuit Setter/Balance Valve	FLOW CONTROL

3. Provide a minimum of 10 extra stickers of each designation to the “Building Engineer” and a written designation of what each sticker represents at the Training session.

B. Equipment in Mechanical Rooms/Basement Tunnel

1. Plates shall be equal to Setonply Style 2060 by Seton or similar style by W.H Brady or MSI.
2. Engraved white letters on a black or red background, 1/16” thick plastic laminate, beveled edges with screw or rivet mounting.
3. All plates must be similar per project. Locate nameplates at or near “eye-level” (66” above floor). Nameplates must match equipment schedule on drawings. If self-adhesive plates are used, provide additional screws or rivets to assure panels will not fall off equipment.

C. Piping

1. Label and banding shall be equal to W.H. Brady, MSI or Seton.
2. Letters shall be a minimum of 3/4” high and state pipe size, contents and directional flow arrows (Example: 2” COLD WATER →). Banding tape color code piping according to the industry standard. Identification shall be applied after pipe and/or covering is painted Tape shall completely circumference the pipe with a 3” minimum overlap.
3. Identify piping not less than once every 30 feet, not less than once in each room, adjacent to each access door or panel, and on both sides of the partition where exposed piping passes through walls, floors or roofs. Place flow directional arrows at each pipe identification location.

D. Valves:

1. Tags shall be equal to those manufactured by EMED Co., Seton MSI or W. H. Brady.
2. Provide round brass tags with 1/2 inch numbers or round color coded PVC tags with 1/2 inch white engraved numbers, 1/4 inch system identification abbreviation, 1 1/4 inch minimum diameter, with brass jack chains or brass “S” hooks around the valve stem.
3. Identify valves with brass tags bearing system identification and a valve sequence number. Valve tags are not required at a terminal device unless the valves are greater than ten feet from the device or located in another room not visible from the terminal unit. Provide a typewritten valve schedule indicating the valve number and the equipment or areas supplied by each valve; locate schedules in each mechanical room and in each Operating and Maintenance manual. Schedules in mechanical rooms to be framed under clear plastic.

GENERAL PLUMBING REQUIREMENTS

- E. Starters and Control Panels:
 - 1. Nameplates shall be equal to those manufactured by W.H. Brady, MSI or Seton.
 - 2. Engraved 3/4" high white letters on a black or red background, 1/16" thick plastic laminate, beveled edges with screw or rivet mounting.
 - 3. Nameplates must match the equipment they serve. If self-adhesive plates are used, provide additional screws or rivets to assure panels will not fall off equipment.
- F. **Access Panels and Doors:** Provide and install self-adhesive plastic tape with 1/2" high black letters. Label shall match the equipment of item for which the panel or door has been provided.
- G. **Exposed equipment, not in mechanical rooms** such as backflow preventers, pumps, water heaters, etc. with self adhesive plastic tape with 1/2" high black letters. Labels must match equipment schedules on drawings.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install all fixtures, equipment and materials in accordance with manufacturer's written instructions.
- B. Field verify all existing conditions. Do not proceed with work if existing conditions are different than what is shown on the drawings. Notify the **Construction Observation Inspector** of all discrepancies between actual field conditions and what is shown on the drawings.
- C. Avoid installing fixtures, equipment, piping, etc. which interferes with service clearances of existing or new electrical equipment and panels. Comply with all service clearance requirements of the National Electric Code.

3.2 DEMOLITION

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).
- B. Perform all demolition as indicated on the drawings to accomplish new work. All demolition work shall be accomplished by workmen skilled in the trade involved, i.e., electrical work by licensed electricians, piping by steamfitters, etc.
- C. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize the amount of contamination of the occupied space. Where pipe is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with the Construction Observation Inspector to minimize disruption to the existing building occupants.

GENERAL PLUMBING REQUIREMENTS

- D. All pipe, fixtures, equipment, wiring and associated conduit, insulation, and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor except as specifically noted otherwise.
- E. MPS reserves right of first refusal on ALL discarded fixtures, and related trim unless specified. Contact the Construction Observation Inspector to allow the shop to mark or otherwise indicate which fixtures, etc. will be set aside for reclamation. All care possible must be exercised when removing prearranged indicated (saved) items, to minimize breakage. The Demolition contractor must prearrange a site of recovery for saved items.

3.3 DELIVERY, STORAGE AND HANDLING

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).
- B. The Contractor shall confine his equipment, apparatus, the storage of materials and operations of his workmen to limits indicated by law, ordinances, permits, or Construction Observation Inspector and shall not encumber the premises with his materials. In general, all material and equipment shall be stored in such manner as to avoid damage to living trees, shrubs, lawns and other ornamental growths. The Contractor shall not load or permit any part of the structure to be loaded with a weight that will endanger its integrity.
- C. Contractor shall confine his equipment; storage of materials and operations of his workmen to limits indicated by directions of the Construction Project Inspector and shall not bring materials onto the site until reasonably required for progress of the Work.
- D. Owner assumes no responsibility for materials, tools, equipment, and rentals stored in buildings or on site. Contractor assumes full responsibility for damage due to storing of any type of materials and equipment.
- E. Promptly inspect shipments to insure that the material and equipment are undamaged and comply with specifications.
- F. Cover all materials to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade.
- G. All equipment must be storage in a facility, which provides shelter from the weather.
- H. Protect all materials, pipe, tube, fittings, equipment, components, etc. so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect materials, fittings, flanges, unions, components shipped loose, etc. by storage inside or by durable, waterproof, aboveground packaging.
- I. Store and handle equipment in accordance with manufacturer's instructions.
- J. Storage and protection methods must allow inspection to verify products.

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- K. Offsite storage agreements will not relieve the contractor from using proper storage techniques.
- L. Install lines passing under foundations with minimum of 1½” clearance to concrete and insure there is no disturbance of bearing soil.
- M. Bed pipe up to a point 12” above the top of the pipe. Take care during bedding, compaction and backfill not to disturb or damage piping.
- N. Mechanically compact bedding and backfill to prevent settlement. The initial compacted lift to not exceed 24” compacted to 95% density per Modified Proctor Test (ASTM D-1557). Subsequent lifts under pavements, curbs, walks and structures are not to exceed 12” and be compacted to 95% density per Modified Proctor Test. In all other areas where construction above the excavation is not anticipated within 2 years, mechanically compact backfill in lifts not exceeding 24” to 90% density per Modified Proctor Test. Route the equipment over each lift of the material so that the compaction equipment contacts all areas of the surface of the lift.

3.4 CUTTING, PATCHING AND PAINTING

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).
- B. Provide all cutting and patching as necessary to permit installation of piping, equipment or any other part of the work under this Section.
- C. See Section 15415, Plumbing Openings, Sleeves and Firestopping.
- D. Patching includes repairing the openings remaining from the removal or relocation of existing system components and painting the surface to match existing surfaces unless indicated to be done by other trades.
- E. Painting means covering the entire patched surface equal to the surrounding surfaces unless indicated to be done by other trades.
- F. Paint all exposed piping, fittings, supports, fasteners, etc. install on or near floor, located outside or installed in a moisture-laden environment with (2) coats of rustproof paint.

3.5 CEILING REMOVAL AND REPLACEMENT

- A. Provide all removal and replacement of existing ceilings, lighting, etc., required for the installation of the plumbing work in unremodeled areas.
- B. In areas with accessible ceilings, ceiling tile shall be removed and stored to prevent damage of soiling and reinstalled after completion of the work. Soiled or damaged tiles shall be replaced subject to the approval of the Construction Project Inspector.
- C. In areas with drywall or plaster ceilings, the ceiling shall be removed as required for the work and repaired and refinished equal to existing subject to the approval of the Construction Project Inspector.

GENERAL PLUMBING REQUIREMENTS

3.6 BUILDING ACCESS FOR APPARATUS

- A. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.7 EQUIPMENT AND PANEL ACCESSIBILITY

- A. Install all piping, conduit, and accessories to permit access to equipment and panels for maintenance as required by code and as recommended by the equipment manufacturer.
- B. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties.
- C. Where access is required in plaster walls or ceilings, furnish the access doors to the General Contractor for installation.
- D. See individual specifications sections, specifically Section 15440, for exact access panel locations.

3.8 COORDINATION

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).
- B. Coordinate all work with other contractors prior to installation. Any work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.
- C. Verify that all devices are compatible for the type of construction and surfaces on which they will be used.
- D. There may be other work being completed concurrently in the building and possible future projects to be completed in phases in the building. Therefore, this Division must coordinate with other contractors in the building, which are not necessarily working on this project or under this scope of work.

3.9 IDENTIFICATION

- A. Provide the appropriate identification as indicated in this section for all new and existing to be reused, remodeled or modified piping, controls, control panels, equipment, starters, valves, ceiling tiles, access panels, etc.
- B. See schedules on drawings for appropriate labeling of equipment and associated controls, starters, etc.

3.10 CLEANING EQUIPMENT, MATERIALS AND SITE

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).

GENERAL PLUMBING REQUIREMENTS

- B. The Contractor shall at all times keep the premises free from accumulations of waste material or rubbish caused by his operations. The Contractor shall remove all dirt, rubbish or debris resulting from his Work, from time to time as the building operations progress and as often as may be directed by the Construction Project Inspector. On the failure, retardation, or refusal of the Contractor to remove said rubbish, dirt and debris promptly, or if majority of the final cleaning up consists of rubbish from several or all Contractors, by the Construction Project Inspector, shall cause same to be removed and the prorated cost thereof shall be charged against the several Contractors responsible and retained out of the contract price. At the completion of the Project, the Contractor shall remove all tools, equipment, and surplus materials and leave the Project "broom clean" or its equivalent.
- C. General Cleaning: Contractor shall remove his rubbish and debris from site promptly upon its accumulation and when requested by the Construction Project Inspector. **Do not use MPS disposal containers.**
- D. Final Cleaning: At final completion of Work and immediately prior to final inspection, Contractor shall remove all tools, debris, equipment, protection, unused materials, and shall remove from Work and equipment provided under the Contract Agreement all foreign matter, spots and soils, so as to put all such Work and equipment, including finishes, in a complete and finished condition to the satisfaction of the Construction Project Inspector.
- E. Install temporary covers, caps, etc. over equipment and piping to minimize dust contamination during construction.
- F. All fixtures, piping, finished surfaces and equipment shall have all grease, adhesive labels and foreign materials removed.

3.11 LUBRICATION

- A. Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any reason. Record lubricant used in maintenance log.
- B. Once the equipment has been run, maintain lubrication in accordance with the manufacturer's instructions until the work is accepted by MPS. Maintain a log of all lubricants used and frequency of lubrication (Running Hours/Relubrication); include this information in the Operating and Maintenance Manuals at the completion of the project.

3.12 FACTORY START-UP AND TRAINING

- A. Factory Start-Up and Training may be completed consecutively but proper notification must be made to required parties.
- B. Equipment Start-Up
 1. Provide factory authorized start-up for all new equipment as specified in individual sections.
 2. See individual Sections for additional start-up instructions.

GENERAL PLUMBING REQUIREMENTS

3. When scheduled a minimum of (2) working days in advance with the MPS Representative and the installing Contractor, the manufacturer's qualified Field Engineer then shall start the equipment, in accordance with manufacturer's start-up instructions and in the presence of the Installing Contractor and Construction Project Inspector.
 4. The field engineer shall inspect the entire installation of piping, wiring, panels, controls, alarms, intakes, venting, etc., and verify that everything required for a complete operating installation has been provided per manufacturer's recommendations.
 5. The field engineer then shall start the equipment, in accordance with manufacturer's start-up instructions and in the presence of the Installing Contractor and the Construction Project Inspector.
 6. Field engineer shall test and adjust the controls and demonstrate compliance with the specified operation requirements.
 7. The equipment shall be adjusted for maximum efficiency.
 8. Any damage or malfunctioning controls and equipment shall be replaced.
- C. Provide factory/manufacturer's representative training as specified in individual sections.
1. See individual sections for additional start-up instructions.
 2. When scheduled a minimum of (5) working days in advance with the Construction Project Inspector, the equipment manufacturer or manufacturer's representative shall furnish the services of a person thoroughly familiar with construction, installation and safety of equipment for a period of time to completely cover all required training material.
 3. This person shall be qualified for, and capable of explaining the construction, operation and maintenance procedures to personnel unfamiliar with this type of **equipment**.
 4. The minimum required bound copies of installation operation and maintenance instructions should have been furnished to the Installing Contractor for O&M Manuals as specified under "Submittals". Coordinate with Installing Contractor so that O&M Manuals are turned over to the Construction Project Inspector at or prior to the (5) day notification period.
 5. Instructions shall include factory or factory representative direction, where each member of MPS' Maintenance Staff is afforded the opportunity of physically performing required tasks in correct sequence and will be required to offer a running commentary as to the reason for each sequential step taken and how each operation is to be carried out.
 6. MPS must be afforded the opportunity to videotape any training sessions.
 7. If the training session is videotaped, a copy of the training videotape shall be turned-over to the Construction Project Inspector 48 hours after the end of the training session.
- D. After completion of start-up, test, adjustment and training, provided for each piece of equipment, a certified written test report shall be filled out and minimum of (6) copies shall be submitted as specified under "Submittals".

GENERAL PLUMBING REQUIREMENTS

- E. The written report shall be presented to the Installing Contractor before final acceptance of the installed equipment, certifying that the equipment installation conforms to all specified requirements; that the equipment has been adjusted and placed in satisfactory operation; that all operating and safety controls have been tested and found to be in good working order and that the equipment is safe to operate.

3.13 TRAINING FOR INSTALLED PLUMBING SYSTEMS

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions).
- B. When scheduled a minimum of (5) working days in advance with Construction Project Inspector, the Installing Contractor shall furnish the services of a person thoroughly familiar with construction, installation and safety devices for the installed systems for a period of not less than **(8)** hours.
- C. This person shall be qualified for, and capable of explaining the construction, operation and maintenance procedures to personnel unfamiliar with these types of **systems**.
- D. O&M Manuals must be turned over to Construction Project Inspector at or prior to the (5) day notification period.
- E. Instructions shall include factory or factory representative direction, where each member of MPS' Maintenance Staff is afforded the opportunity of physically performing required tasks in correct sequence and will be required to offer a running commentary as to the reason for each sequential step taken and how each operation is to be carried out.
- F. MPS and its designated representatives reserve the right to videotape hands-on sessions. (If the training session is videotaped, a copy of the training videotape shall be turned-over to the Construction Project Inspector 48 hours after the end of the training session.)
- G. Before final acceptance of the installed systems, (6) copies of a dated written report shall be presented to the Construction Project Inspector, by the Installing Contractor, for routing as specified under "Submittals", certifying that the entire system installation conforms to all specified requirements; that the installed system has been adjusted and placed in satisfactory operation; that all operating and safety controls have been tested and found to be in good working order; that the entire installation is entirely safe to operate and that MPS's operating personnel has been properly instructed as to how the installation should be operated.

GENERAL PLUMBING REQUIREMENTS

3.14 COMMISSIONING

- A. See individual specifications sections.
- B. This Contractor shall inspect, test and repair or replace any defective part or component of the systems and equipment installed or affected by the performed work.

END OF SECTION

SECTION 15450

PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SCOPE

- A. Drawings and general provisions of the Contract, including Bidding Requirements, General Requirements, and Conditions applying to this Section.
- B. Provide, install, extend, remove and remodel all required plumbing equipment and associated accessories, tanks, pumps, motors, controls, etc. of types, qualities, sizes, lengths, etc. as indicated on drawings and specified herein for this project.
- C. Included are the following topics:
 - 1. Scope
 - 2. Related Work
 - 3. Reference Standards
 - 4. Quality Assurance
 - 5. Submittals
 - 6. Design Criteria
 - 7. Hot Water System Circulating Pump
 - 8. Expansion Tanks
 - 9. Solar Thermal Water Storage Tanks with Heat Exchangers
 - 10. Solar Thermal System Circulation Pumps
 - 11. Solar Thermal Collector Panels
 - 12. Solar Thermal Controllers
 - 13. Fluid Cooler
 - 14. Installation
 - 15. Solar Thermal Sequence of Operation
 - 16. Commissioning
 - 17. Training

1.2 RELATED WORK

- A. Section 15400 - Plumbing General Requirements
- B. Section 15401 - Plumbing Pipe and Pipe Fittings
- C. Section 15410 - Plumbing Valves
- D. Section 15412 - Plumbing Piping Specialties

PLUMBING EQUIPMENT

- E. Section 15417 - Plumbing Motors, Starters, Disconnects and Control Wiring
- F. Section 15426 - Plumbing Systems Insulation
- G. Division 16000 - Electrical

1.3 REFERENCE STANDARDS

- A. NFPA-54: National Fuel Gas Code.
- B. NFPA-70: National Electric Code.
- C. ASHRAE 90.1: Energy Efficient Design of New Buildings.
- D. ANSI/ASME PTC25.3-1998 for Relief and Safety Valves
- E. AGA: American Gas Association
- F. U.L. 795 Commercial-Industrial Gas Heating Equipment
- G. ANSI/UL 1453-1987: Electric Booster and Commercial Storage Water Heaters

1.4 QUALITY ASSURANCE

- A. Plumbing products requiring approval by the State of Wisconsin DOC must be approved or have pending approval, at the time of shop drawing submission.
- B. Acceptable manufacturers shall be companies regularly engaged in the manufacture of plumbing equipment of type and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- C. Provide electric motors and electrical components required as part of plumbing equipment, which have been listed and labeled by Underwriters Laboratories (U.L.) and comply with NEMA standards.
- D. Comply with NFPA No. 70 as applicable to installation and electrical connections of ancillary electrical components of plumbing equipment.
- E. Comply with ASME Boiler and Pressure Vessel Code for construction and stamp with ASME Code symbol:
 - 1. When the following apply:
 - a) The tank volume exceeds 120 gallons
 - b) The temperature exceeds 210°F.
 - c) The internal heat gain into the tank exceeds 200,000 BTU/HR
 - 2. For the following equipment:
 - a) Water tanks.

PLUMBING EQUIPMENT

1.5 SUBMITTALS

- A. Refer to Division 0 and Division 1 (Bidding Requirements, General Requirements and General Conditions) for submittal requirements.
- B. Refer to requirements of Section 15400, Submittals.
- C. Include data concerning dimensions, rated capacities of selected models, materials of construction, ratings, weights, pump curves with net positive suction head requirements, furnished specialties, accessories, manufacturer's installation requirements, piping and wiring connections, required clearances, manufacturer's performance limitations, and appropriate identification.
- D. Include manufacturer's instructions, including maintenance data and parts lists for each item of plumbing equipment. Include troubleshooting maintenance guides.
- E. Submit wiring diagrams from manufacturers detailing electrical requirements for electrical power supply wiring for solar controller. Include ladder-type wiring diagrams for interlock and control wiring required for final installation of solar thermal system. Differentiate between portions of wiring that are factory installed and portions that are to be field installed. Include sequence of operation for solar controller and solar thermal system.
- F. Submit certificates of shop inspection and data report as required by provisions of the ASME Boiler and Pressure Vessel Code.

1.6 DESIGN CRITERIA

- A. All equipment sizes, capacities, pressures and operating characteristics shall be as specified or as indicated on drawings.
- B. Pumps
 - 1. Pumps shall meet or exceed operating efficiencies scheduled or indicated.
 - 2. Provide all pumps with motors, impellers, drive assemblies, bearings, coupling guard, and other accessories specified. Statically and dynamically balance all rotating parts. Provide flanged connections on all pumps unless specified otherwise. Service of base mounted pumps shall not require breaking piping connections or removal of motor.
 - 3. Where a pump is specified for parallel operation, the scheduled conditions are for that pump with both pumps operating; i.e., total system flow rate is twice that scheduled for a single pump. When only one of the parallel pumps is operating, the operating point of that pump must fall within the manufacturer's recommended operating range.
 - 4. Provide pump with a motor sized for non-overloading over the entire pump curve. Motors to be 1750 RPM unless specified otherwise.
 - 5. Furnish each pump and motor with a nameplate giving the manufacturer's name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current.

PLUMBING EQUIPMENT

6. Test all pumps, clean and paint before shipment. The manufacturer shall certify all pump ratings.
7. All pumps to operate without excessive noise or vibration.
8. After completion of balancing, provide replacement of impellers, or trim impellers to provide specified flow at actual pumping head, as installed.

1.7 WARRANTY

- A. Submit a written warranty, executed by manufacturer, agreeing to repair or replace water heater units and water storage tanks that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, tanks, heat exchangers, and burners. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 PRODUCTS

2.1 EXPANSION TANKS

- A. Expansion tanks shall be as manufactured by Amtrol/Thrush, Armstrong Pumps, Bell and Gossett, Taco or Wessels.
- B. Bladder Type expansion tanks shall be constructed of steel, tested and stamped in accordance with Section 8D of the ANSI/ASME Code and furnished with the National Board Form U-1, rated for not less than 125 PSIG working pressure, precharged with air to the initial fill pressure indicated on the drawings, butyl diaphragm suitable for fluid temperatures to 220°F, and furnished with a tank drain connection, system connection, mounting saddles for horizontal installation or base for vertical installation, prime coated, size/capacity as indicated on the drawings. Tank and bladder construction must allow field replacement of the bladder on its failure.

2.2 SOLAR THERMAL WATER STORAGE TANKS

- A. Solar thermal water storage tanks shall be as manufactured by Badgerland Tanks or MPS approved equal
- B. Provide each water storage tank with the following:
 1. Tanks shall be of sizes, capacities, tappings, etc. as indicated on schedule and constructed in accordance with Section IV of the ASME Code for a designed for a working pressure of 150 PSI. Tank shall be registered with the National Board of Boiler and Pressure Vessel Inspectors and Certificate of Shop Inspection shall be furnished.
 2. Glass lined interior self supporting steel tank with 2" T R-17 insulation with PVC jacket
 3. Tappings of sizes and in locations as indicated and required including:
 - a) Tank top domestic hot water and cold water connections
 - b) Relief and drain valve connections
 4. ASME rated temperature and pressure relief valve

PLUMBING EQUIPMENT

5. Full port drain valve with hose connection
6. Anode rod
7. Surface mounted aqua stat suitable for field connections

2.3 SOLAR HOT WATER SYSTEM CIRCULATING PUMP

- A. Solar hot water system circulating pump(s) shall be as equal to B&G PL Series, Grundfos UP Series or Taco
- B. Pump shall be of sizes and capacities as indicated on plans
- C. Pump shall be bronze, inline style, centrifugal, single-stage, permanently oil lubricated, maintenance free, rated for 150 PSIG working pressure and 222.5°F continuous water temperature.

2.4 HEAT EXCHANGER

- A. Brazed plate with stainless connections and plates.
- B. Maximum pressure drop of 3 psig.

2.5 SOLAR THERMAL COLLECTOR PANELS

- A. Solar thermal collector panels shall be as manufactured by Alternate Energy Technologies, Aquarius, [Caleffi Solar](#), Gull Industries, Heliodyne, Solar Skies SS Series, or MPS approved equal
- B. Panels shall be SRCC rated with sizes, weights, capacities, etc. as indicated on drawings.
- C. Panels shall have the following construction:
 1. Aluminum extruded batten ribbed extrusions and a smooth compressed EPDM gasket provide water tightness
 2. Architectural aluminum corner bracket angles inside with pin grip rivets insure high stability.
 3. Embossed aluminum back panel cover
 4. Low-iron tempered glass with an iron oxide content of less than 1% and total solar energy transmission of greater than 91%.
 5. Glass coating to provide $\alpha \approx 0.945 - 0.96$ and $\varepsilon \approx 0.06 - 0.09$
 6. Glass gasket to be EPDM channel with molded corners
 7. Full Copper Absorber forge welded to piping
 8. Foil-faced Poly-Isocyanurate insulation and Thermax sheathing
 9. EPDM Grommets
- D. Panels shall come complete with a completely compatible and matching mounting aluminum frame system and mounting hardware tested to wind load conditions of 181mph as required for the installation configuration indicated on the drawings.

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2.6 SOLAR THERMAL SYSTEM CONTROLLERS

- A. Solar thermal system controllers shall be as manufactured by Caleffi Solar, IMC Instruments, Inc. Model Eagle 2, Tekmar Model 155 or Solarnetix #Deltasol BS3.
- B. Controller shall come with all required sensors and must be compatible with aqua stat temperature sensors on water storage tanks.
 - 1. Thermistor Sensors; bolt on for collector, immersion for storage tank. Industrial Rated for 400 °F(204°C) 10K , +/- 1 °F accuracy. (RTD's are not acceptable).
 - 2. Sensor Wiring - PLTC" Belden # 9322 (22ga) or 9320 (20ga).
- C. Controller shall be capable of :
 - a) Diverting flow to the fluid cooler to prevent the system from overheating.
 - b) Adjustable setpoint of storage tank temperature.
 - c) Pump "ON/OFF" control for both circulation pumps
 - d) System energy production based on flow rate and water temperature difference
 - e) Connection to a RS-232 data port for interconnection to MPS intranet (IP Address by MPS)
- D. Control panel face shall have a LCD read out with clear indications of all sensor values, pump "ON/OFF", System Power, and System Alarm or Fault.
- E. BTU METER
 - 1. Local readout and dry contacts for connection to the building automation system. Flow and temperature sensors. Metrima F2 or engineer approved equal.
- F. Energy Monitor
 - 1. Energy monitor shall be the Apollo2 or engineer approved equal.
 - 2. Flow and temperature sensors shall be furnished which are compatible with the energy monitor and installed where shown on the drawings.

2.7 FLUID COOLER

- A. Cabinets shall be constructed of heavy-gauge, corrosion resistant galvanized steel. All end panels, center supports and partitions shall have collared tube holes. The coils shall be constructed of 1/2" outside diameter seamless copper tubing on a staggered tube pattern. Tubes shall be mechanically expanded into continuous full-collared plate-type aluminum fins for permanent metal-to-metal contact. Headers are supplied with drains and vents. All fans shall be aluminum propeller

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blade type with painted steel hubs. Fans shall be dynamically balanced and factory tested before shipping to ensure quiet operation. Fans shall have dual square head set screws spaced 90 degrees apart which seat onto one flat and keyway on the motor shaft. Fan diameters shall not exceed 30 inches. Fan guards shall be heavy-gauge, close-meshed steel wire with vinyl coating for maximum rigidity, and long life. Fan motors are heavy type PSC or three phase open drip-proof type with permanently lubricated ball bearings and built-in overload protection. All motors shall be factory wired with leads terminating in a weather-tight enclosure located opposite the header end on the unit and mounted on 12 gage galvanized steel base rails. Leads on units having five (5) or more fans shall terminate at a power block. All units to be UL & CUL and MEA as well as ETL listings.

- B. Provide mounting channels for roof mounting on rails supplied by the mechanical contractor per drawings.
- C. Include option for "Fan cycling with motor fusing option".

PART 3 EXECUTION

3.1 GENERAL

- A. Install plumbing equipment where indicated and in accordance with manufacturer's recommendations.
- B. Coordinate equipment location with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances.
- C. Locate equipment and arrange plumbing piping to provide access space for servicing all components.
- D. Coordinate with Division 16000 for electrical requirements at site and specific locations of receptacles, starters, power connection points, etc.
- E. Connect equipment to water piping and drain piping with unions or flanges and isolation valves as directed in Section 15401 and Section 15410.
- F. Install temperature and pressure relief valves and route to floor drain or floor as indicated and required by Code.
- G. Set and connect units in accordance with manufacturer's written installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances. Orient so controls and devices needing servicing are accessible.
- H. Where piping connections are dissimilar metals, make connections with dielectric fittings or dielectric unions specified in Section 15401 Plumbing Piping and Fittings.
- I. Extend relief valve discharge to closest floor drain.

PLUMBING EQUIPMENT

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3.2 WATER TANKS

- A. Install water tanks in domestic water system and where shown on drawings with all isolation shutoff valves, unions, etc.

3.3 EXPANSION TANKS

- A. Install tanks where indicated on the drawings, coordinating concrete base installation with the General Contractor or fabricating steel supports to suit the application. Install all specified tank accessories.
- B. Bladder Tanks: Verify proper air charge; recharge as necessary. Install an isolation valve in the piping connecting the tank to the system. In the piping between the tank and the isolation valve, install a pressure gauge and a drain valve with a hose adapter. Install a drain valve with hose adapter in the drain connection of the tank. Make sure that all drains are accessible and a hose can be attached.

3.4 SOLAR THERMAL SYSTEMS

- A. Level and install Solar Thermal Water Storage Tanks where indicated on plans. Connect tanks to domestic cold and hot water systems with a single set of shut-off valves and by-pass valve.
- B. Install the Solar Thermal System Circulation Pump in solar thermal system above the elevation of the heat exchangers with shut-off isolation and check valves.
- C. Mount Solar Thermal System Controller on wall. Connect panel to transformer provide by Div. 16000. Install temperature sensors in the sensor well located in the supply and return piping from the solar panels. Route control wiring conduit from all sensors in piping, in aqua stats of storage tanks and circulation pump.
- D. Securely install Solar Thermal Collector Panels with framing system and hardware to roof support rails. Connect each panel to the next in an array of up to (8) panels wide. Connect array to solar supply and return piping as indicated on plans.
- E. Solar Contractor to provide a Focus on Energy recognized modeling report - equivalent to RetScreen – demonstrating the solar energy delivered. Collector pitch at 60° and orientation is due South. Estimated energy offset by the system is 1,962 therms / year.
- F. The contractor performing the solar work shall be on the Focus on Energy full service installers list within one month of the actual installation.
- G. The Focus on Energy rebate will be completed and submitted by this contractor. This contractor is also required to provide breakdown of cost for the labor and material of the solar water heating system. Assist owner with the Focus on Energy Notice of Installation (NOI) paperwork

PLUMBING EQUIPMENT

- ~~G.~~
- H. The Solar collector panel array must be Grounded directly to an earth ground line.
- I. Provide all rails, mounting feet, rear legs, cross bracing and hardware. Racking and rails shall be designed and approved for IBC 90 mph wind loading.
- J. Securely attach all panel brackets using stainless steel hardware. All bolts to Uni-Strut racking shall be through bolts. Uni-Strut spring clips are not allowed.
- K. Support piping adjacent to panels such that no weight is carried by the header pipe.
- L. Follow manufacturer's guidelines for assembly of panel arrays.
- M. Where more than one piping system material is specified, use compatible system components and joints.
- N. Use non-conducting dielectric connections whenever jointing dissimilar metals
- O. Install flanges, unions, and couplings at locations requiring servicing. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections.
- P. Install full port ball valves for shut-off and panel array isolation.
- Q. Install 3/4 inch ball valves with cap for drains at low points of piping, bases of vertical risers and at equipment.
- R. Install the collectors and make connections between collectors within the arrays.
- S. Provide sensor wiring, conduit and an array ground between the collectors and the solar station. All arrays need to be commonly grounded.
- T. Provide sensor wiring in conduit, ~~conduit~~ between the storage tanks, all flow and temperature sensors, and the solar station.
- U. All sensor and control wiring shall be in conduit furnished and installed by Division 15 contractor and complying with specification 16111.
- ~~U.V.~~ Contractor to provide all solar loop field piping as shown on the plans.
- ~~V.W.~~ Contractor to provide final connections to each array (four array's equals 8 -1" connections).
- ~~W.X.~~ Contractor to provide the domestic field piping as shown on the plans and connect to the solar station shut-off valves.
- Y. All exterior piping to be water tight, metal jacketed, and protected from ultra violet radiation

PLUMBING EQUIPMENT

~~X.~~

~~Y-Z.~~ Heat Transfer Fluid

1. Circulate and clean piping
2. Fill system with appropriate amounts of High temperature Propylene glycol to provide burst protection to at least -20 degrees F (9 degrees F "no slush" condition).
3. Fill the system with heat transfer fluid.

3.5 FLUID COOLER

- A. Securely install Fluid Cooler on roof support rails a minimum of 18" high.

3.6 SOLAR THERMAL SEQUENCE OF OPERATION

- A. A device called a differential controller measures the temperature of the solar collectors.
- B. The differential controller also measures the temperature of the stored water in the solar storage tank.
- C. The differential controller will compare these two temperature readings.
- D. If the solar collectors are at least 15° warmer than the water in the storage tank the differential controller will turn on the solar lift pump and storage tank circulating pump. ~~This~~ The lift pump will circulate a heat transfer fluid through the collectors, where it will pick up heat from the collectors.
- E. The heated heat transfer fluid then travels to the heat exchanger where it will give off its heat to the potable water on the cold side of the heat exchanger.
- F. This all happens in a "closed loop", meaning the heat transfer fluid that goes through the collectors and back to the heat exchanger never comes in contact with the water in the solar collection tank.
- G. ~~This~~ The solar pumps will continue to run as long as the collectors stay at least 4° warmer than the stored water in the solar collection OR if the stored water in the storage tank reaches a set point temperature of 180° .
- H. When the solar system can't or does not want to make any more hot water (set point reached or off differential is met) the solar pump is turned off and the heat transfer fluid stops flowing. The heat transfer fluid is comprised of food grade propylene glycol, so it will not freeze in extreme conditions.

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- I. If the max set point is reached and the heat transfer fluid stops flowing, it is possible the glycol could reach its maximum temperature range. To prevent this from happening we circulate the glycol through a heat dump until the system cools to within safe temperatures. When the heat dump function is active the fluid cooler is energized.
- J. Since we can't count on the sun to provide 100% of our hot water needs, we need to have a backup water heater.
- K. The solar storage is plumbed up stream of the existing water heating system. If the potable water going into the existing water heater is hot enough, your existing water heater will not have to heat that water up anymore.

3.7 ENERGY MONITOR

- A. Final connection to existing communication system by Owner.
- B. Provide all conduit, control wiring, test wells, flow sensors, and temperature sensors to monitor collector loop supply temperature, collector loop return temperature, collector loop flow, cold water temperature, cold water flow, and hot water temperature.
- L.C. Include standard setup for SunReports Web2.0.

3.7.3.8 COMMISSIONING

- A. Start-up and test all equipment adjusting operating and safety controls for proper operation.

3.8.3.9 WARRANTY

- A. Flat plat collectors must be fully warranted to be free from defects in both material and workmanship for a total period of ten (10) years from date of installation acceptance.
- B. Storage Tanks must be fully warranted to be free from defects in both material and workmanship for a total period of five (5) years from date of installation acceptance.
- C. Heat Exchanger must be fully warranted to be free from defects in both material and workmanship for a total period of five (5) years from date of installation acceptance.
- D. Balance of System components must be fully warranted to be free from defects in both material and workmanship for a total period of one (1) years from date of installation acceptance.
- E. Installation must be fully warranted to be free from defects in workmanship for a total period of two (2) years from date of installation acceptance.

PLUMBING EQUIPMENT

~~3.9~~3.10 TRAINING

- A. The field engineer shall be qualified for, and capable of, explaining the construction, operation and maintenance procedures to personnel unfamiliar with this type of equipment (solar equipment, solar controller, and energy monitor).
- B. Instruction shall be thorough and shall cover normal operation, emergency conditions and routine maintenance procedures.
- C. Instructions shall include hands-on sessions, where each member of MPS's Maintenance Staff is afforded the opportunity of physically performing required tasks in correct sequence and will be required to offer a running commentary as to the reason for each sequential step taken and how each operation is to be carried out.
- ~~D.~~ A written report shall be presented to the Installing Contractor and MPS, before final acceptance, certifying that the entire installation conforms to all specified requirements and that MPS's operating personnel has been properly instructed as to how the installation should be operated.
- ~~D-E.~~ Installing contractor shall coordinate with Milwaukee Shines and to be present for at two separate question and answer sessions with students at the project location (maximum 1-1/2 hours per session).

~~3.10~~3.11 INSPECTION AND REPORT FOR EXISTING EQUIPMENT TO BE REUSED

- A. The Contractor shall provide cleaning and inspection and report on condition of existing water heaters to be reused as follows:
 - 1. Inspect piping connections, tanks, pumps, valves, vent stacks, etc. and report deficiencies found.
 - 2. Lubricate and check for proper operation of pumps.
 - 3. Relight pilots.
- B. After completion of inspection of existing units, Contractor shall submit to the Architect a written report on the condition of the units. The report shall contain the following:
 - 1. Unit manufacturer and model number.
 - 2. Location of unit and area of building served unit serves.
 - 3. Describe general condition of units including heat exchanger, pumps, motor, controls, etc.
 - 4. Identify any deficiencies and include recommendations and cost estimates for repair and replacement.
- C. After review of report and recommendations, MPS will determine which if any repairs are to be made.

END OF SECTION

SECTION 16800
PHOTOVOLTAIC POWER GENERATION SYSTEM

PART 1 GENERAL

1.1 SCOPE

- A. Drawings and general provisions of Contract, including Bidding Requirements, General Requirements and General Conditions apply to this section.
- B. Provide, install, remove or replace all photovoltaic power generation system complete with collectors and associated mounting frame system, wiring, fasteners, etc. as indicated on drawings and specified herein for this project.
- C. Included are the following topics:
 - 1. Scope
 - 2. Related Work
 - 3. Reference Standards
 - 4. Quality Assurance
 - 5. Submittals
 - 6. Design Criteria
 - 7. Warranty
 - 8. Collector Manufacturers
 - 9. Collector Electrical Specifications
 - 10. Collector Assembly And Frame
 - 11. Collector Physical Specifications
 - 12. Collector Thermal Parameters
 - 13. Collector Wiring
 - 14. Collector Mounting Frame System
 - 15. General
 - 16. Module Wiring
 - 17. Grounding
 - 18. Mounting Frame System
 - 19. Commissioning

1.2 RELATED WORK

- A. Section 16010 - General Electrical Provisions
- B. Section 16810 - Photovoltaic Power Generation System Inverters

PHOTOVOLTAIC POWER GENERATION SYSTEM

1.3 REFERENCE STANDARDS

- A. National Electrical Code (NEC)
- B. State of Wisconsin and local supplements to NEC
- C. National Electrical Contractors Association (NECA) - Standard of Installation.
- D. National Electrical Code Article 690-7(a)

1.4 DESCRIPTION

- A. This section covers photovoltaic collection systems also known as solar collectors or modules and their respective support systems.

1.5 QUALITY ASSURANCE

- A. Refer to Division 1 and General Conditions for equals and substitutions.
- B. Provide factory tested equipment.
- C. Factory where collectors are manufactured shall be ISO14001 certified.
- D. Provide equipment and components with UL label. Specifically UL 1703

1.6 SUBMITTALS

- A. Refer to requirements of Sections 01300 and 16010, Submittals.
- B. Detailed specification sheet with specific collector(s) identified.
- C. Installation instructions, wiring diagrams with all required field connection clearly indicated.
- D. IV Curve charts.

1.7 DESIGN CRITERIA

- A. Sizes, capacities, quantities, minimum acceptable efficiency ratings shall be as follows:
- B. Maximum output of collector array: **10,000 Watts or 10 KW,**
- C. Maximum collector power output shall be the following:
 - 1. ~~(4036) at 285 Watts~~ 300 Watts
- D. Tolerance: +10%/-5%
- E. Conversion efficiency: >16%

PHOTOVOLTAIC POWER GENERATION SYSTEM

1.8 WARRANTY

- A. In addition to the one year standard labor and parts warranty, provide a non-prorated, labor and parts extended warranty for the following:
 - 1. 25 year on power output. Not more than 10% reduction within 12 years and 20% in 25 years.

PART 2 PRODUCTS

2.1 COLLECTOR MANUFACTURERS

- A. Collectors shall be manufactured by Helios Solar works.
- B. In a multiple collector array, all collectors shall be of the same manufacturer and where possible of the same size and power output.

2.2 COLLECTOR ELECTRICAL SPECIFICATIONS

- A. Provided by Vendor for specific collector submitted:
 - 1. Maximum power voltage: ~~33.31~~33.72
 - 2. Maximum power current: ~~6.43~~6.67
 - 3. Open circuit voltage: ~~40.97~~41.48
 - 4. Short-circuit: ~~6.88~~7.14A

2.3 COLLECTOR ASSEMBLY AND FRAME

- A. Collectors shall be constructed of multiple polycrystalline silicon photovoltaic cells, high transmission, tempered glass front surface, polyvinyl fluoride (PVF) back sheet. Entire assembly shall be housed in an anodized aluminum frame with holes and/or brackets for mounting to an adjustable rail system.
- B. Collectors shall possess a Class C fire rating.

2.4 COLLECTOR PHYSICAL SPECIFICATIONS:

- A. 7T2285 Collector
 - 1. Length: 78.11 inches
 - 2. Width: 38.74 inches
 - 3. Depth: 1:58 inches
 - 4. Weight: 57.2 pounds

2.5 COLLECTOR THERMAL PARAMETERS:

- A. Operating collector temperature: -40 to 90°C (-40 to 120°F)
- B. I_{sc} Current temperature coefficient: $(3.18 \times 10^{-3}) A/^{\circ}C$

PHOTOVOLTAIC POWER GENERATION SYSTEM

- C. V_{oc} Voltage temperature coefficient: $(-1.23 \times 10^{-1}) \text{ V/}^\circ\text{C}$

2.6 COLLECTOR WIRING

- A. Modules shall come pre-wired and terminated ready for free standing or direct building installations. Each module shall have (2)#10 AWG type USE-2/RHH/RHW-2 stranded sunlight resistant output cables each terminated with Multi-Contact connectors. The positive (+) terminal shall have the female connector while the negative (-) terminal shall have the male connector.

2.7 COLLECTOR MOUNTING FRAME SYSTEM:

- A. Mounting frame system shall be manufactured by UniRac SolarMount or MPS approved equal.
- B. All components, including but not limited to; frames, rails, legs, clamps, clips, feet, fasteners, etc. shall be from the same manufacturer and be completely compatible to the photovoltaic collectors.
- C. All components shall be constructed of heavy duty anodized aluminum.
- D. All fasteners shall be manufactured from 18-8 stainless steel.
- E. Provide all required components as required for a complete mounting assembly.

PART 3 EXECUTION

3.1 GENERAL

- A. Install and wire all collectors in accordance with manufacturer's written instructions.
- B. Install all collectors on solar mounting rails and support assemblies designed specifically for the awarded collector manufacturer.
- C. Coordinate with Construction Project Inspector and MPS Roof Shop for roof top installations.
- D. For optimal performance in all applications, maintain the required clearance between the module frame and the mounting surface as required to allow cooler ambient air to circulate around the back of the module.

3.2 MODULE WIRING

- A. The module shall be wired for series connections only, i.e. female (+) to male (-) interconnections. Series and parallel connections shall be made by use of two #10 AWG type XLP sunlight resistant output cables with male and female Multi-Contact connectors.
- B. When making connections with Multi-Contact connectors, make sure the array is disabled. **DO NOT MAKE CONNECTIONS WHILE UNDER LOAD.** Module output connections are marked "Do not disconnect under load".

PHOTOVOLTAIC POWER GENERATION SYSTEM

- C. Do not exceed the maximum system voltage rating of the collector system recommended by the collector manufacturer.
- D. Refer to the National Electrical Code Article 690-7(a) for determining the maximum number of series modules that can be placed in series. Temperature coefficients, specific to the module of use, can be used to provide the most accurate prediction of module voltage under temperature extremes.

3.3 GROUNDING

- A. Before installing your solar system, contact local authorities to determine the necessary grounding.
- B. Attach all module frames to an earth ground in accordance with the National Electrical Code (NEC).
- C. Proper grounding shall be achieved by connecting the module frame(s) and structural members contiguously one to another using a suitable "grounding conductor". The grounding conductor shall be a material acceptable for use as an electrical conductor per NEC. The grounding conductor must then make a connection to earth using a suitable earth ground electrode. Ensure positive electrical contact through the anodizing on the module's frame by utilizing the method as recommended by collector manufacturer.

3.4 MOUNTING FRAME SYSTEM

- A. Install, assemble and erect mounting frames, rails, legs, clamps, clips, feet, fasteners, in accordance with manufacturer's written instructions and as detailed on drawings.
- B. Assemble mounting frame system to provide a code compliant grounding system.

3.5 COMMISSIONING

- A. Adjust collectors and support rail assembly to the correct azimuth as indicated on drawings.
- B. Demonstrate that all components are functioning properly. Replace all defective parts.

END OF SECTION

SECTION 16810

PHOTOVOLTAIC POWER GENERATION SYSTEM INVERTERS

PART 1 GENERAL

1.1 SCOPE

- A. Drawings and general provisions of Contract, including Bidding Requirements, General Requirements and General Conditions apply to this section.
- B. Provide, install, remove or replace all photovoltaic power generation system inverters with accessories to connect photovoltaic collection system to the utility power grid as indicated on drawings and specified herein for this project.
- C. Included are the following topics:
 - 1. Scope
 - 2. Related Work
 - 3. Reference Standards
 - 4. Description
 - 5. Quality Assurance
 - 6. Submittals
 - 7. Warranty
 - 8. Acceptable Inverters
 - 9. Requirements
 - 10. Installation

1.2 RELATED WORK

- A. Section 16010 - General Electrical Provisions
- B. Section 16800 - Photovoltaic Power Generation Systems

1.3 REFERENCE STANDARDS

- A. National Electrical Code (NFPA 70)
- B. Including State of Wisconsin and local supplements
- C. National Electrical Contractors Association (NECA)
- D. NECA – Standard of Installation
- E. National Electrical Manufacturers Association (NEMA)
- F. Institute of Electrical and Electronic Engineers (IEEE)
- G. ASME

PHOTOVOLTAIC POWER GENERATION SYSTEM INVERTERS

H. WE Energies

I. Local Codes having jurisdiction

1.4 DESCRIPTION

A. This section covers photovoltaic collection systems also known as solar collectors or modules and their respective support systems.

1.5 QUALITY ASSURANCE

A. Refer to Division 1 and General Conditions for equals and substitutions.

B. Inverter and installation shall conform to all standards, codes, organizations, etc. in the Referenced Standards of the Section.

C. Provide factory tested equipment.

D. Must be certified under UL 1741 by a nationally recognized testing laboratory.

E. Must have a CEC efficiency of 94% when operating at maximum connected load.

F. Inverter must be new. It shall not have been previously installed at any other location or used for any other applications. Rebuilt, refurbished or relocated inverters shall not be used.

1.6 SUBMITTALS

A. Refer to requirements of Sections 01300 and 16010, Submittals.

1.7 SUBMITTALS

- A. Provide original manufacture's product data sheets that include the following:
1. Manufacture, part number, device dimensions, nameplate nomenclature, electrical ratings both inputs and outputs.
 2. Installation instructions.
 3. Interrupting Rating
 4. KW Rating
 5. Alarms and Warnings

1.8 WARRANTY

A. The inverter must have a minimum five year warranty to protect the purchaser against system or component breakdown. The warranty must cover and provide no-cost repair or replacement of the system or components including any associated labor for a minimum of five years. The warranty must cover the inverter against breakdown or degradation in electrical output of more than 10 percent deviation from their originally rated electrical output during the period. The manufacturer's warranty may be provided in combination with installer.

PHOTOVOLTAIC POWER GENERATION SYSTEM INVERTERS

PART 2 - PRODUCTS

2.1 ACCEPTABLE INVERTERS

A. Ingeteam # ~~IS-SMART~~ SUNLITE 5 UT.

2.2 REQUIREMENTS

A. Inverter shall be equipped with the following protection functions, and ratings:

1. Integrated load break rated AC and CD disconnect switch.
2. Integrated fused series string combiner.
3. Sealed electronics enclosure
4. Synchronism Check.
5. Under Voltage: must be adjustable and have time delay to override system transients and clearing of external faults. The pickup setting shall be 90% of nominal voltage and have a time delay of 1.0 seconds.
6. Over-voltage: must be adjustable. The pickup setting shall be 110% of nominal voltage and have a time delay of 0.1 seconds.
7. Under-frequency: must have a single set point at 59.5 Hz and have a time delay of 0.5 seconds.
8. Over-frequency: must have a single set point at 60.5 Hz and be instantaneous.
9. Automatically disconnect ~~in~~ if utility has loss of power.
10. Automatically synchronize with utility distribution system.
11. Must comply with the latest version of IEEE 519 "Recommended Practices and Requirements of Harmonic Control in Electric Power Systems."
12. Power factor must be maintained between .9 leading and .9 lagging.
13. Shall not cause flicker in excess of 2%.
14. Maximum input DC Voltage 600Volts with a range of Peak Power Tracking 250-480volts, and DC ripple voltage of <5%.
15. DC Input adjustable PV start voltage.
16. DC Input, minimum of 4 fused inputs.
17. AC Output, the inverter must be a single phase device rated to operate on two phases of a 3 phase system. The inverter output shall monitor and match school electrical system.
18. Inter-Inverter Communications via RS-485 port.
19. INGARAS PV for internet data display.
20. Ingecon Sun Manager Software and programming.

PHOTOVOLTAIC POWER GENERATION SYSTEM INVERTERS

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install inverters in accordance with manufacturer's written instructions, installation drawing, and applicable requirements of NEC and in accordance with recognized industry practices.
- B. Equipment shall not be installed such that it voids any warranties or listings on it or any other equipment it is installed with. Any discrepancies shall be brought to the engineers and manufacturers attention prior to continuing with the work.

END OF SECTION

Plotted By: megan
 Plot File Date Created: Mar/08/2012 2:32 PM
 Layout-Sheet Name: SCHEDULES - ALTERNATE NO. 1 - PLUMBING
 Filename: G:\PROJECTS\2011\1-046\DRAWINGS\01 - DDS\PILOT SHEETS\PLUMBING\PO01A.DWG

EXPANSION TANK SCHEDULE

TAG	LOCATION	MANUFACTURER	MODEL	MINIMUM OPERATING PRESSURE	MAXIMUM OPERATING PRESSURE	ACCEPTANCE VOLUME (GALLONS)	TOTAL VOLUME (GALLONS)	HEIGHT	DIAMETER	REMARKS
ET-1	TUNNEL 3	WESSELS	NVA 130	15	60	35	35	37"	20"	CONTRACTOR TO ADJUST FACTORY PRECHARGE AS REQUIRED

THREE WAY DIVERTING VALVE SCHEDULE

TAG	LOCATION	MANUFACTURER	MODEL	SERVICE	MIN FLOW (GPM)	DESIGN FLOW (GPM)	PRESSURE DIFFERENTIAL (PSI)	INLET (INCHES)	OUTLET (INCHES)	INLET TEMP (°F)cold	INLET TEMP (°F)hot	OUTLET TEMP (°F)	REMARKS
DV-1	TUNNEL 3	CALEFFI	Z611515	SOLAR COLLECTOR	1.0	15	5	3/4	3/4	180	180	180	

INLINE PUMP SCHEDULE

TAG	LOCATION	MANUFACTURER	MODEL	SERVICE	FLOW (GPM)	HEAD (PSI)	MOTOR (HP)	RPM	VOLTAGE/HERTZ/PHASE	REMARKS
CP-1	TUNNEL 3	TACO	IL133	SOLAR STORAGE	15	12.99	3/4	1725	115/ 60 / 1	ALL BRONZE OF STAINLESS STEEL CONSTRUCTION
CP-2	TUNNEL 3	TACO	0011-F4	SOLAR COLLECTOR	15	7.74	3/8	3250	115 / 60 / 1	

STORAGE TANK SCHEDULE

TAG	LOCATION	MANUFACTURER	MODEL	SERVICE	VOLUME (GALLONS)	DIAMETER (IN)	HEIGHT (IN)	LENGTH (IN)	REMARKS
ST-1	TUNNEL 3	BAGERLAND TANKS	BS-30-111	SOLAR WATER HEATER	320	30	39	111	TO BE INSULATED PER SPECIFICATION SECTION 15426
ST-2	TUNNEL 3	BAGERLAND TANKS	BS-30-111	SOLAR WATER HEATER	320	30	39	111	TO BE INSULATED PER SPECIFICATION SECTION 15426
ST-3	TUNNEL 3	BAGERLAND TANKS	BS-30-111	SOLAR WATER HEATER	320	30	39	111	TO BE INSULATED PER SPECIFICATION SECTION 15426

FLAT PLATE HEAT EXCHANGER SCHEDULE

TAG	LOCATION	MANUFACTURER	MODEL	SERVICE	LOAD (BTU/H)	SURFACE AREA (SQ. FT.)	FOULING FACTOR	SIDE A DATA			SIDE B DATA		
								FLUID	FLOW / PRESSURE DROP	ENT/LEAVING TEMPERATURE	FLUID	FLOW / PRESSURE DROP	ENT/LEAVING TEMPERATURE
HX-1	TUNNEL 3	AIC	LB31-70 DWR	SOLAR WATER HEATER	106000	23.1	0.0001	40% PROP. GLYCOL	15 GPM / 0.98 PSI	120°F/105°F	WATER	15 GPM / 0.5 PSI	50°F/60°F

PLUMBING MOTOR LOAD COORDINATION SCHEDULE - REFERENCE ONLY

TAG	EQUIPMENT DESCRIPTION	LOCATION	POWER DATA			DISCONNECT			REMARKS
			LOAD	VOLTS	EMERG. POWER	FURNISH BY	INSTALL BY	WIRED BY	
CP-1	INLINE PUMP	TUNNEL 3	3/4 HP	115 / 1	NO	DIV 16000	DIV 16000	DIV 16000	
CP-2	INLINE PUMP	TUNNEL 3	3/8 HP	115 / 1	NO	DIV 16000	DIV 16000	DIV 16000	
CONTROL PANEL	SOLAR CONTROL PANEL	TUNNEL 3	15A	115 / 1	NO	DIV 16000	DIV 16000	DIV 16000	
FC-1	FLUID COOLER	ROOF	1/2 HP	208 / 1	NO	DIV 16000	DIV 16000	DIV 16000	

FLUID COOLER (FC) SCHEDULE

UNIT NO.	SYSTEM SERVED	MODEL NO.	HEAT REJECTION COIL SIDE					AIR HANDLING SIDE					ELECTRICAL	REMARKS	
			GPM	EW T (°F)	LWT (°F)	AT REJ. MBH	AP (PSI)	FANS #	TOTAL CFM	HP EA.	RPM	MCA			VOLTS
FC-1	SOLAR COLLECTOR	FCV-01S	30	180	160	218	5.46	1	3900	1/2	1140	15	208V	1 PH	

THERMOSTATIC MIXING VALVE SCHEDULE

TAG	LOCATION	MANUFACTURER	MODEL	SERVICE	MIN FLOW (GPM)	DESIGN FLOW (GPM)	PRESSURE DIFFERENTIAL (PSI)	INLET (INCHES)	OUTLET (INCHES)	INLET TEMP (°F)	INLET TEMP (°F)	OUTLET TEMP (°F)	REMARKS
TMV-1	COORDOR-B6	BRADLEY	S59-3130	HOT WATER	2.0	15	3	2	2	40	180	120	SURFACE MOUNTED STAINLESS STEEL CABINET

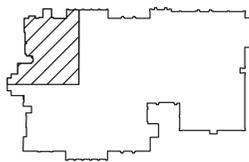
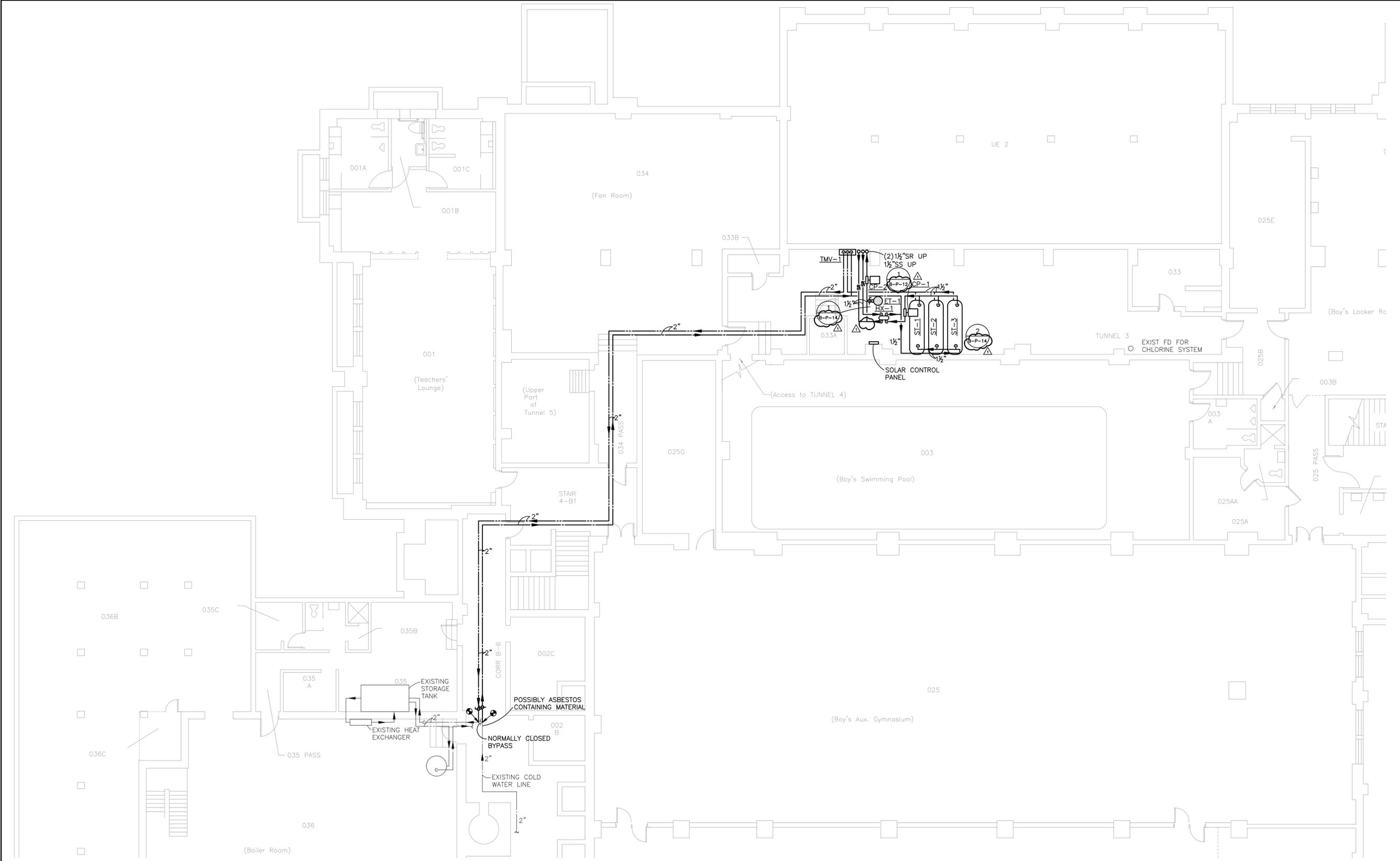
SOLAR THERMAL PANEL SCHEDULE

DRAWINGS ARE BASED ON MANUFACTURES & MODEL NO.	QUANTITY	HOLDING CAPACITY EA. (GAL)	LENGTH (IN)	WIDTH (IN)	DEPTH (IN)	PIPE CONN. SIZE (IN)	PANEL WTR. VOLUME (GAL)	WEIGHT (LBS)	TRANSPARENT AREA (SF)	MBTU/DAY (CLEAR PAR T. CLEAR)*	MIN SOLAR ENERGY TRANS.	REMARKS
SOLARSKIES SS-32	16	3.2	97.25	48	SBV	1	1.2	113	29.93	24/13	91%	NOTE 1
TOTALS		51.2	1556	768				1808	478.88			

SBV - INFORMATION TO BE SUPPLIED BY VENDOR
 * - BASED ON SRRC 06-100 Ti-Ta=90°F (2000 BTU/SF-DAY FOR CLEAR SKY AND 1500 BTU/SF-DAY PART CLEAR DAY)
 1 - PROVIDE WITH MATCHING SUPPORT SYSTEM AND HARDWARE

DRN	DES	CHK	APP	KEH			
				ADDENDUM #1	NO	REVISIONS	
				MAC/MB	03/08/12	DRN/CHK	DATE
MILWAUKEE PUBLIC SCHOOLS SOLAR PROJECTS CITY OF MILWAUKEE, WISCONSIN SCHEDULES - ALTERNATE NO. 1 - PLUMBING SITE 012							
DATE: FEBRUARY 2012 PROJECT NO: 60239135 FILENAME: SHEET NO: DRAWING NO: B-P-03							

Plotted By: megan
 Plot File Date Created: Mar/08/2012 2:32 PM
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 Reference Drawings 1-01-based.dwg
 Working Drawings\Plumbing\1p-01-based.dwg
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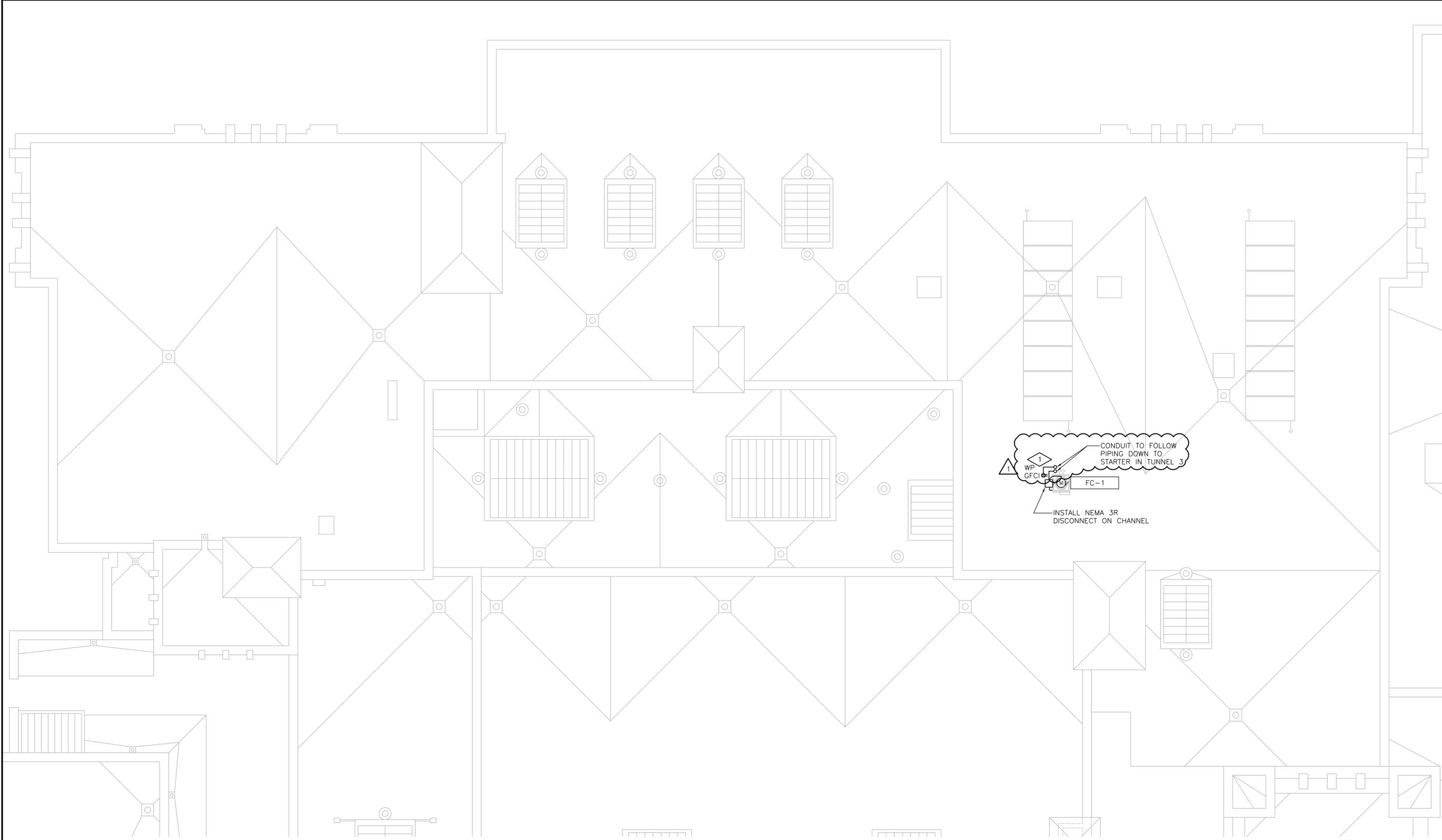


BASEMENT FLOOR PLAN - ALTERNATE NO. 1 - PLUMBING

1/8" = 1'-0"
 1 INCH
 NORTH

MILWAUKEE PUBLIC SCHOOLS SOLAR PROJECTS CITY OF MILWAUKEE, WISCONSIN		 4135 TECHNOLOGY PARKWAY SHEBOYGAN, WI 53083-1883 T 920.458.8711 F 920.458.0537 WWW.AECOM.COM		 City of Milwaukee Department of Public Works		 P.S.J. ENGINEERING, INC. CONSULTING ENGINEERS MILWAUKEE: (414) 382-2811 MADISON: (608) 281-5660 PLUMBING, HVAC, FIRE PROTECTION DOCUMENTS DELIVERED BY AAS		DRN DES CHK APP KEH NO ADDENDUM #1 REVISIONS DRN/CHK DATE	
						MAC/MXB		03/08/12	

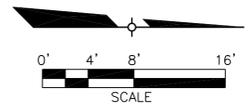
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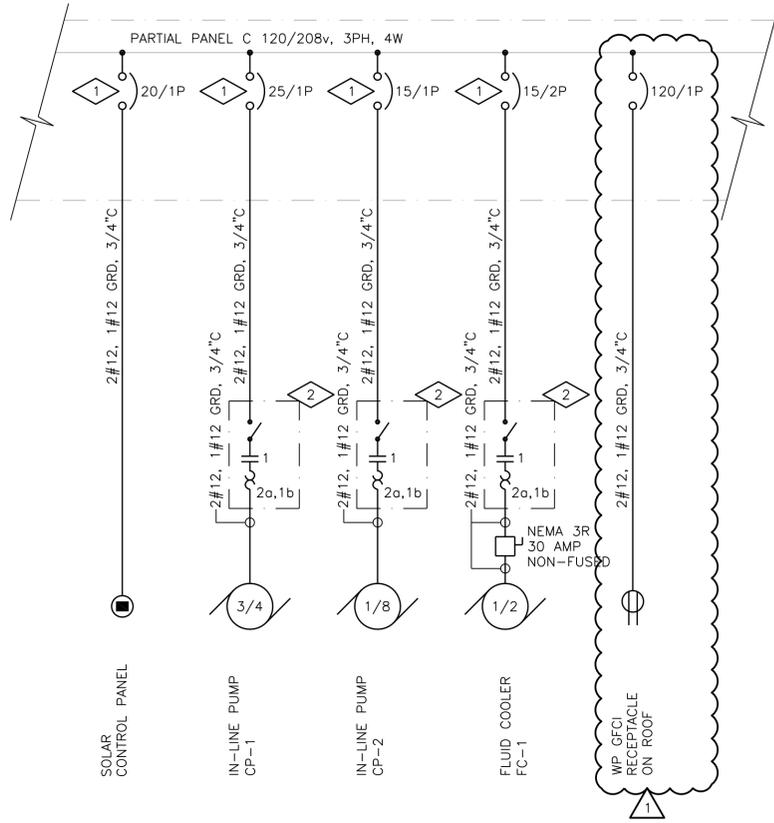
ROOF PLAN ALTERNATE
 SITE NO: 012 - BAY VIEW HIGH SCHOOL
 2751 S. LENOX STREET, MILW., WI 53207-2299

- PLAN NOTES:**
1. PROVIDE NEMA 5-20R, 20A, 120VAC, GROUND FAULT CIRCUIT INTERRUPTER DUPLEX RECEPTACLE. MOUNT TO DISCONNECT RACK, HUBBELL #GF201L OR EQUAL. PROVIDE BELL SINGLE GANG DIE-CAST ALUMINUM BOX AND HINGED GASKETED DIE-CAST ALUMINUM HORIZONTAL MOUNT COVER/ENCLOSURE TO MAINTAIN WEATHER TIGHT SEAL.

CONDUIT TO FOLLOW PIPING DOWN TO STARTER IN TUNNEL 3
 FC-1
 INSTALL NEMA 3R DISCONNECT ON CHANNEL



 4135 TECHNOLOGY PARKWAY SHEBOYGAN, WI 53083-1883 T 920.458.8711 F 920.458.0537 WWW.AECOM.COM		 MILWAUKEE PUBLIC SCHOOLS SOLAR PROJECTS CITY OF MILWAUKEE, WISCONSIN BAY VIEW HIGH SCHOOL ROOF PLAN ALTERNATE SITE 012	
DATE FEBRUARY 2012 PROJECT NO 60239135 FILENAME B-E-05.DWG SHEET NO DRAWING NO		1 ADDENDUM NO.1 NO REVISIONS DRN KWB DES WRW CHK EDM APP KEH	
 Division of Facilities and 124 North 11th Street Milwaukee, Wisconsin 53205-0289 Phone: 414.224.6900		 PSJ ENGINEERING, INC. CONSULTING ENGINEERS 1000 W. WISCONSIN AVENUE MADISON, WI 53703-5601 PLUMBING, HVAC, FIRE PROTECTION DOCUMENTS DESIGNED BY MEB	
DRN KWB DES WRW CHK EDM APP KEH		KWB WRW 03/08/12 DRN CHK DATE	



THERMAL SOLAR POWER DISTRIBUTION ONE-LINE DIAGRAM

NTS NOTE: PROVIDE SAME FOR ALTERNATE BID ITEM.

DIAGRAM NOTES:

1. PROVIDE NEW CIRCUIT BREAKER IN SPACE IN EXISTING SQUARE D NOOB PANEL C. MATCH MANUFACTURER AND AIC RATING.
2. ALLEN BRADLEY SINGLE PHASE COMBINATION (DISCONNECT TYPE) MAGNETIC STARTER WITH 120V CONTROL POWER TRANSFORMER 2 N.O., 1 N.C. AUX CONTACTS, NEMA SIZE 1 MINIMUM, NEMA 12 ENCLOSURE.

MILWAUKEE PUBLIC SCHOOLS
 SOLAR PROJECTS
 CITY OF MILWAUKEE, WISCONSIN

**BAY VIEW HIGH SCHOOL
 ONE-LINE DIAGRAM
 SITE 012**

DATE FEBRUARY 2012
 PROJECT NO 60239135
 FILENAME B-E-06.DWG
 SHEET NO
 DRAWING NO
B-E-06

AECOM
 4135 TECHNOLOGY PARKWAY
 SHEBOYGAN, WI 53083-1883
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 WWW.AECOM.COM

**City of Milwaukee
 Department of Public Works**

Milwaukee Public Schools
 Division of Facilities and
 Construction
 124 North 11th Street
 Milwaukee, Wisconsin 53205-0299
 Phone: 414.224.6900

PSJ ENGINEERING, INC.
 CONSULTING ENGINEERS
 1000 W. Wisconsin Ave., Suite 100
 Madison, WI 53704
 PLOMBING, HVAC, FIRE PROTECTION
 DOCUMENTS DESIGNED BY: MAB

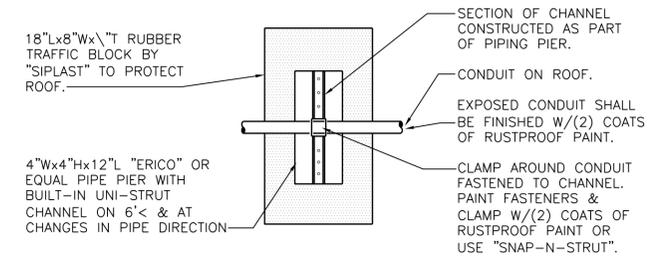
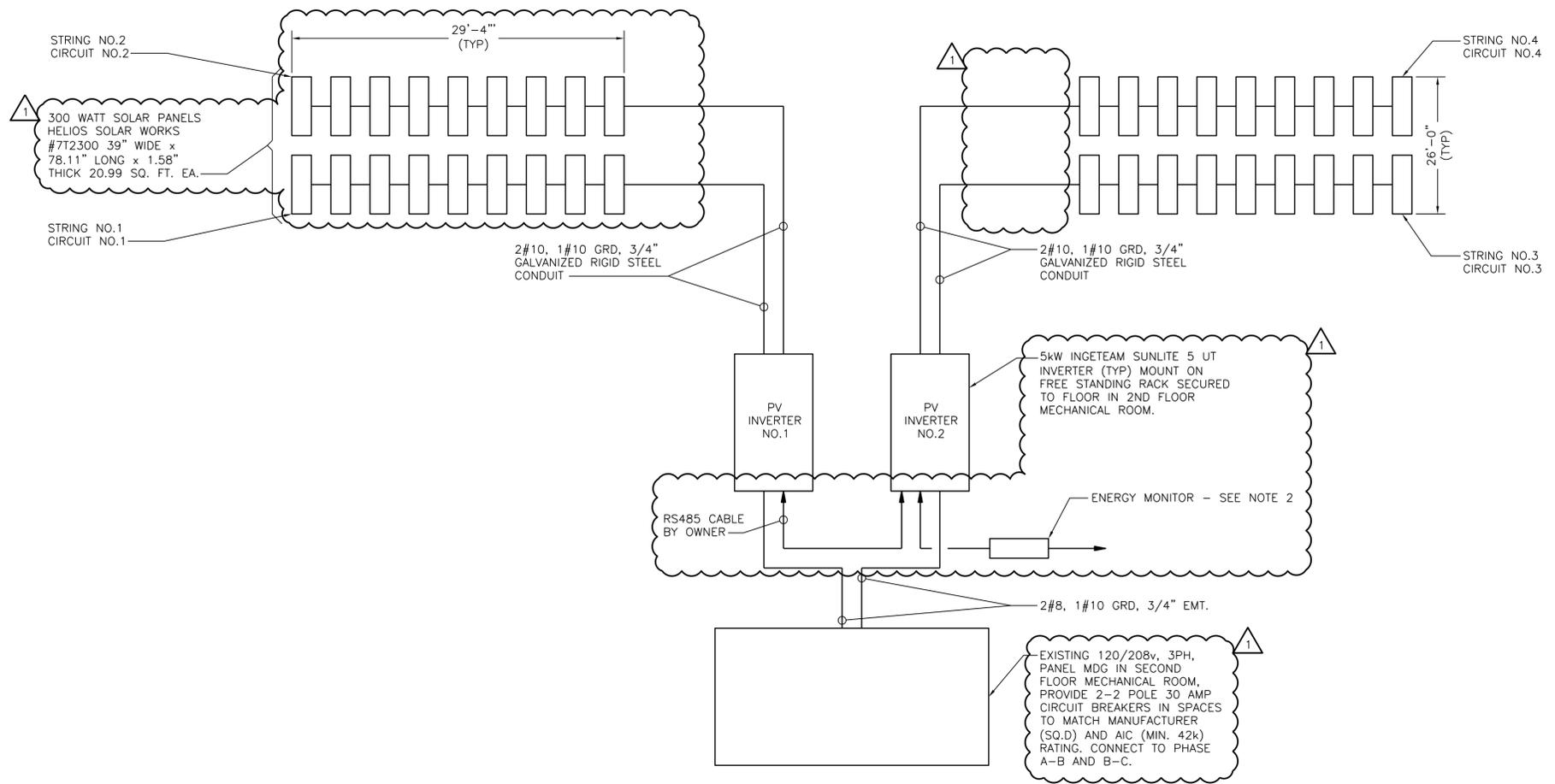
DRN KWB	-
DES WRW	-
CHK EDM	-
APP KEH	-

NO	1	ADDENDUM NO.1	REVISIONS	NO
DRN	CHK	DRN	CHK	DATE
				03/08/12
				KWB WRW

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NOTES:
 INSTALL SUPPORTS PER NEC. PAINT ALL EXPOSED PIPING, SUPPORTS, FASTENERS, ETC. WITH (2) COATS OF RUST PROOF PAINT.

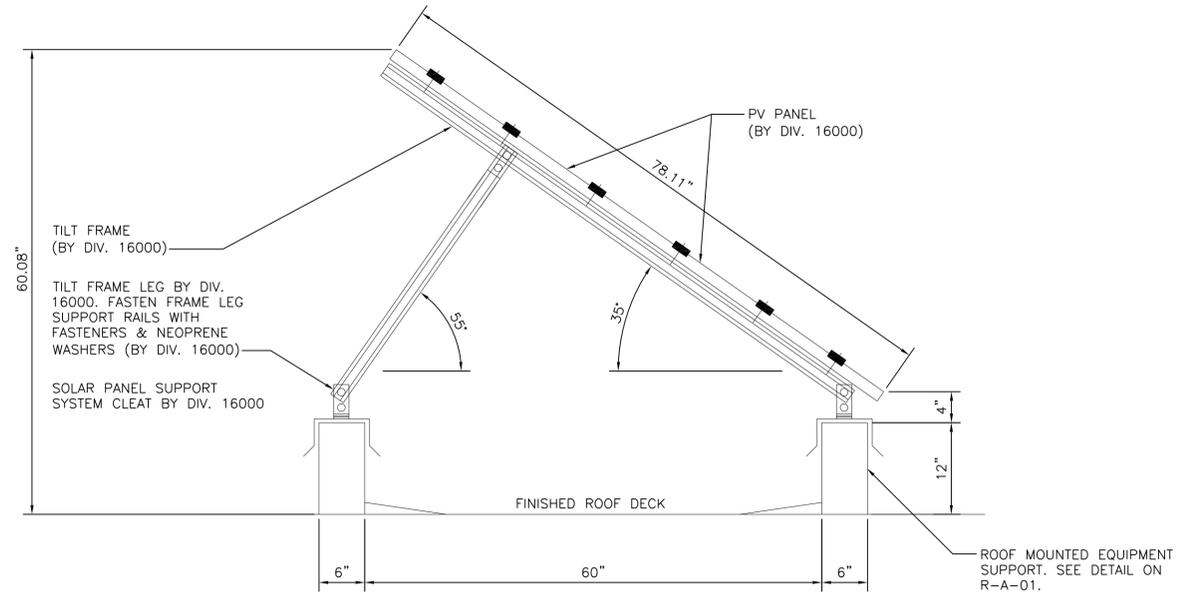
ROOF MOUNTED CONDUIT SUPPORT DETAIL
 NTS

PV ELECTRICAL RISER DIAGRAM (BASE BID)

NTS
 NOTES: 1. GROUND AND BOND PER NEC 250 AND 690.
 2. ENERGY MONITOR - PROVIDE SUN REPORTS INC. APOLLO 2 COMMERCIAL MODEL. CABLES AND TERMINATIONS BY OWNER.

PHOTOVOLTAIC PANEL SCHEDULE

DRAWINGS ARE BASED ON MANUFACTURER & MODEL NO.	QUANTITY	MAX. POWER (WATTS)	TOLERANCE	MAX. POWER VOLTAGE (VOLTS)	MAXIMUM CURRENT (AMPS)	OPEN CURRENT VOLTAGE (VOLTS)	SHORT-CIRCUIT CURRENT (AMPS)	ARRAY WIDTH (IN)	ARRAY LENGTH (IN)	DEPTH (IN)	WEIGHT (LBS)	REMARKS
HELIOS SOLAR WORKS MODEL 712300	36	300	+5%/-5%	30.35	6.67	37.62	7.14	78.11	39	1.58	51.5	
CIRCUIT 1	9	2700	+5%/-5%	303.5	6.67	376.2	7.14	78.11	352	1.58	515	RACK #1-10
CIRCUIT 2	9	2700	+5%/-5%	303.5	6.67	376.2	7.14	78.11	352	1.58	515	RACK #11-20
CIRCUIT 3	9	2700	+5%/-5%	303.5	6.67	376.2	7.14	78.11	352	1.58	515	RACK #21-30
CIRCUIT 4	9	2700	+5%/-5%	303.5	6.67	376.2	7.14	78.11	352	1.58	515	RACK #31-40
TOTALS	36							-	-		2060	



DETAIL NOTES:
 1. TILT MOUNTING FRAME MUST BE COMPATIBLE WITH THE PANEL MANUFACTURER.
 2. VERIFY ROOF SUPPORT RAIL LENGTHS AND LOCATIONS WITH EXACT PANEL AND FRAME MANUFACTURER.
 3. SPACING AND DIMENSIONS BASED ON HELIOS 712285 PANELS.

PHOTOVOLTAIC PANEL ARRAY ELEVATION DETAIL



DRN	KWB	DES	WRW	CHK	EDM	APP	KEH
1							

MILWAUKEE PUBLIC SCHOOLS
 SOLAR PROJECTS
 CITY OF MILWAUKEE, WISCONSIN

**RIVERSIDE UNIVERSITY HS
 RISER DIAGRAM AND DETAILS
 SITE 029**

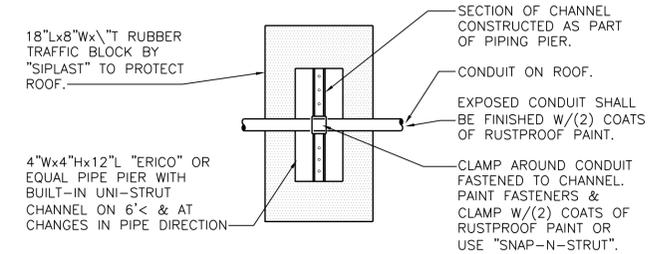
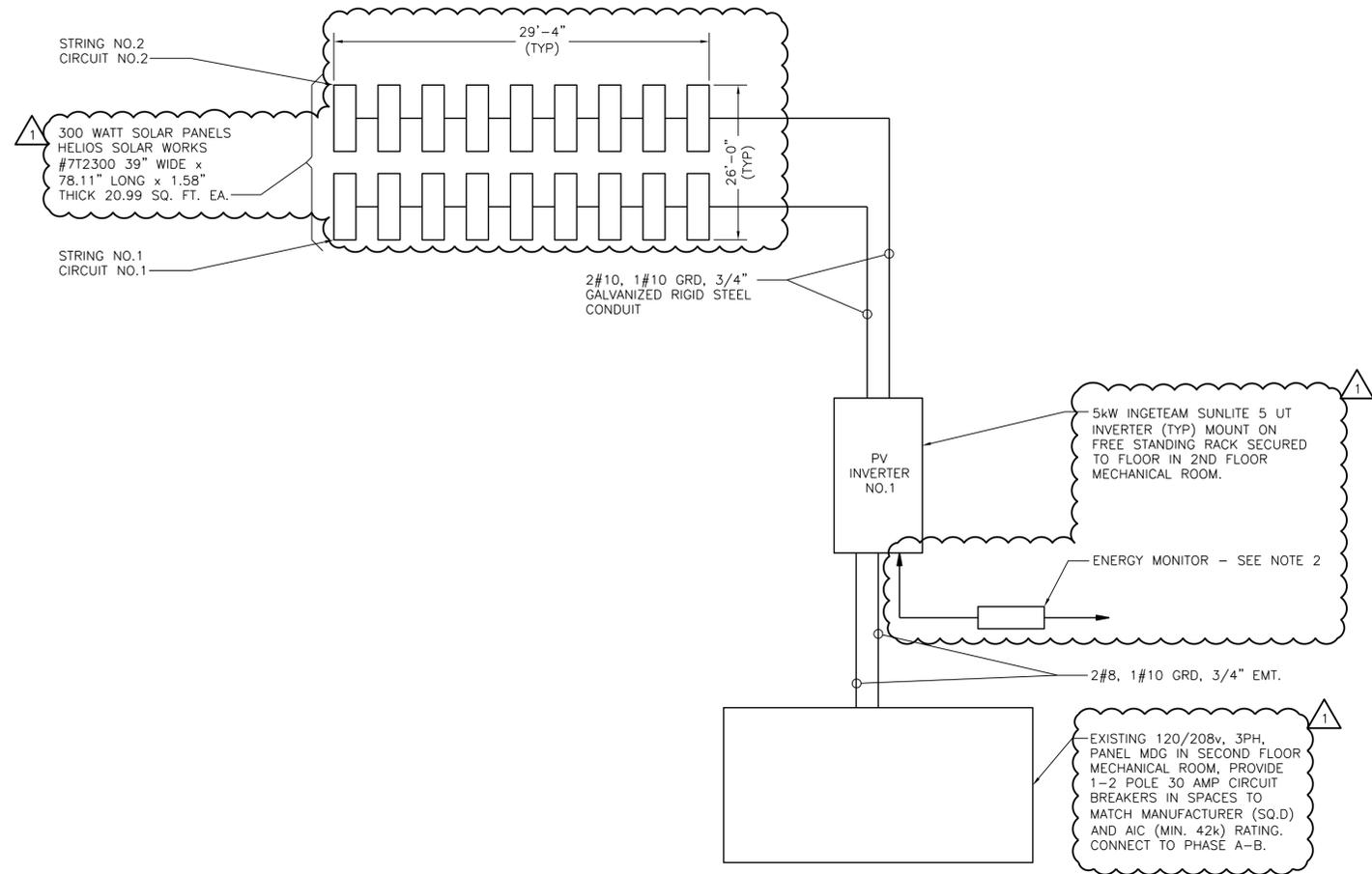
DATE: FEBRUARY 2012
 PROJECT NO: 60239135
 FILENAME: R-E-02.DWG
 SHEET NO:
 DRAWING NO:

REVISIONS
 NO. 1
 APPENDUM NO. 1
 DATE: 06/08/12
 DRN: KWB
 CHK: WRW
 APP: KEH

ADDENDUM NO. 1
 NO. 1
 DATE: 06/08/12
 DRN: KWB
 CHK: WRW

PSJ ENGINEERING, INC.
 CONSULTING ENGINEERS
 124 NORTH 11TH STREET
 MADISON, WI 53703-5601
 PHONE: 608.261.5600
 FAX: 608.261.5601
 DOCUMENTS DESIGNED BY: MAB

AECOM
 4135 TECHNOLOGY PARKWAY
 SHEBOYGAN, WI 53083-1883
 T 920.458.8711 F 920.458.0537
 WWW.AECOM.COM



NOTES:
 INSTALL SUPPORTS PER NEC. PAINT ALL EXPOSED PIPING, SUPPORTS, FASTENERS, ETC. WITH (2) COATS OF RUST PROOF PAINT.

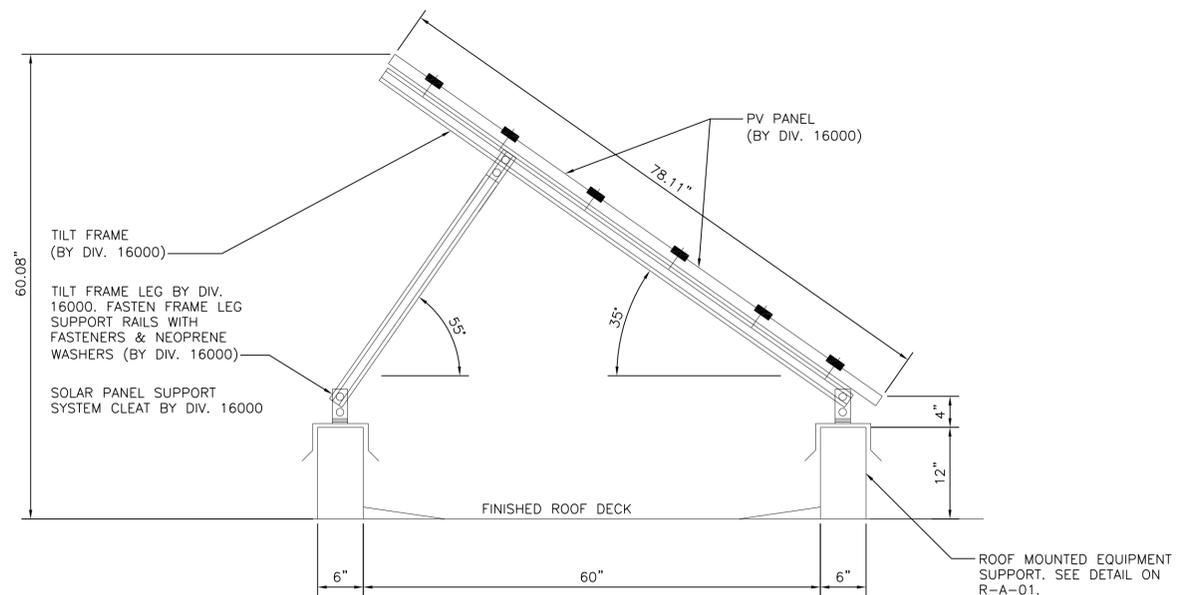
ROOF MOUNTED CONDUIT SUPPORT DETAIL
 NTS

PV ELECTRICAL RISER DIAGRAM (ALTERNATE BID)

NTS
 NOTES: 1. GROUND AND BOND PER NEC 250 AND 690.
 2. ENERGY MONITOR - PROVIDE SUN REPORTS INC. APOLLO 2 COMMERCIAL MODEL. CABLES AND TERMINATIONS BY OWNER.

PHOTOVOLTAIC PANEL SCHEDULE

DRAWINGS ARE BASED ON MANUFACTURER & MODEL NO.	QUANTITY	MAX. POWER (WATTS)	TOLERANCE	MAX. POWER VOLTAGE (VOLTS)	MAXIMUM CURRENT (AMPS)	OPEN CURRENT VOLTAGE (VOLTS)	SHORT-CIRCUIT CURRENT (AMPS)	ARRAY WIDTH (IN)	ARRAY LENGTH (IN)	DEPTH (IN)	WEIGHT (LBS)	REMARKS
HELIOS SOLAR WORKS MODEL 7T2300	18	300	+5%/-5%	30.35	6.67	37.62	7.14	78.11	39	1.58	51.5	
CIRCUIT 1	9	2700	+5%/-5%	303.5	6.67	376.2	7.14	78.11	352	1.58	515	RACK #1-10
CIRCUIT 2	9	2700	+5%/-5%	303.5	6.67	376.2	7.14	78.11	352	1.58	515	RACK #11-20
TOTALS	18										1030	



DETAIL NOTES:
 1. TILT MOUNTING FRAME MUST BE COMPATIBLE WITH THE PANEL MANUFACTURER.
 2. VERIFY ROOF SUPPORT RAIL LENGTHS AND LOCATIONS WITH EXACT PANEL AND FRAME MANUFACTURER.
 3. SPACING AND DIMENSIONS BASED ON HELIOS 7T2285 PANELS.

PHOTOVOLTAIC PANEL ARRAY ELEVATION DETAIL

SCALE: 0' 1' 2'

DRN	KWB	DES	WRW	CHK	EDM	APP	KEH
1							
ADDENDUM NO. 1 NO. 1 REVISIONS NO. 1 DRN CHK DATE 03/08/12 KWB WRW							
Milwaukee Public Schools Division of Facilities and 124 North 11th Street Milwaukee, Wisconsin 53205-0289 Phone: 414-224-6000							
PSJ ENGINEERING, INC. CONSULTING ENGINEERS 600 W. Wisconsin Ave., Suite 111 Madison, WI 53703 PLUMBING, HVAC, FIRE PROTECTION DOCUMENTS DESIGNED BY: MAB							
City of Milwaukee Department of Public Works							
AECOM 4135 TECHNOLOGY PARKWAY SHEBOYGAN, WI 53083-1883 T 920.458.8711 F 920.458.0537 WWW.AECOM.COM							
MILWAUKEE PUBLIC SCHOOLS SOLAR PROJECTS CITY OF MILWAUKEE, WISCONSIN RIVERSIDE UNIVERSITY HS RISER DIAGRAM AND DETAILS ALTERNATE SITE 029							
DATE FEBRUARY 2012							
PROJECT NO 60239135							
FILENAME R-E-03.DWG							
SHEET NO							
DRAWING NO							
R-E-03							

Plotted By: brendelk
 Plot File Date Created: Mar/08/2012 3:15 PM
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