<table>
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<th>Schedule</th>
<th>Description</th>
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<tr>
<td>MECHANICAL SCHEDULE</td>
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<tr>
<td>ABOVERGROUND HVAC PIPING &amp; VALVE APPLICATION SCHEDULE</td>
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### Sheet Title

**Project Title**

**Revision**

**Sheet No.**

**Date**

**Issue**

**Bids**

**Electrical Standard**

**Schedules**

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#### Branch Circuit Voltage Drop Testing Schedule

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<td>1</td>
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<tr>
<td>3</td>
<td>15</td>
<td>Efficiency</td>
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**Note:** Some symbols and abbreviations shown may not apply to this project.
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9/25/14

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PROPOSAL DATA FOR
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Detroit, MI

44OP-999999

ARCHITECT
Peter Basso Associates
ENGINEER

CONTRACTOR
GENERAL
SPEC1 ELECTRICAL INSTALL SPEC.
SPEC2 ELECTRICAL INSTALL SPEC. 2
SPEC3 ELECTRICAL INSTALL SPEC. 3
TIRM1 TX--I/O TERMINATION SPEC.
TIRM2 TX--I/O TERMINATION SPEC. 2
TMR TX--I/O WIRING SPECIFICATION

CONTROL DRAWINGS
001 DDC COMMUNICATIONS RISER
002 CHILLED WATER SYSTEM CONTROL
003 CHILLER PENTHOUSE EXHAUST
004 EXHAUST FAN 10
005 ROOM 1536
006 TEST CELL 1539
007 COMPRESSED AIR SYSTEM
008 ROOM SENSOR RELOCATION
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.

B. Division 23, Common Work Results for mechanical requirements apply to this section and will require the contractor participation on the Above Ceiling Coordination Program.

1.2 GENERAL INFORMATION

A. This specification section shall include all electrical responsibilities required for the installation & wiring of all temperature controls, as outlined on job plans, specification and temperature central drawings. Specifically, this contractor shall provide pricing direct to those general or mechanical contractors (bid to prime on project) contractors bidding this work, and will be responsible for installation & wiring of all automatic temperature control devices furnished by Siemens Building Technologies as outlined below and as may be required per the project plans & specifications.

B. Siemens Building Technologies, Inc. will provide the following equipment for the building automation system as shown in the temperature central drawings Bill of Materials to include but not limited to:

1. Terminal Equipment Controllers (TEC's)
2. Auxiliary TEC power panels
3. Room Temperature Sensors
4. Damper actuators
5. Flanges
6. Low Voltage Transformers

The Electrical Installation & Wiring Contractor (EWC) shall be responsible for installation of all preceding devices as applicable to this project. This list shall not be considered complete and all bidders should refer to temperature central drawings for specific equipment quantities and locations.

C. During the bidding process, the EWC shall address all questions relative to the Siemens temperature control drawings in writing (RFQ) through the tier of bidding contractors. Siemens shall respond in writing through the tier of bidding contractors.

D. EWC shall install all control equipment provided by Siemens. The EWC shall furnish, install, and terminate all necessary wiring, conduit, hangars, etc. to provide a complete control system installation. All controls to be installed and adjusted by a Siemens qualified electrician in the full time employ of the EWC.

E. The EWC must have full time project superintendent who shall attend all construction meetings after notification that their services are required onsite.

F. Upon completion of all installation and wiring by the EWC, Siemens Building Technologies will conduct verification of point to point wiring and any pneumatic tubing. The EWC will be responsible to make any necessary wiring corrections. At the completion of the point to point verification, approval shall be made by the Owner's Construction Inspection Department and Siemens Building Technologies, Inc.

G. Upon approval by the Owners Construction Inspection Department, Siemens shall program all DDC panels, create necessary graphics and provide any interface between the building automation system and the campus environmental control system.

H. Upon completion of the aforementioned, a performance test shall be conducted as specified in the commissioning section of the specifications.

I. Upon a successful conclusion of the final checkout, performance test and the Owner's acceptance, the EWC's responsibility reverts to a standard warranty (12 months) for labor and material installed by the EWC and labor only for equipment supplied by others.

J. Siemens assumes the manufacturers warranty for all equipment supplied to the EWC for installation on this project.

K. Siemens services to include the following: Design engineering labor required to interface with WSU and the consulting engineer to design the temperature control system. Supervision of the EWC installation and final checkout and approval.

L. Equipment provided by others may require specific cable type and terminations. It is up to EWC to provide cable and terminations needed for a complete working system.

1.3 DEFINITIONS

A. DDC: Direct digital control.
B. I/O: Input/output.
C. BACnet: A central network technology platform for designing and implementing interoperable control devices and networks.
D. NS/TP: Master slave/token passing.
E. PC: Personal computer.
F. PID: Proportional plus integral plus derivative.
G. RTD: Resistance temperature detector.

ELECTRICAL INSTALLATION AND WIRING FOR HVAC TEMPERATURE AND LAB CONTROLS

26 0900 1

ELECTRICAL INSTALLATION AND WIRING FOR HVAC TEMPERATURE AND LAB CONTROLS

26 0900 2

REVISION HISTORY

1 9/25/2014 KAB CHANGES / ADDITIONS PER UPGRADES PROJECT

SIEMENS

Siemens Industry, Inc.
Building Technologies Division

WSU EDC UPGRADES

440P-999999

Detroit, MI

SPEC1

ELECTRICAL INSTALL SPEC.
1.4 PRODUCTS & SERVICES PROVIDED BY OTHERS

A. Mechanical Contractor: Installation of flow switches, temperature or thermometer sensor wells, gage taps, pressure sensor pipe taps, fire valves & tubing into pipe pressure taps and variable frequency drives.

B. Electrical Contractor: Provide 120/10 VAC power to all DDC panels, wire power to all VFD’s. Furnish & install 4" x 4" trough above all control panels. Furnish & install conduit up maximum ten feet from all 4" x 4" troughs. Installation all required nipples between electrical panels and through.

C. Sheetmetal Contractor: Installing all terminal units, airflow stations and dampers.

1.5 PRODUCTS INSTALLED BY THE EWC BUT NOT FURNISHED UNDER THIS SECTION

A. Connect control components, as shown on the plans, factory supplied as part of equipment controlled.

1.6 RELATED SECTIONS

A. Division 23 – General Mechanical Requirements.

B. Division 33 – Instrumentation and controls for HVAC.

C. Division 23 – Indoor Air Handling Units.

D. Division 23 – Air Terminal Units.

E. Division 23 – Testing and Balancing for HVAC.

F. Division 23 – Commissioning of HVAC.

G. Division 26 – Electrical Work.

H. Standard Specifications and Codes: in addition to the requirements shown or specified, comply with the following applicable standard specifications, codes or ordinances:

2. UL – Underwriter’s Laboratories.

G. Include all items of labor and material required to comply with such standards, codes or ordinances in accordance with the contract documents. Where quantities, sizes, or other requirements indicated on the drawings or herein specified are in excess of the standard or code requirements, the specification and drawings shall govern.

1.7 QUALIFICATIONS FOR THE EWC

A. Controls Installation Contractor: The EWC’s will be pre approved by WSU prior to bidding this project.

ELECTRICAL INSTALLATION AND WIRING FOR HVAC TEMPERATURE AND LAB CONTROLS

1.8 QUALITY ASSURANCE

A. Installer Qualifications: EWC contractor must be able to provide references, upon request, for similar projects (in size & scope) that were completed satisfactorily, in Michigan. Project names, owner contacts and companies who awarded this work to you shall all be provided upon request to WSU and/or the AE of record. EWC contractor must be prepared to submit a minimum of three (3) satisfactorily completed projects, annually, for the past five (5) years.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with ASHRAE 135 for DDC system components.

1.9 SEQUENCING AND SCHEDULING

A. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

B. Coordinate with other Contractors and sub contractors to ensure system is completed and commissioned by the Date of Substantial Completion.

C. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

1.10 WARRANTY

A. Provide as per project general conditions.

1.11 CONTROL WIRING

A. The EWC is required to use the cable below.

Refer to temperature control drawing ASBAC Building Automation Cable Specification Catalog.

If a wire type is required that is not referenced on the ASBAC sheet then it is up to the EWC to provide the appropriate wire for the application.

B. The EWC is required to tag all wiring. Wiring that is used for DDC control points should be tagged with abbreviated DDC point name from control submittal.

If wire is to be demod’d make sure the wire is labeled “spare” or “not in use”.

1.12 INSTALLATION

A. Refer to project plans and DDC temperature control drawings for central wiring required and equipment locations.

B. Install control devices per installation requirements of central device. Before installing, always refer to local codes.

ELECTRICAL INSTALLATION AND WIRING FOR HVAC TEMPERATURE AND LAB CONTROLS

REVISION HISTORY

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SPEC2

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1.1 ELECTRICAL WIRING INSTALLATION BY THE EWC (Project Plans and Specifications Preval)

A. Furnish and install ALL wiring and interlock wiring as specified and as shown on the project plans DDC temperature control drawings. Connect controls in accordance with DDC temperature control drawings.

B. Installation minimum requirements:
1. Mechanical Rooms & Penthouses Areas: EMT up ten feet, then exposed plenum I/O point wiring
2. TEC Space Sensors: All cables furnished by Siemens, installed within wall construction without EMT.
3. Other Space Sensors: I/O point wire in EMT for all non-accessible walls, approved plenum open wire in accessible walls.
5. Ceiling Returns (non-accessible) and all other inaccessible areas: All wiring in EMT.
6. Power and low voltage wiring shall not be run in the same conduit.

2.0 ON-SITE TESTING

A. Provide Owner-approved operation and acceptance testing of the complete system. The following shall witness the performance test:
1. The EWC — Electrical (controls) Installation & wiring contractor
2. The equipment manufacturer's representative
3. The Owner's agent
4. The Owner
5. Architect/Engineer

B. Field Test: When installation of the system is complete, all systems shall be tested to their sequence of operation including all safety circuits.

END OF SECTION 26 0000
Reference Only

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CHILLED WATER SYSTEM CONTROL
SEQUENCE OF OPERATIONS

1. MODIFY THE EXISTING SEQUENCE OF OPERATION TO ACCOMMODATE NEW WORK AS FOLLOWS:

FREE COOLING OPERATION

2. FREE COOLING OPERATION SHALL BE ENABLED BY THE DDC WHEN THE NET BULB TEMPERATURE IS BELOW 40°F AND THERE IS A DEMAND FOR CHILLED WATER. THE SYSTEM WILL RETURN TO CHILLER OPERATION WHEN THE OUTSIDE AIR NET BULB TEMPERATURE IS ABOVE 42°F. (ENSURE A SUFFICIENT DEADBAND FOR THE INITIATION AND DEACTIVATION OF THE FREE COOLING MODE TO PREVENT SHORT CYCLING)

3. IN THE FREE COOLING MODE THE EXISTING CHILLER SHALL BE DISABLED BY THE DDC SYSTEM. THE EXISTING CHILLER ISOLATION VALVES SHALL CLOSE, THE ISOLATION VALVES ON ONE COOLING TOWER CELL SHALL CLOSE AND THE FREE COOLING HEAT EXCHANGER ISOLATION VALVES SHALL OPEN.

4. ONE CONDENSER WATER PUMP SHALL RUN AND ONE CHILLED WATER PUMP VFC SHALL BE CONTROLLED BY DDC TO MAINTAIN THE DESIRED DIFFERENTIAL PRESSURE IN THE SYSTEM.


6. DURING FREE COOLING MODE WHEN OUTDOOR AIR TEMPERATURE IS BELOW 32°F TOWER SHALL OPERATE WITH FAN REVERSED IN A DEFOST MODE FOR 10 MINUTES (ADJUSTABLE) EACH HOUR (ADJUSTABLE).

7. DURING FREE COOLING MODE, ONLY ONE TOWER CELL SHALL OPERATE WHILE THE OTHER CELL IS OFF AND THE ISOLATION VALVE ON THE DE-ENERGIZED CELL SHALL BE CLOSED. ALTERNATE OPERATION OF EACH TOWER CELL WEEKLY.

MINIMUM FLOW CONTROL

WHEN THE SYSTEM IS RUNNING THE FREE COOLING MODE, THE DDC SYSTEM SHALL OPEN THE CHILLED WATER BYPASS VALVE TO 50 GPM MINIMUM FLOW AT THE CHILLED WATER PUMPS, REGARDLESS OF CHILLED WATER FLOW TO THE LOAD. THE EXISTING DIFFERENTIAL PRESSURE CONTROL MODULATES THE EXISTING CHILLED WATER PUMP VARIABLE FREQUENCY CONTROL TO MAINTAIN SYSTEM DIFFERENTIAL PRESSURE.

WHEN THE SYSTEM IS OPERATING IN THE CHILLER MODE THE DDC MODULATES THE CHILLED WATER BYPASS VALVE TO MAINTAIN A 350 GPM MINIMUM FLOW RATE THROUGH THE OPERATING Chiller AS SENSED BY THE EXISTING FLOW METER. THE EXISTING DIFFERENTIAL PRESSURE CONTROL MODULATES THE EXISTING CHILLED WATER PUMP VARIABLE FREQUENCY CONTROL TO MAINTAIN SYSTEM DIFFERENTIAL PRESSURE. AS THE SYSTEM FLOW INCREASES ABOVE 350 GPM, THE BY-PASS VALVE CLOSES TO ALLOW FLOW OUT INTO THE SYSTEM.
REFRIGERANT MONITORING / PENTHOUSE EXHAUST FAN
SEQUENCE OF OPERATIONS

1. WHEN THE REFRIGERANT MONITOR SYSTEM DETECTS A LEAK, BOTH EXHAUST FANS ARE STARTED IN THE PURGE MODE AND RUN CONTINUOUSLY UNTIL THE REFRIGERANT MONITOR SYSTEM IS RESET. A PURGE ALARM IS ACTIVATED IN THE DDC SYSTEM WHEN PURGE MODE IS ACTIVATED.

2. DDC SHALL MONITOR CF RUN STATUS THRU CURRENT SWITCH. ABNORMAL STATUS CONDITION SHALL ACTIVATE ALARM.
Reference Only

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REVISION HISTORY
1 9/25/2014 KAB CHANGES / ADDITIONS PER UPGRADES PROJECT

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CHILLER PENTHOUSE EXHAUST
EXHAUST FAN EF-10
SEQUENCE OF OPERATIONS

THE EXISTING DDC SYSTEM IS TO BE MODIFIED AS INDICATED BELOW TO ALLOW THE FIRE SUPPRESSION SYSTEM, ENGINE EXHAUST SYSTEMS, AND TEST CELL PRESSURIZATION AND TEMPERATURE CONTROL TO FUNCTION AS INDICATED BELOW.

THE EXISTING SUPPLY AIR TERMINAL UNIT DDC SHALL TRACK THE ROOM GENERAL EXHAUST AIR TERMINAL UNIT AND ENGINE EXHAUST AIR TERMINAL UNIT AIR FLOWS AND ADJUST THE SUPPLY AIR FLOW INTO THE ROOM TO MAINTAIN A 100 CFM PER DOOR NEGATIVE OFFSET BETWEEN THE EXHAUST AND SUPPLY AIR LEAVING AND ENTERING THE ROOM. THE EXISTING SPACE TEMPERATURE SENSOR, THROUGH DDC, MODULATES THE HEATING COIL CONTROL VALVE AND GENERAL EXHAUST AIR TERMINAL UNIT AIR FLOW CONTROL IN SEQUENCE TO MAINTAIN THE DESIRED ROOM TEMPERATURE CONTROL.

THE ENGINE EXHAUST IS MANUALLY ACTIVATED BY A SWITCH. THE ENGINE EXHAUST AIR TERMINAL UNIT IS OPENED BY THE DDC AND MAINTAINS 1000 CFM OF EXHAUST AIR FROM THE SPACE WHEN THE SWITCH IS ACTIVATED. AN END SWITCH ON THE ENGINE EXHAUST BOX DAMPER LIGHTS A GREEN INDICATOR LIGHT WHEN THE EXHAUST IS ACTIVATED.

THE CO MONITOR INPUTS THE CO CONCENTRATION LEVEL TO THE DDC. IF THE CO CONCENTRATION RISES ABOVE A SAFE LEVEL THE DDC ACTIVATES THE RED ALARM INDICATOR LIGHT IN THE ROOM, A RELAY IS DEACTIVATED SHUTTING DOWN THE ENGINE BEING TESTED AND AN ALARM IS GENERATED IN THE DDC SYSTEM.

WHEN THE ENGINE IS REQUIRED TO BE SHUT DOWN, FROM EITHER THE FIRE SUPPRESSION OR CO MONITOR SYSTEMS, IT IS ACCOMPLISHED THROUGH A STANDARD RECEPTACLE OUTLET ON THE FACE OF THE INDICATOR PANEL LOCATED IN THE ROOM. THE ENGINE CONTROL SAFETY CIRCUIT WILL "PLUG INTO" THE RECEPTACLE COMPLETING THE ENGINE TEST SAFETY CIRCUIT AND ALLOWING THE ENGINE TO RUN UNLESS EITHER OF THESE SYSTEMS IS IN ALARM.

WHenever ANY EXHAUST TERMINAL UNIT DAMPER OPENS, THE DDC STARTS THE EXHAUST FAN, EF-10. THE DDC MONITORS THE STATUS OF EF-10 AND ACTIVATES A FAILURE ALARM IN THE DDC SYSTEM IF AN ABNORMAL CONDITION OCCURS. WHEN ALL ENGINE EXHAUST TERMINAL UNIT DAMPERS ARE CLOSED THE FAN IS STOPPED BY THE DDC.

A STATIC PRESSURE SENSOR LOCATED NEAR THE INLET PLenum FOR EF-10, THRU THE DDC, MODULATES THE EF-10'S VARIABLE FREQUENCY DRIVE TO MAINTAIN THE DESIRED STATIC PRESSURE IN THE ENGINE EXHAUST AIR PLenum.

WHEN THE FIRE SUPPRESSION SYSTEM IN A TEST CELL IS ACTIVATED, THE DDC CLOSES THE ROOM SUPPLY AND ROOM GENERAL EXHAUST AIR SHUTOFF DAMPERS, OVERRIDES CLOSED THE ROOM ENGINE EXHAUST TERMINAL UNIT DAMPER AND STOPS THE ENGINE BEING TESTED. WHEN THIS OCCURS AN ALARM IS GENERATED IN THE DDC SYSTEM.
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REVISION HISTORY

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004
EXHAUST FAN EF-10
SEQUENCE OF OPERATIONS

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WHEN THE FIRE SUPPRESSION SYSTEM IN A TEST CELL IS ACTIVATED, THE DDC CLOSES THE ROOM SUPPLY AND ROOM GENERAL EXHAUST AIR SHUTOFF DAMPERS, OVERRIDES CLOSED THE ROOM ENGINE EXHAUST TERMINAL UNIT DAMPER AND STOPS THE ENGINE BEING TESTED. WHEN THIS OCCURS AN ALARM IS GENERATED IN THE DDC SYSTEM.
COMPRESSED AIR SYSTEM

ADD DEMPOINT SENSOR TO MONITOR COMPRESSED AIR DRYER PERFORMANCE WITH THE DDC SYSTEM. SEQUENCE OF OPERATIONS TO BE DETERMINED.

DESSICANT DRYER TO BE ADDED IN REGENERATIVE DRYER BYPASS.
DISCONNECT EXISTING ROOM SENSOR AT VAV SV1541 AND LEAVE IN PLACE.

MOUNT NEW ROOM SENSOR & CONNECT TO VAV BOX SV1541 DDC CONTROLLER.

Reference Only
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