ADDENDUM NO. 7 **DATE: February 28, 2011**

EAST HARTFORD-GLASTONBURY
ELEMENTARY MAGNET SCHOOL PHASE 2
GLASTONBURY, CONNECTICUT
STATE PROJECT NOS. 054-0095 MAG/N/PS & 054-0096 MAG/N/PS
GLASTONBURY BID NO. GL-2011-04

The following changes to the Drawings and Project Manual shall become a part of the Contract Documents superseding previously issued Drawings and Specifications to the extent modified by this Addendum No. 7. Bidders shall ensure this addendum is acknowledged in the appropriate space provided on the Bid Form when submitting their bid.

NOTICE TO ALL PLAN HOLDERS:

If you received this Addendum No. 7 electronically you may not change it in any way except to format it to print on your printer.

CHANGES TO PREVIOUS ADDENDA

A. ADDENDUM NO. 5 - CHANGES TO THE PROJECT MANUAL:

1) On Page 5, under Section 48 14 00 - Solar Energy Electrical Power Generation, the referenced attachment was accidentally omitted from the addendum package. A copy of the new section is attached to this addendum.

B. ADDENDUM NO. 4 - CHANGES TO THE PROJECT MANUAL:

1) On Page 3, under Section 08 41 23 - Fire-Rated Glass and Framing Systems, REPLACE the specification section issued as an attachment to Addendum No. 4 with the attached revised section consisting of 10 pages inclusive dated February 28, 2011.

CHANGES TO THE DRAWINGS

A. GENERAL NOTE - ARCHITECTURAL DRAWINGS:

1) On the architectural drawings, the Graphic Scale Units are to be in “Foot Increments” typical. Note that the “8 inch” dimension is to be “8 foot” dimension. Omit reference to Graphic Scale on Wall Section Drawings – A-300 Series and Drawing A-421.

RESPONSES TO BID RFIS

A. SKETCHES ASSOCIATED WITH BID RFIS:

1) Refer to attached Sketches SKA-003A (RFI No. B-060), SKA-003B (RFI No. B-060), and SSK-2 (RFI No. B-124) that have been issued as part of answered RFIs.

RFI No. B-115 (Dated 2/3/2011)

QUESTION: Drawing S100.2, Section 6/S201. Who is responsible for the underpinning?

REVISED RESPONSE: Bid Package ~~BP-104,~~ Revise to READ: BP-105. Concrete is responsible for the underpinning.

RFI No. B-177, (Dated 2/8/2011)

QUESTION: *Requesting an Asphalt Adjustment be added to the method of payment due in part to the duration of the time to install the final course of pavement being installed in 2012.*

RESPONSE: There is No Escalation or De-escalation clause for Asphalt Adjustment for Bituminous Concrete Pavement.

RFI No. B-315 (Dated 2/11/2011)

QUESTION: Reference special instructions 36 Project Lift. Do you mean Projector Lift? If yes, please provide specification and attachment detail.

REVISED RESPONSE: Yes, it should READ: Projector Lift. In addition, see BID RFI No. B-042 Response regarding BP-111 Item #36. Refer to Addendum No. 4 for Specification Section and Details for Projector Lift. Refer to Detail 10 on Drawing No. E-205 for projector lift manufacturer and model number. Attachment to supporting structure to be in accordance with manufacturer's recommendations.

END OF ADDENDUM NO. 7

SOLAR ENERGY ELECTRICAL POWER GENERATION EQUIPMENT SECTION 48 14 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.2 SECTION INCLUDES

A. Solar energy electrical power generation systems.

1.3 RELATED REQUIREMENTS

A. Section 01 91 13 - General Commissioning Requirements: Commissioning of solar energy electrical power generation equipment.

B. Section 07 54 19 - Polyvinyl-Chloride (PVC) Roofing: Roofing system over which solar energy electrical power generation equipment will be installed.

C. Division 26 sections as applicable to solar energy electrical power generation equipment specified in this section.

1.4 REFERENCES

A. International Electrotechnical Committee (IEC):

1. IEC 61646 - Thin-Film Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval.
2. IEC 61730 - Photovoltaic (PV) Module Safety Qualification.

B. Institute of Electrical and Electronics Engineers Standards Association (IEEE-SA):

1. IEEE-SA 929 - Recommended Practice for Utility Interface of Photovoltaic (PV) Systems.

C. Underwriters Laboratories (UL):

1. UL 1741 - Standard for Safety Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at project site.

1.6 ACTION SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for solar energy electrical power generation equipment.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

C. LEED Submittals:

1. EA Prerequisite 1 and EA Credit 3: Document compliance with performance requirements included in the basis of design report.
2. EA Credit 2: Document the amount of energy produced by the solar energy electrical power generation system and calculate the percentage of the building's annual energy cost provided by the solar energy system. Use the building's annual energy cost calculated in EA Credit 1 or the U.S. Department of Energy's Commercial Building Consumption Survey database to determine the estimated electricity use.

D. Shop Drawings:

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

E. Delegated-Design Submittal: For solar energy electrical power generation system.

1. Determine electric utility company requirements for integration between the solar energy electrical power generation system and the electric grid.
2. Confirm layout of PV modules on roof area to maximize solar power potential in assigned area and provide the required number of modules and rated system capacity.
3. Provide signage as required by NEC 690.
4. Provide electrical power load generation analysis for the PV system and size conductors for both the AC and DC portions of the system.
5. Provide drawings and specifications for a roof mounted PV system capable of producing approximately 52.4kW and include the DC and AC portions of the system as well as equipment required to integrate PV system with electric utility equipment.
6. Prepare and provide a 20-year financial analysis of the system's performance, maintenance requirements and economic underlying parameters for the Owner.

F. Bill of Materials: For solar energy electrical power generation system equipment including the following components:

1. PV modules and arrays.
2. PV module interconnection wiring.
3. Array source circuit wiring.
4. Array output circuit wiring.
5. DC disconnect.
6. Grid-dependent inverter.
7. Combiner boxes.
8. AC branch circuit breakers.
9. AC wiring.
10. Grounding and bonding wiring.
11. DC over-current protection, PV combiner boxes, AC disconnect and surge suppression device as may be required.

1.7 INFORMATIONAL SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Qualification Data: Furnish for solar energy electrical power generation system designer and installer.

C. Product Test Reports: For each solar energy electrical power generation equipment item, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Field quality-control reports.

E. Sample Warranty: For manufacturer's warranty.

1.8 CLOSEOUT SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Operation and Maintenance Data: For solar energy electrical power generation equipment to include in operation and maintenance manuals.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: For each item of equipment specified in this section, a firm experienced in manufacturing solar energy electrical power generation equipment similar to that indicated for this project and with a record of successful in-service performance.

B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.10 DELIVERY, STORAGE AND HANDLING

A. Protect PV modules during delivery, storage and handling to comply with manufacturer's directions, and as required to prevent damage.

1. Minimize risk from exposed fasteners, sharp edges, and potential damage to PV modules or support structure.
2. Ensure modules are fastened to their shipping pallet or mounting rack to avoid them blowing off the roof.
3. Do not install any scratched or damaged modules.
4. Keep modules clean.

B. Store equipment under cover on blocks above the ground.

C. Store and protect electronic components in a dry, dust-free environment until time of installation.

1.11 FIELD CONDITIONS

A. For roof mounted equipment, verify that membrane is completed prior to start of installation of PV modules. Coordinate installation of PV modules with work of roofing contractor.

1.12 WARRANTY

A. PV Manufacturer's Warranty: Manufacturer agrees to repair or replace components of the cylindrical PV modules that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. Power: 25 years from date of Substantial Completion.
b. Product: Five (5) years from date of Substantial Completion.

B. Inverter Manufacturer's Warranty: Manufacturer agrees to repair or replace components of the inverter that fails in materials or workmanship within specified warranty period.

1. Warranty Period:

a. Product: Minimum Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in

Section 01 40 00, to design solar energy electrical power generation system.

B. Seismic Performance: Solar energy electrical power generation system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

D. Operating Condition Ratings:

1. Materials and equipment located outdoors shall be resistant to sunlight, temperature, humidity, and other weather conditions to which they are exposed.
2. Electrical equipment and products shall have appropriate voltage, current, and temperature ratings for the intended application. Include the terminals of the products.

a. Wiring combiner boxes, junction boxes and terminals near the PV modules shall be rated for 194 degrees F.

2.2 MATERIALS

A. Sealants: Urethane sealant for all non-flashed roof penetrations or as required by roof manufacturer.

B. Do not use dissimilar metals, such as steel and aluminum, in direct contact with one (1) another.

1. Do not place aluminum in direct contact with concrete materials.

C. Nameplates: Provide component parts of each item of equipment or device with a manufacturer's nameplate indicating the name of the manufacturer, description, size, type, serial or model number, electrical characteristics, etc., in order to facilitate maintenance or replacement. The nameplate of a subcontractor or distributor will not be acceptable. At a minimum provide nameplates for the following:

1. Photovoltaic panels.
2. Inverters.
3. DC disconnects.
4. Combiner boxes.
5. AC disconnects.

2.3 PHOTOVOLTAIC (PV) PANELS

A. Cylindrical PV Modules: PV panels assembled from individual cylindrical modules incorporating copper indium gallium diselenide (CIGS) thin-film technology contained in glass tubes. Factory test modules for design performance and include results in operation and maintenance manuals.

1. Products: Subject to compliance with requirements, provide the following:

a. Solyndra, Inc.; Model SL-150-182 Cylindrical PV Panels.

B. Capacities and Characteristics:

1. Cell Type: Cylindrical CIGS.
2. Maximum System Voltage: Universal design; 1000V (IEC) and 600V (UL) systems.
3. Panel Dimensions: 1.82m x 1.08m x 05m
4. Panel Height: 0.03m to top of panel on mounts.
5. Mounts: Non-penetrating, powder-coated aluminum.
6. Connectors: Four (4) Tyco Solarlok; 0.20 m cable.
7. Series Fuse Rating: 24.4 Amps.
8. Roof Load: 3.3 lb/sq ft for panel and mounts.
9. Panel Weight: 68 lbs without mounts.
10. Snow Load Maximum: 50.1 lbs/sq ft.
11. Hailstone Impact: 25 mm, 7.53 g at 23 m/s per IEC 61646.
12. Wind Performance: 130 mph maximum; self-ballasting with no attachments.
13. Operating and Storage Temperature: -40 C to + 85 C degrees
14. Normal Operating Temperature: 47.1 degrees C at 800 W/m^2 where the temperature is 20 degrees C and the wind is one (1) m/s.

C. System Capacities and Characteristics:

1. Total Number of Panels: 288.
2. Minimum Total System Capacity: 52.4 Kw.
3. Model Number: SL-150-182.
4. Power Rating (P_{mp}): 182 Wp.
5. Power Tolerance (%/Wp): +/- 4.
6. Voltage at Maximum Power (V_{mp}): 92.9 V.
7. Current at Maximum Power (I_{mp}): 1.96 A.
8. Open Circuit Voltage (V_{oc}): 125.1 V.
9. Short Circuit Current (I_{sc}): 2.31 A.
10. Temp. Coefficient of V_{oc}: -.28 %/°C.
11. Temp. Coefficient of I_{sc}: -.02 %/°C.
12. Temp. Coefficient of Power: -.38 %/°C.

2.4 DC/AC INVERTERS

A. DC/AC Inverter: IEEE 929 compliant, listed to UL 1741, CEC approved; utility interactive type. Factory test inverters for design performance and include results in operation and maintenance manuals.

1. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

a. SMA ST-42
b. SatCon; PowerGate Plus PV Inverter – 50kW.

B. Capacities and Characteristics:

1. AC Current Distortion at Rated Power: <5% THD.
2. Power Tracking Window Range: 330 to 600 VDC.
3. Maximum Ripple Current (Percentage of Rated Current): <5%.
4. Peak Inverter Efficiency: >95%.
5. Standby Tare Losses: <30 watts.
6. Ambient Temperature Range: -40 degrees F to 122 degrees F.
7. Cooling Method: Convection cooling.
8. Protective Functions:

    a. Standard wakeup voltage.
    b. Wakeup time delay.
    c. Shut down power.
    d. Shut down time delay.
    e. AC over / under voltage and time delays.
    f. AC over / under frequency and time delays.
    g. Ground over current.
    h. Over-temperature.
    i. AC and DC over current.
    j. DC over voltage.

9. User Display: Standard-LCD, four-line, twenty characters.
10. Communications Software: Serial communications and control software.
11. Furnish inverter with a communication port capable of remote monitoring of operation from a computer or from specialized monitoring equipment.

C. Automatic Drop-off:

1. Inverters to automatically drop-off-line when normal utility power is lost to avoid unintentional islanding effects. Drop-off to activate due to over-voltage (110 percent) or under-voltage (88 percent) and be adjustable.
2. Frequency drifts outside 59.3 to 60.5 Hz for more than 10 cycles shall activate automatic drop-off.
3. Automatic reconnection shall not occur until the normal utility power has been stable for at least four (4) minutes.

D. The system shall be capable of operating between a power factor of 0.9 lagging to 0.9 leading.

2.5 DC DISCONNECT SWITCH

A. DC disconnect switch to have a DC current rating appropriate to PV output circuit. Disconnect to be either single or two (2) pole to meet DC ratings.

B. Locate disconnect between PV module array and inverter to disconnect inverter from array unless circumstances dictate otherwise.

1. Enclosure: Totally enclosed, non-ventilated.
2. Enclosure Materials: Coated steel or stainless steel.
3. NEMA Design: 4R.

2.6 DC OVER-CURRENT PROTECTION

A. Provide appropriately sized DC over-current protective devices for PV array strings when:

1. The PV modules' maximum series fuse specification is less than the sum of the array fault current; and
2. The array consists of more than two (2) strings.

B. Size the DC over-current protection to include any AC back feed from the grid.

2.7 SURGE SUPPRESSION DEVICES

A. Furnish and install a surge suppression device if inverter does not contain one (1), appropriately sized and mounted near the inverter. Connect surge suppression device to the inverter and/or at point of interconnection as recommended by the inverter manufacturer.

2.8 COMBINER BOXES

A. Combiner Boxes, if design specified: Permits the safe organization and fusing of PV module arrays. UL listed for safety as an inverter accessory to UL 1741. Enclosure to be weather-sealed and hinged to permit vertical or horizontal mounting.

1. Manufacturers: Subject to compliance with inverter and design requirements, provide products by one (1) of the following:

   a. SMA.
   b. Blue Oak PV Products, a Sunlink Company.
   c. Square D.

2. Enclosure: Totally enclosed, non-ventilated.
3. Enclosure Materials: Aluminum or fiberglass.
4. NEMA Design: 4X.

2.9 WIRE MANAGEMENT CHANNELS

A. Conduits shall be mounted on high-density polyethylene (HDPE) supports, such as Pipe Pier, or equivalent and must comply with Roof Manufacture's specification so as not to react adversely with roof membrane.

2.10 WIRING

A. Wiring to conform to national and local electrical codes. Wiring to be suitable for the location in which it is used and rated for the conditions in which it is installed. Use copper conductor insulated wire.

1. Power wiring insulation rating to be 600 V.
2. Exposed wiring not in conduit to be UV resistant, i.e. USE-2 negative conductor in white, labeled as such, and listed for temperature rating of 194 degrees F in wet locations.
3. In areas where conductors may be subject to high temperatures such as in exposed conduit or mechanical rooms, insulation rating shall be 194 degrees F. In other areas, use 167 degrees F rating.
4. Use copper conductors for #10 and larger cables.
5. Utilize cable trays provided by panel manufacturer.

B. DC Wiring: Size conductors such that there is a maximum of one (1) percent voltage drop measured at the short circuit rating of that circuit over the entire length of each circuit from PV modules to inverter and back to PV modules.

C. AC Wiring: Size conductors for maximum of one (1) percent voltage drop measured at the continuous AC current rating of the inverter between the inverter and the point of interconnection with the PV module array.

2.11 AC SERVICE PANELS

A. AC Service Panels: Refer to Section 26 24 13 and 26 24 16.

2.12 WARNING SIGNAGE

A. Furnish and install the following signage at completion of the installation:

No.	Warning Sign	Location	Mounting Holes	Sign Location	Typical Width	Typical Height
1	Solar Array Rating V_{oc} XXX VDC[1] I_{sc} X.X ADC[2] V_{mp} XXX VDC[3] I_{mp} X.X ADC[4]	On DC disconnect next to inverter	Not required	Indoors	3-1/4 inches	1-1/16 inches
2	Solar Electric System	At inverter's AC disconnect	Not required	Indoors	2-3/8 inches	1-1/16 inches
3	Solar Electric System	At the building's meter	Yes	Outdoors	4 inches	3 inches
4	Inside parts that can be energized when switch is open	On inverter's AC disconnect	Not required	Indoors	3-1/8 inches	1-1/16 inches
5	Solar Electric System	Next to PV system's breaker at breaker panel	Not required	Indoors	2 inches	1 inch
6	Warning: Live during Daylight Hours Max XXX VDC[1]	On inside or outside of any junction box with solar array DC circuits	Not required	Indoors	2 inches	1 inch

1 XXX is the open circuit voltage of the PV array - typically 200 to 600 volts DC.
2 X.X is the short circuit current of the PV array - typically 4 to 30 amperes DC.
3 XXX is the voltage of the PV array at its rated operating point - typically 200 to 400 VDC.
4 X.X is the amperage of the PV array at its rated operating point - typically 4 to 15 ADC.

2.13 ACCESSORIES

A. Cable Ties: Non-ferrous, UV resistant

B. Cable Clips: See wire channel cable trays above.

C. Array Output Cables: Fabricated from #10 AWG USE-2 sunlight-resistant cable. Furnish cables with snap-together multi-contact hard plastic connectors; male on one (1) end and female on the other end. Cables are for use between PV arrays and junction boxes or grid-tie inverters. Negative conductor to be white and positive conductor to be red, black or blue, consistent throughout.

1. Products: Subject to compliance with requirements, provide the following:

a. Tyco Solarlok.

D. Array Connectors: Site assembled or pre-made connectors to permit fabrication of custom cables using a special crimping tool and wrench. Accommodates #10 AWG USE-2 and #10 AWG PV wire.

E. Grid-Tie System Monitoring Equipment:

1. Use inverter specific data acquisition systems such as SMA Webbox or Satcon PV Viewing Monitor system.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Acceptable Installers: Subject to compliance with requirements, utilize the following installer for system design and installation:

1. American Solar & Alternative Power (ASAP), 62 Southfield Avenue, Suite 118, Stamford, CT 06902, Telephone: 203-324-7186, Website: www.solarasap.com.

3.2 EXAMINATION

A. Examine areas and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for solar energy electrical power generation equipment conduit to verify actual locations of connections before equipment installation.

C. Examine walls, floors, and roofs for suitable conditions where solar energy electrical power generation equipment will be installed.

D. Prepare written report, endorsed by installer, listing conditions detrimental to performance.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION, GENERAL

A. Equipment Installation: Install solar energy electrical power generation equipment with seismic-restraint devices included. Comply with requirements for seismic-restraint devices specified in Section 26 05 48.

B. Comply with NECA 1.

C. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

D. Wiring Within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.4 INSTALLATION

A. PV Arrays:

1. Coordinate PV array installation with building envelope penetration or groundwork.
2. Ensure that roof area or other installation site is capable of handling designed array size with no overlapping edges except as per design.
3. If roof mounted, verify that the roof is capable of handling additional weight of PV system.
4. Install PV mounting rack and modules in accordance with shop drawings.
5. Ensure corrosion resistance and durability of mechanical hardware.
6. Use live wiring methods when connecting PV modules, since modules are electrically "alive" as soon as they are exposed to light.
7. Provide lock-washers to prevent "backing out" of nuts at bolted connections. Use stainless steel fasteners only.
8. Check string output, V_{oc} and I_{sc}, with over current load tester designed for this purpose, when installing.
9. Must take all precautions to preserve roof manufacturers roof warranty.

B. Inverters: Locate inverters where indicated on Drawings and in a space that complies with inverter’s ambient temperature operating requirements.

C. Wiring:

1. Install wiring connections and terminations at PV modules and inverters in accordance with manufacturers’ recommendations.
2. Label all circuits within combiner boxes and any terminal strips in junction boxes for polarity and string number (both positive and negative). Label all other wiring for polarity and/or phase.
3. Permanently label exterior or interior of junction boxes containing PV DC circuits with the words "Warning: Live during Daylight Hours".

D. Monitoring Equipment:

1. Prior to installation, confirm that Owner has installed a suitable internet communication cable between the internet router and monitoring equipment and that this cable is operational. Connection requires static IP internet address to access inverter and monitoring equipment.
2. Install monitoring equipment, instrumentation and wiring in accordance with manufacturer's installation instructions.
3. Confirm that monitoring equipment is operational.

E. Identification of Components:

1. Clearly identify all control devices (i.e. circuit breakers, switches, AC and DC disconnects) as to their function and the equipment controlled.
2. Clearly identify inverters and the panelboard they serve.
3. Identification text shall be a minimum of 3/4 inches high.
4. Equipment labels and warning signs shall be permanent self-adhesive engraved phenolic legend plates with standard engraver's letter style, using a standard size appropriate for the application. Minimum label thickness shall be 0.063 inch.

F. Lightning Arrestor Tie-in: Tie solar energy electrical power generation equipment located on roof into lightning arrestor system.

3.5 FIELD QUALITY CONTROL

A. Field Testing: Perform the following testing:

1. Field-test each PV string prior to completing installation to verify electrical integrity and specified performance.

a. Measure and record open circuit voltage (V_{oc}) and short circuit current (I_{sc}).
b. Record ambient air temperature, module surface temperature and solar irradiance conditions (watts/m^2) at panel level
c. Complete testing under sunny conditions.
d. In the event that measurements are out of expected ranges, deem the module defective and notify the equipment manufacturer.
e. Do not install defective modules.
f. Correct all installation defects identified during field testing.
g. Prepare and submit testing reports to Architect, Construction Manager, and Owner.

3.6 EQUIPMENT STARTUP

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

B. Inspect equipment prior to starting to ensure full compliance with the equipment

manufacturers' specifications and instructions as to the electrical connections, voltages and other applicable considerations.

C. Place each item of equipment installed including PV modules, disconnects, wiring, inverters, etc., and start up each unit and check it for performance.

3.7 SYSTEM COMMISSIONING

A. System Commissioning: Commission the solar energy electrical power generation system to assist in the verification and inspection of the system after installation and for subsequent re-inspection, maintenance or modifications. Verify that the system has been installed in accordance to the delegated design and manufacturer's installation instructions.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain system components.

B. Provide a one (1) hour on-site training session for personnel designated by Owner.

C. Training session to include the following as a minimum:

1. Operate the solar energy electrical power generation system, know the location of control components, and know how to turn the system on and off.
2. Demonstrate control functions, operating modes and emergency procedures.
3. Understand system equipment, their location and connection to other equipment.
4. Understand system operation, including factors affecting its optimal operation.
5. Access graphics, data reports, and logs.
6. Recognize malfunctions of system by observation of visual information.

D. Provide training session during the daytime using the completed operation and maintenance manual.

3.9 CLEANING

A. At completion of Work, check equipment furnished under this section for paint damage, and repair any factory-finished paint that has been damaged to match adjacent areas.

B. Replace any cabinet or enclosure that has been deformed with new material and repaint to match adjacent equipment.

END OF SECTION

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.2 SECTION INCLUDES

A. Fire rated curtain wall systems including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of curtain wall framing.

1.3 RELATED SECTION

A. Section 08 11 13 - Hollow Metal Doors and Frames: Standard hollow metal doors and frames.

B. Section 08 71 00 - Door Hardware: Door hardware for fire-rated doors and frames.

C. Section 08 80 00 - Glazing: Glazed lites in steel doors and frames.

D. Sections 09 91 23 - Interior Painting: Field painting hollow metal doors and frames.

1.4 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings.

B. ASTM International (ASTM):

1. ASTM A1008 - Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
2. ASTM A1011 - Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
3. ASTM E119 - Methods for Fire Tests of Building Construction and Materials.
4. ASTM E283 - Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen.

5. ASTM E330 - Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference Procedure A.
6. ASTM E331 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
7. ASTM E783 - Test Method for Field Measurement of Air Leakage through Installed Exterior Windows and Doors.
8. ASTM E1105: Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.
9. ASTM E2074 - Test Method for Fire Tests of Door Assemblies, including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.
10. ASTM E2010 - Test Method for Positive Pressure Fire Tests of Window Assemblies.

C. Consumer Product Safety Commission (CPSC):

1. CPSC 16 CFR 1201 Categories I and II - Safety Standard for Architectural Glazing Materials.

D. National Fire Protection Association (NFPA):

1. NFPA 80 - Standard for Fire Doors and Fire Windows.
2. NFPA 251 - Standard Methods of Tests of Fire Endurance of Building Construction and Materials.
3. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
4. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies.

E. Underwriters Laboratories, Inc. (UL):

1. UL 9 - Fire Tests of Window Assemblies.
2. UL 10B - Fire Tests of Door Assemblies.
3. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
4. UL 263 - Fire tests of Building Construction and Materials

1.5 PERFORMANCE REQUIREMENTS

A. System Description:

1. Steel fire-rated glazed curtain wall system, outside glazed pressure plate, cover cap format.
2. Face Width: 1-3/4 inches.
3. Water Drainage: System is vertically weeped. No joint plugs or weep holes at horizontal mullions. Notch and receive horizontal gaskets by vertical gaskets.

B. Structural Loads:

1. Uniform Wind Load: ASTM E330; Static air design load of 40 psf applied in positive and negative direction; no deflection in excess of L/175 of span of any framing member at design load.

2. At structural test load equal to 1.5 times specified design load, no glass breakage or permanent set in the framing members in excess of 0.2 percent of their clear spans shall occur.
3. Seismic Loads: As indicated on Drawings.

C. Air Infiltration: ASTM E283; Air infiltration rate shall not exceed 0.06 cfm/ft^2 at a static air pressure differential of 6.24 psf.

D. Water Resistance (Static): ASTM E331; No leakage at a static air pressure differential of 30 psf as defined in AAMA 501.

E. Water Resistance (Dynamic): AAMA 501.1; No leakage at an air pressure differential of 30 psf as defined in AAMA 501.

F. Thermal Movements: Provide steel fire-rated glazed curtain-wall systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

1.6 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

C. LEED Submittal:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

D. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer registered in the State of Connecticut detailing fabrication and assembly of steel fire-rated glazed curtain-wall systems.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Samples for Initial Color Selection: For curtain wall frames with factory-applied powder coat color finishes.

1. Duplicate copies of manufacturer's powder coating color charts showing the full range of colors available.

F. Samples: For following products:

1. Two (2) 8-inch by 10-inch samples for glass.
2. Verification sample of selected finish on steel frame piece.

G. Glazing Schedule: Use same designations indicated on drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

H. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements.

1. Separate certification will not be required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for project and whose work has resulted in construction with a record of successful in-service performance.

1. Engineering Responsibility: Preparation of data for glazed curtain-wall systems including the following:

a. Shop drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this project and submission of reports of tests performed on manufacturer's standard assemblies.

B. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction, approving acceptable installer and approving application method.

C. Source Limitations for Glazing Accessories: Obtain framing system, glazing and glazing accessories from one (1) source for each product and installation method indicated.

D. Listings and Labels - Fire Rated Assemblies: Under current follow-up service by Underwriter Laboratory maintaining a current listing or certification. Label assemblies accordance with limits of manufacturer's listing.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle under provisions specified by manufacturer.

B. Deliver materials to specified destination in manufacturer or distributor's packaging undamaged.

C. Store off ground, under cover, protected from weather and construction activities.

1.9 PROJECT CONDITIONS

A. Obtain field measurements prior to fabrication of frame units. If field measurements will not be available in a timely manner coordinate planned measurements with the work of other sections.

1. Note whether field or planned dimensions were used in the creation of the shop drawings.

B. Coordinate the work of this section with others affected including but not limited to other interior components and door hardware beyond that provided by this section.

1.10 WARRANTY

A. Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of steel fire-rated glazed curtain-wall systems that do not comply with requirements or that deteriorate as defined in this section within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration caused by thermal movements.
c. Deterioration of metals and other materials beyond normal weathering.
d. Water leakage.
e. Failure of operating components to function normally.

B. Provide the manufacturer's five (5) year warranty dated from substantial completion.

C. Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - GLAZING MATERIAL AND CURTAIN WALL SYSTEM

A. Basis-of-Design Glazing Material: "Pilkington Pyrostop®" fire-rated IGU as manufactured by the Pilkington Group and distributed by Technical Glass Products (TGP), 8107 Bracken Place SE, Snoqualmie, WA 98065, Telephone: 800-426-0279,

Web Site http://www.fireglass.com combined with Viracon Insulating Glass Unit specified in Section 08 80 00.

B. Basis-of-Design Frame System: "Fireframes® Curtainwall Series fire-rated steel frame system as manufactured and supplied by Technical Glass Products (TGP).

C. Substitutions: Substitutions will be processed under provisions of Section 01 25 00.

2.2 MATERIALS - GLASS

A. Fire Rated Glazing Type F: ASTM C1036 and ASTM C1048; composed of multiple sheets of Pilkington “Optiwhite” high visible light transmission glass laminated with an intumescent interlayer. Double-glaze frame with insulating glass unit and fire rated glazing in Stair No. 2.

B. Thickness of Glazing Material: Pilkington Pyrostop® 45, 19mm, 3/4-inch thick and one (1) inch thick Insulated Glass Unit (IGU).

C. Approximate Visible Transmission: Varies with thickness (approximate range 75 to 88 percent).

D. Logo: Each piece of fire-rated glazing shall be labeled with a permanent logo including name of product, manufacture, testing laboratory (UL® only), fire rating period, safety glazing standards, and date of manufacture.

2.3 MATERIALS – STEEL FRAMING

A. Steel Curtainwall Framing System: 45 minutes.

1. Steel Frame: Profiled steel tubing permanently joined with steel bolts.
2. Steel Pressure Plates: Formed stainless steel pressure plate with dimensions recommended by manufacturer to securely hold glazing material in place.
3. Cover Caps: Extruded aluminum.

B. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

C. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A36.
2. Cold-Rolled Sheet and Strip: ASTM A611.
3. Hot-Rolled Sheet and Strip: ASTM A570.

D. Brackets and Reinforcements: Manufacturer's standard high-strength materials with nonstaining, nonferrous shims for aligning system components.

E. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, non-bleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turn out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.

F. Anchors: Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123 or ASTM A153 requirements.

G. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, non-bleeding flashing compatible with adjacent materials.

2.4 FABRICATION

A. Fabricate components per manufacturer's installation instructions and with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush and weatherproof.

C. Prepare components to receive anchor devices.

D. Fabricate anchors.

E. Arrange fasteners and attachments to be concealed from view.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish frames after assembly.

C. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable. Noticeable variations in the same piece are not acceptable.

E. Interior Steel Color-Coated Finish: Apply manufacturer's standard powder coating finish system applied to factory-assembled frames before shipping, complying with manufacturer's written instructions for surface preparation including pretreatment, application, and minimum dry film thickness.

F. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: Cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

2.6 ACCESSORY MATERIALS

A. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil thickness per coat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and members to which the work of this section attaches or adjoins prior to frame installation.

B. Provide openings plumb, square and within allowable tolerances.

1. Provide 3/8-inch shim space at all walls.

C. Notify Architect of any conditions which jeopardize the integrity of the proposed fire wall / door system.

D. Do not proceed until such conditions are corrected.

3.2 INSTALLATION

A. Install frames by a specialty contractor with appropriate experience qualifications; and in strict accordance with the reviewed shop drawings.

B. Install fire safing / fire stopping at edges of system.

C. Install glazing in strict accordance with fire resistant glazing material manufacturer’s specifications.

1. Field cutting or tampering is not permissible.

D. Do not install damaged frames or chipped glassing units.

E. Install plumb and true. Limit out of plumb or true to 1/8-inch in 10’-0” in any dimension.

3.3 REPAIR AND TOUCH UP

A. Limited to minor repair of small scratches. Use only manufacturer's recommended products.

1. Such repairs shall match original finish for quality or material and view.

B. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged.

3.4 PROTECTION AND CLEANING

A. Protect glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

1. Do not clean with astringent cleaners. Use a clean "grit free" cloth and a small amount of mild soap and water or mild detergent.
2. Do not use any of the following:

a. Steam jets;
b. Abrasives;
c. Strong acidic or alkaline detergents, or surface-reactive agents;
d. Detergents not recommended in writing by the manufacturer;
e. Do not use any detergent above 77 degrees F;
f. Organic solvents including but not limited to those containing ester, ketones, alcohols, aromatic compounds, glycol ether, or halogenated hydrocarbons;
g. Metal or hard parts of cleaning equipment must not touch the glass surface.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Wash glass on both exposed surfaces in each area of project not more than four (4) days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

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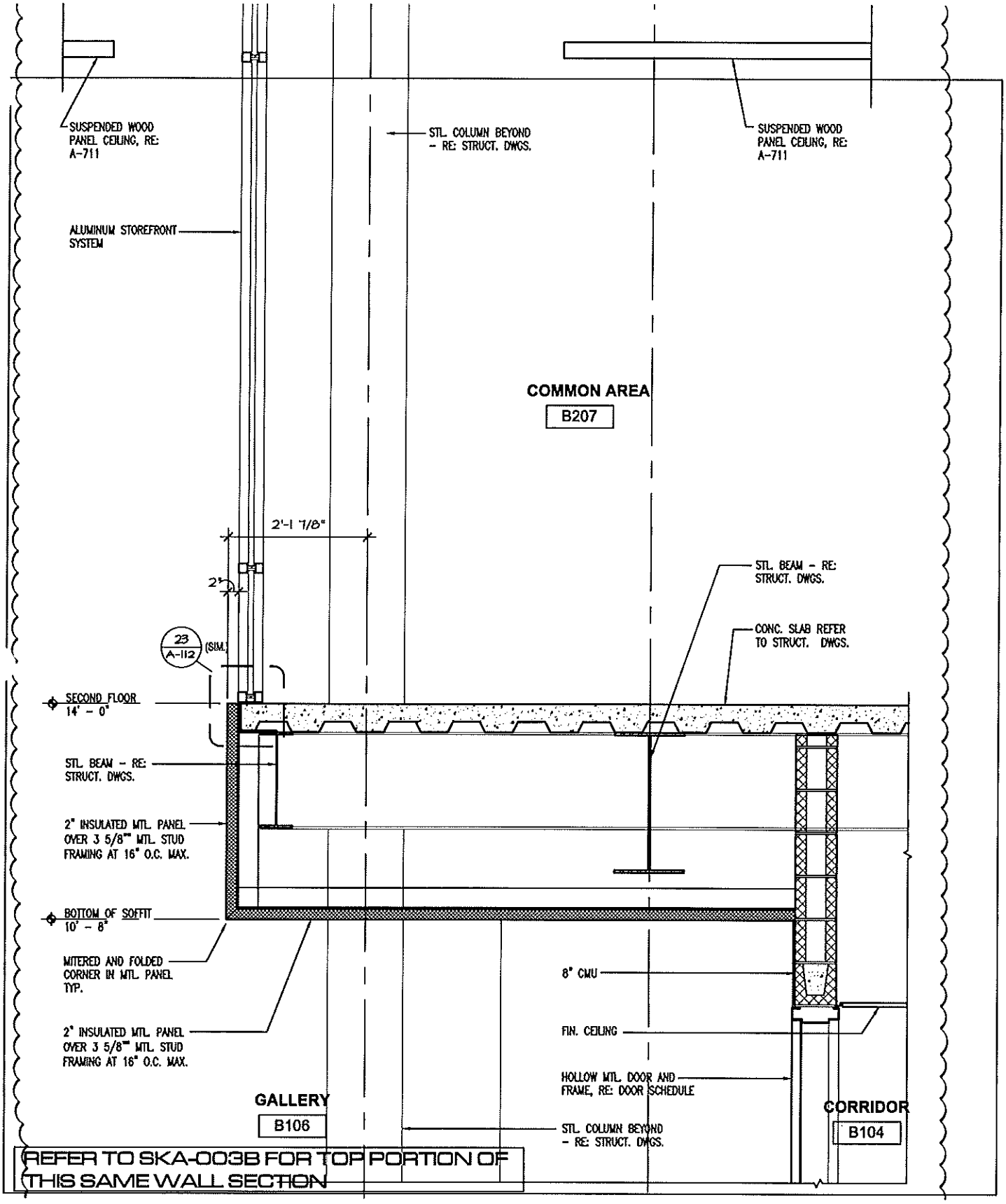
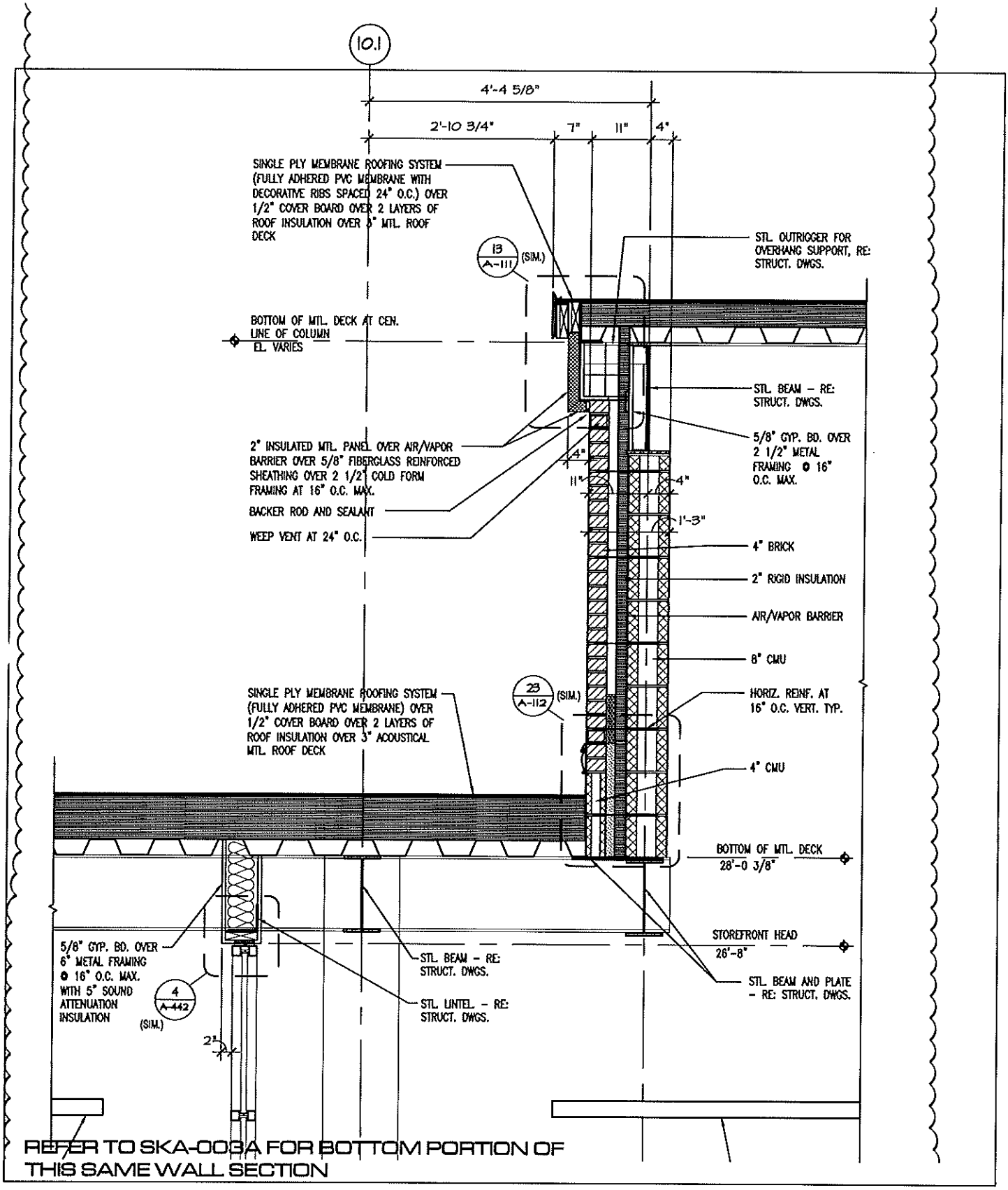
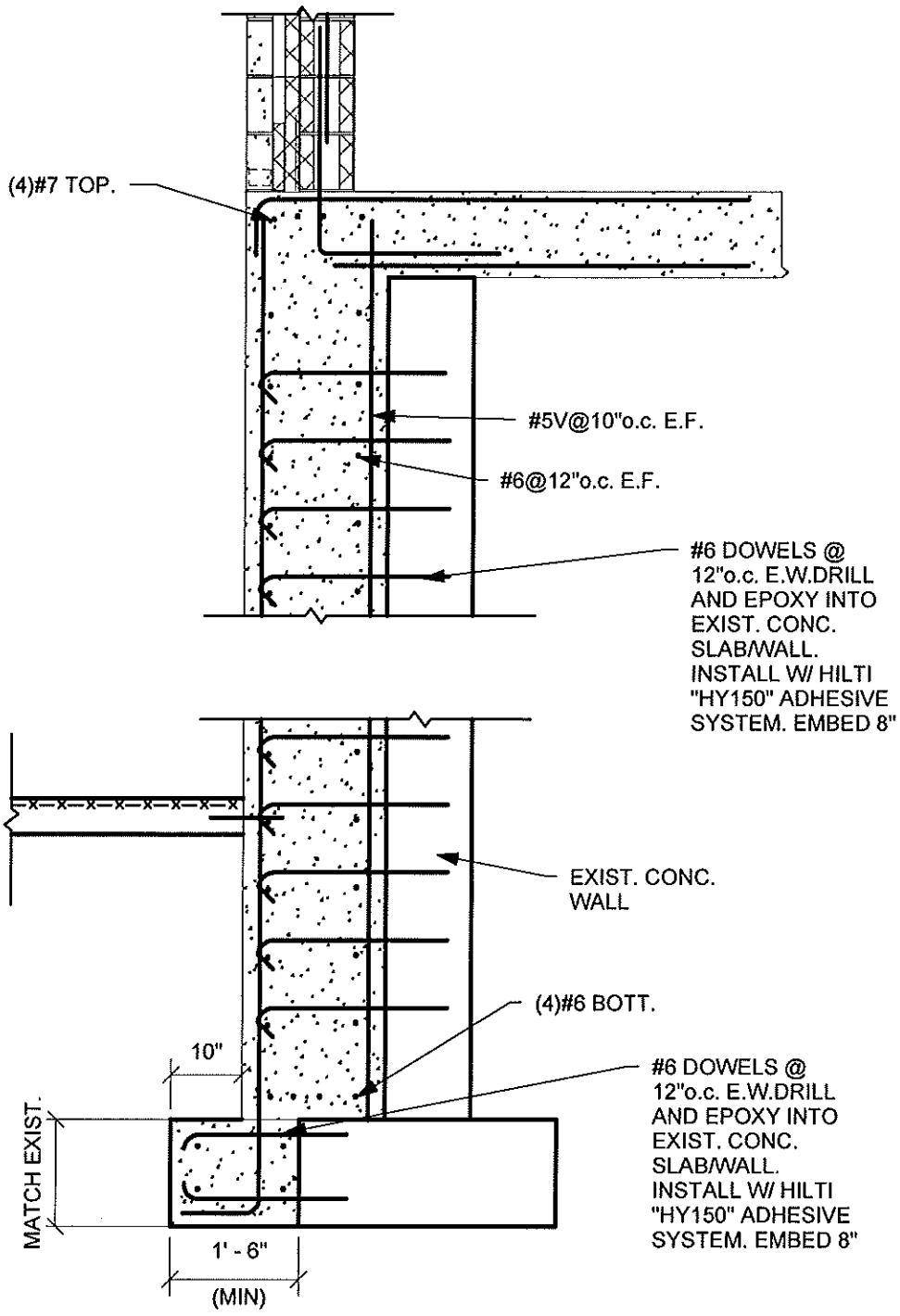


FLETCHER THOMPSON ELEVATING DESIGN | SHAPING SOLUTIONS ARCHITECTURE | ENGINEERING | INTERIOR DESIGN	PROJECT TITLE: EAST HARTFORD GLASTONBURY			2/4/11
	DRAWING TITLE: WALL SECTION PART 1		PROJECT NO.: H090230.000	
THREE CORPORATE DRIVE SHELTON, CONNECTICUT 06484-6244	DRAWN BY: GCC	SCALE: 1/2" = 1'-0"	DWG. NO.: SKA-003A	



FLETCHER THOMPSON ELEVATING DESIGN | SHAPING SOLUTIONS ARCHITECTURE | ENGINEERING | INTERIOR DESIGN THREE CORPORATE DRIVE SHELTON, CONNECTICUT 06484-6244	PROJECT TITLE: EAST HARTFORD GLASTONBURY		2/2/11
	DRAWING TITLE: WALL SECTION PART 2		PROJECT NO.: H090230.000
	DRAWN BY: GCC	SCALE: NTS	DWG. NO.: SKA-003B



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EAST HARTFORD
GLASTONBURY
ELEMENTARY MAGNET
SCHOOL

SECTION 7/S202

Project number	H090230
Date	FEB. 9, 2011
Drawn by	JAS
Checked by	CMW

SSK-2

Scale

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