WAYNE STATE UNIVERSITY

ENGINEERING DEVELOPMENT CENTER UPGRADES
5050 ANTHONY WAYNE DRIVE, DETROIT MI 48202

WSU PROJECT NO. 090-247931

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WAYNE STATE UNIVERSITY

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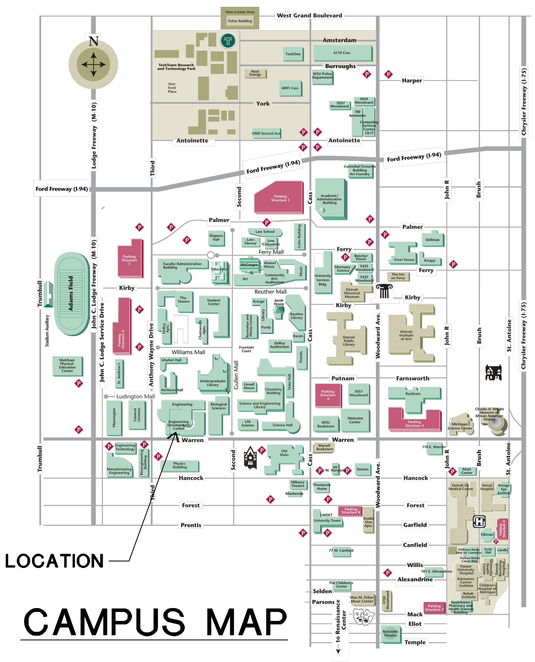

CAMPUS MAP

MECHANICAL DRAWING INDEX

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SIEMENS TEMPERATURE CONTROLS DRAWINGS

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002	CHILLED WATER SYSTEM CONTROL
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ELECTRICAL DRAWING INDEX

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E0.1	ELECTRICAL STANDARDS AND DRAWING INDEX
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E5.1	ONE LINE DIAGRAM

MECHANICAL ABBREVIATION LIST

ABBREVIATION	DESCRIPTION
A	COMPRESSED AIR
A(___#)	COMPRESSED AIR (SPECIFIC PSIG)
AAV	AUTOMATIC AIR VENT
ACC	AIR COOLED CONDENSER
ACCU	AIR COOLED CONDENSING UNIT
AD	ACCESS DOOR
AD	AREA DRAIN
AE	AIR EXTRACTOR
AFF	ABOVE FINISHED FLOOR
AHU	AIR HANDLING UNIT
ALT	ALTERNATE
AMP	AMPERE
APD	AIR PRESSURE DROP
ASHRAE	AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR-CONDITIONING ENGINEERS
ASR	AUTOMATIC SPRINKLER RISER
AUX	AUXILIARY
AV	ACID VENT
AVTR	ACID VENT THROUGH ROOF
AW	ACID WASTE
BAS	BUILDING AUTOMATION SYSTEM
BCU	BLOWER COIL UNIT
BDD	BACKDRAFT DAMPER
BFF	BELOW FINISHED FLOOR
BFP	BACKFLOW PREVENTER
BHP	BRAKE HORSEPOWER
BOD	BOTTOM OF DUCT
BOP	BOTTOM OF PIPE
BTU	BRITISH THERMAL UNIT
BTUH	BRITISH THERMAL UNIT PER HOUR
BWV	BACKWATER VALVE
C	COMMON
CAP	CAPACITY
CAV	CONSTANT AIR VOLUME
CB	CATCH BASIN
CC	COOLING COIL
CD	COLD DECK
CD	CONDENSATE DRAIN
CFH	CUBIC FEET PER HOUR
CFM	CUBIC FEET PER MINUTE
CH	CHILLER
CHW	CHILLED WATER
CHWR	CHILLED WATER RETURN
CHWS	CHILLED WATER SUPPLY
CLG	COOLING
CNDS	CONDENSATE
CNDS (___#)	CONDENSATE (SPECIFIC PSIG)
CO	CLEAN OUT
CO2	CARBON DIOXIDE
CONT	CONTINUATION OR CONTINUED
CONTR	CONTRACTOR
CONV	CONVECTOR
COS	CENTRAL OPERATOR STATION
CP	CIRCULATING PUMP
CRU	CONDENSATE RETURN UNIT
CSS	CLINICAL SERVICE SINK
CT	COOLING TOWER
CUH	CABINET UNIT HEATER
CW	DOMESTIC COLD WATER
CWR	CONDENSER WATER RETURN
CWS	CONDENSER WATER SUPPLY
D&T	DRIP AND TRAP
DA	DISCHARGE AIR
DAT	DISCHARGE AIR TEMPERATURE
DB	DRY BULB
DDC	DIRECT DIGITAL CONTROL
DEG	DEGREE
DFU	DRAINAGE FIXTURE UNITS
DIA	DIAMETER
DMPR	DAMPER
D/N	DAY/NIGHT
DN	DOWN
DNZ	DOWNSPOUT NOZZLE
DT	DRAIN TILE
DTC	DRAIN TILE CONNECTION
DWH	DOMESTIC WATER HEATER
DWG	DRAWING
(E)	EXISTING
E	EXHAUST GRILLE OR REGISTER
EA	EACH
EA	EXHAUST AIR
EAT	ENTERING AIR TEMPERATURE
EC	EXPANSION COMPENSATOR
ECUH	ELECTRIC CABINET UNIT HEATER
EDB	ENTERING DRY BULB
EEW	EMERGENCY EYE WASH
EF	EXHAUST FAN
EFF	EFFICIENCY
EHC	ELECTRIC HEATING COIL
EJ	EXPANSION JOINT
EL	ELEVATION
ELEC	ELECTRICAL
EMS	ENERGY MANAGEMENT SYSTEM
ERL	ENERGY RECOVERY LOOP
ERLR	ENERGY RECOVERY LOOP RETURN
ERLS	ENERGY RECOVERY LOOP SUPPLY
ERU	ENERGY RECOVERY UNIT
ESH	EMERGENCY SHOWER
ESP	EXTERNAL STATIC PRESSURE
EUH	ELECTRIC UNIT HEATER
EWB	ENTERING WET BULB
EWC	ELECTRIC WATER COOLER
EWT	ENTERING WATER TEMPERATURE
EXH	EXHAUST
F	FIRE PROTECTION
°F	DEGREES FAHRENHEIT
F&B	FACE AND BYPASS
F&T	FLOAT AND THERMOSTATIC
FA	FACE AREA
FCU	FAN COIL UNIT

ABBREVIATION	DESCRIPTION
FD	FLOOR DRAIN
FFD	FUNNEL FLOOR DRAIN
FH	FIRE HYDRANT
FHC	FIRE HOSE CABINET
FHR	FIRE HOSE RACK
FHV	FIRE HOSE VALVE
FLA	FULL LOAD AMPS
FLR	FLOOR
FM	FLOW MEASURING DEVICE
FMS	FLOW MEASURING STATION
FPM	FEET PER MINUTE
FP	FIRE PUMP
FPTU	FAN POWERED (AIR) TERMINAL UNIT
FS	FLOOR SINK
FT	FEET
FTR	FINNED TUBE RADIATION
FV	FACE VELOCITY
G	NATURAL GAS
GA	GAUGE
GAL	GALLON
GRH	GRAVITY RELIEF HOOD
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
H	HYDROGEN
HB	HOSE BIBB
HC	HEATING COIL
HD	HOT DECK
HEPA	HIGH EFFICIENCY PARTICULATE ARRESTANCE
HL	HIGH LIMIT
HOA	HAND/OFF/AUTO
HP	HEAT PUMP
HP	HORSEPOWER
HPCW	HIGH PRESSURE DOMESTIC COLD WATER
HPHW	HIGH PRESSURE DOMESTIC HOT WATER
HPHWR	HIGH PRESSURE DOMESTIC HOT WATER RETURN
HPL	HEAT PUMP LOOP
HPLR	HEAT PUMP LOOP RETURN
HPLS	HEAT PUMP LOOP SUPPLY
HR	HOUR
HTG	HEATING
HV	HEATING VENTILATING
HVAC	HEATING, VENTILATING, AIR CONDITIONING
HW	HOT WATER HEATING
HWR	HOT WATER HEATING RETURN
HWS	HOT WATER HEATING SUPPLY
HW	DOMESTIC HOT WATER
HW(___)	DOMESTIC HOT WATER (SPECIFIC TEMP °F)
HWR	DOMESTIC HOT WATER RETURN
HX	HEAT EXCHANGER
HZ	HERTZ
IAQ	INDOOR AIR QUALITY
ID	INSIDE DIAMETER
IE	INVERT ELEVATION
IH	INTAKE HOOD
IN	INCHES
IR	INFRARED HEATER
IW	INDIRECT WASTE
JC	JANITOR'S CLOSET
JP	JOCKEY PUMP
KW	KILOWATT
KWH	KILOWATT-HOUR
LAT	LEAVING AIR TEMPERATURE
LAB	LABORATORY
LAV	LAVATORY
LBS	POUNDS
LDB	LEAVING DRY BULB
LL	LOW LIMIT
LPC	LOW PRESSURE CONDENSATE
LPS	LOW PRESSURE STEAM
LRA	LOCKED ROTOR AMPS
LTU	LAB (AIR) TERMINAL UNIT
LWB	LEAVING WET BULB
LWT	LEAVING WATER TEMPERATURE
MA	MIXED AIR
MAT	MIXED AIR TEMPERATURE
MAU	MAKE-UP AIR UNIT
MAX	MAXIMUM
MBH	THOUSAND BRITISH THERMAL UNITS PER HOUR
MCA	MEDICAL COMPRESSED AIR
MCA	MINIMUM CIRCUIT AMPACITY
MCC	MOTOR CONTROL CENTER
MECH	MECHANICAL
MEZZ	MEZZANINE
MFR	MANUFACTURER
MH	MANHOLE
MIN	MINIMUM
MISC	MISCELLANEOUS
MMBH	MILLION BRITISH THERMAL UNITS PER HOUR
M/S	MOTOR STARTER
MTD	MOUNTED
MTR	MOTOR
MV	MANUAL AIR VENT
MVAC	MEDICAL VACUUM
N	NITROGEN
N2O	NITROUS OXIDE
NC	NOISE CRITERIA
NC	NORMALLY CLOSED
NCTC	NORMALLY CLOSED TIMED CLOSED
NCTO	NORMALLY CLOSED TIMED OPEN
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NOTC	NORMALLY OPEN TIMED CLOSED
NOTO	NORMALLY OPEN TIMED OPEN
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NOM	NOMINAL
NPCW	NON POTABLE COLD WATER

ABBREVIATION	DESCRIPTION
O	OXYGEN
OA	OUTSIDE AIR
OAT	OUTSIDE AIR TEMPERATURE
OBD	OPPOSED BLADE DAMPER
OC	ON CENTER/CENTER TO CENTER
OD	OUTSIDE DIAMETER
OL	OVERLOAD
ORC	OVERFLOW RAIN CONDUCTOR
ORD	OVERFLOW ROOF DRAIN
OS&Y	OUTSIDE SCREW AND YOKE
OV	OUTLET VELOCITY
PACU	PACKAGED AIR CONDITIONING UNIT
PBD	PARALLEL BLADE DAMPER
PC	PUMPED CONDENSATE
PCW	PROCESS COOLING WATER
PCWR	PROCESS COOLING WATER RETURN
PCWS	PROCESS COOLING WATER SUPPLY
PD	PRESSURE DROP (FEET OF WATER)
PH	PERIMETER HEAT
PHR	PERIMETER HEAT RETURN
PHS	PERIMETER HEAT SUPPLY
PNL	PANEL
PPM	PARTS PER MILLION
PRESS	PRESSURE
PRV	PRESSURE REDUCING VALVE
PSAN	PUMPED SANITARY
PST	PUMPED STORM
PSI	POUNDS PER SQUARE INCH
PSIA	POUNDS PER SQUARE INCH - ABSOLUTE
PSIG	POUNDS PER SQUARE INCH - GAUGE
PW	PURIFIED WATER
PWR	PURIFIED WATER RETURN
PWS	PURIFIED WATER SUPPLY
(R)	RELOCATED
R	RETURN GRILLE OR REGISTER
RA	RETURN AIR
RAT	RETURN AIR TEMPERATURE
RC	RAIN CONDUCTOR
RCP	RADIANT CEILING PANEL
RD	ROOF DRAIN
REQD	REQUIRED
REF	ROOF EXHAUST FAN
RF	RETURN FAN
RH	RELATIVE HUMIDITY
RL	REFRIGERANT LIQUID
RLFA	RELIEF AIR
RPM	REVOLUTIONS PER MINUTE
RS	REFRIGERANT SUCTION
RTU	ROOFTOP UNIT
S	SUPPLY AIR DIFFUSER OR GRILLE
SA	SOUND ATTENUATOR
SA	SUPPLY AIR
SAN	SANITARY WASTE
SAT	SUPPLY AIR TEMPERATURE
SECT	SECTION
SF	SUPPLY FAN
SH	SHOWER
SK	SINK
SMR	SNOW MELT RETURN
SMS	SNOW MELT SUPPLY
SP	STATIC PRESSURE
SPEC	SPECIFICATION
SPKLR	SPRINKLER
SQFT	SQUARE FOOT/SQUARE FEET
S/S	START/STOP
SS	SERVICE SINK
ST	STORM
STD	STANDARD
STK	STACK
STM	STEAM
STM(___#)	STEAM (SPECIFIC PSIG)
S/W	SUMMER/WINTER
SW	SWITCH
T	TRANSFER GRILLE
TC	TEMPERATURE CONTROL
TC	TEMPERING COIL
TCP	TEMPERATURE CONTROL PANEL
TD	TRENCH DRAIN
TEMP	TEMPERATURE
TEMP	TEMPORARY
TH	TERMINAL HEATING
THR	TERMINAL HEATING RETURN
THS	TERMINAL HEATING SUPPLY
TSP	TOTAL STATIC PRESSURE
TU	(AIR) TERMINAL UNIT
TV	TURNING VANES
TYP	TYPICAL
UH	UNIT HEATER
UL	UNDERWRITER'S LABORATORY
UON	UNLESS OTHERWISE NOTED
UR	URINAL
UV	UNIT VENTILATOR
V	VALVE
V	VENT
VAC	VACUUM
VAV	VARIABLE AIR VOLUME
VB	VACUUM BREAKER
VD	VOLUME DAMPER (MANUALLY ADJUSTABLE)
VOL	VOLUME
VFC	VARIABLE FREQUENCY CONTROLLER
VTR	VENT THROUGH ROOF
VUV	VERTICAL UNIT VENTILATOR
W	WASTE
W&V	WASTE AND VENT
WB	WET BULB
WC	WATER CLOSET
WC	WATER COLUMN
WG	WATER GAUGE
WH	WALL HYDRANT
WPD	WATER PRESSURE DROP
WT	WEIGHT
XFMR	TRANSFORMER

TEMPERATURE CONTROL - PARTIAL SYMBOLS LIST

SYMBOL	DESCRIPTION
CO2	CARBON DIOXIDE SENSOR
CO	CARBON MONOXIDE SENSOR
DPT	DIFFERENTIAL PRESSURE TRANSMITTER
FM	FLOW METER
	GUARD FOR STAT OR SENSOR
H	HUMIDISTAT OR HUMIDITY SENSOR (AS DEFINED ON TC DRAWINGS)
OS	OCCUPANCY SENSOR
PT	PRESSURE TRANSMITTER
SP	STATIC PRESSURE SENSOR OR PROBE
	VALVE - 2 WAY CONTROL VALVE
	VALVE - 3 WAY CONTROL VALVE
T	THERMOSTAT OR TEMPERATURE SENSOR (AS DEFINED ON TC DRAWINGS)

NOTE: LIST OF ADDITIONAL SYMBOLS & ABBREVIATIONS ASSOCIATED WITH TEMPERATURE CONTROLS ARE IDENTIFIED ON TC DRAWINGS.

MECHANICAL SYMBOL LIST

PIPING SYMBOLS

SYMBOL	DESCRIPTION
AV	AIR VENT - AUTOMATIC
MV	AIR VENT - MANUAL
BFP	BACKFLOW PREVENTER
	CATCH BASIN
	CIRCULATING PUMP
CO	CLEAN OUT - IN FLOOR
CO	CLEAN OUT - FLANGE
	DIRECTION OF FLOW
	DIRECTION OF PITCH - DOWN
	FINNED TUBE RADIATION
	FIRE PROTECTION - SIAMESE CONNECTION - FREE STANDING
	FIRE PROTECTION - SIAMESE CONNECTION - WALL MOUNTED
	FIRE PROTECTION - SPRINKLER HEAD, CONCEALED
	FIRE PROTECTION - SPRINKLER HEAD, PENDANT
	FIRE PROTECTION - SPRINKLER HEAD, UPRIGHT
	FIRE PROTECTION - SPRINKLER HEAD, SIDEWALL
	FLOOR DRAIN
	FLOOR DRAIN - ELEVATION
	FLOOR DRAIN - FUNNEL
	FLOOR DRAIN - FUNNEL, ELEVATION
FS	FLOW MEASURING DEVICE
	FLOW SWITCH
HB	HOSE BIBB
MH	MANHOLE
	OPEN SITE DRAIN
	PIPE - ANCHOR
	PIPE - CAP OR PLUG
	PIPE - ELBOW DOWN
	PIPE - ELBOW UP
	PIPE - EXPANSION JOINT OR COMPENSATOR
	PIPE - FLANGE
	PIPE - FLEXIBLE CONNECTION
	PIPE - GUIDE
	PIPE - TEE DOWN
	PIPE - TEE UP
	PIPE - UNION
P/T	PRESSURE AND TEMPERATURE TEST PLUG
	PRESSURE GAUGE AND COCK
	REDUCER - CONCENTRIC
	REDUCER - ECCENTRIC
	ROOF/OVERFLOW DRAIN
	STEAM TRAP - FLOAT AND THERMOSTATIC
	STEAM TRAP - BUCKET
	STRAINER
	STRAINER WITH BLOW-OFF
	THERMOMETER
	TRAP
	VALVE - ANGLE
	VALVE - BALL
	VALVE - BUTTERFLY
0.5	VALVE - BALANCE (i.e. BALANCE VALVE TO 0.5 GPM)
0.5	VALVE - COMBINATION BALANCE & FLOW MEASURING (i.e. BALANCE VALVE TO 0.5 GPM)
	VALVE - CHECK
	VALVE - SPRING CHECK
	VALVE - GAS (MANUAL)
	VALVE - GLOBE
	VALVE - ISOLATION
	VALVE - NEEDLE
	VALVE - OS&Y
	VALVE - PLUG
	VALVE - PRESSURE REGULATING
	VALVE - PRESSURE REDUCING
	VALVE - PRESSURE RELIEF
	VALVE - PRESSURE & TEMPERATURE RELIEF
VTR	VENT THROUGH ROOF
WH	WALL HYDRANT

DOUBLE LINE PIPING SYMBOLS

SYMBOL	DESCRIPTION
	FLANGE
	FLEX CONNECTION
	STRAINER - BASKET
	STRAINER - Y TYPE
	VALVE - 2 WAY CONTROL
	VALVE - 3 WAY CONTROL
	VALVE - BUTTERFLY
	VALVE - CHECK
	VALVE - DETECTOR CHECK
	VALVE - OS&Y HORIZONTAL STEM
	VALVE - OS&Y VERTICAL STEM

DUCTWORK SYMBOLS

SYMBOL	DESCRIPTION
TU-101	AIR TERMINAL UNIT
TU-101	AIR TERMINAL UNIT WITH HEATING COIL
LTU-101	LABORATORY AIR TERMINAL UNIT
LTU-101	LABORATORY AIR TERMINAL UNIT WITH HEATING COIL
	DAMPER - HORIZONTAL FIRE (EXISTING, NEW)
	DAMPER - HORIZONTAL FIRE / SMOKE (EXISTING, NEW)
	DAMPER - SMOKE (EXISTING, NEW)
	DAMPER - VERTICAL FIRE (EXISTING, NEW)
	DAMPER - VERTICAL FIRE / SMOKE (EXISTING, NEW)
BDD	DAMPER - BACK DRAFT
M	DAMPER - MOTORIZED
	DAMPER - VOLUME (MANUALLY ADJUSTABLE)
	DIFFUSER - BLANK OFF
	DIFFUSER - LINEAR SLOT
	DIFFUSER - SQUARE OR RECTANGULAR
	DUCT CROSS SECTION - SUPPLY
	DUCT CROSS SECTION - RETURN OR EXHAUST
	DUCT CROSS SECTION - EXHAUST
	DUCT - FLEXIBLE CONNECTION
	DUCT - FLEXIBLE DUCT
	DUCT TAKE-OFF - ROUND CONICAL
	DUCT TAKE-OFF - RECTANGULAR WITH SHOE TAP
	ELBOW - RECTANGULAR WITH TURNING VANES
	ELBOW - ROUND
	ELBOW - RECTANGULAR SMOOTH RADIUS
	ELBOW DOWN - RECTANGULAR
	ELBOW DOWN - ROUND
	ELBOW UP - RECTANGULAR
	ELBOW UP - ROUND
	FAN - AXIAL
	FAN - CENTRIFUGAL (ELEVATION)
	HEATING COIL
D	INCLINED DROP IN DIRECTION OF AIRFLOW
R	INCLINED RISE IN DIRECTION OF AIRFLOW
	INTAKE OR RELIEF HOOD
	REGISTER - RETURN OR EXHAUST
	REGISTER - RETURN WITH BOOT
	REGISTER - TRANSFER GRILLE
	ROOF EXHAUST FAN
	TRANSITION - CONCENTRIC
	TRANSITION - ECCENTRIC
	UNIT HEATER - HORIZONTAL THROW
	UNIT HEATER - VERTICAL THROW

DOUBLE LINE DUCTWORK SYMBOLS

SYMBOL	DESCRIPTION
	DUCT TAKE-OFF - RECTANGULAR WITH SHOE TAP
	DUCT TAKE-OFF - ROUND CONICAL
	ELBOW - RECTANGULAR WITH TURNING VANES
	ELBOW - RECTANGULAR SHORT RADIUS WITH SPLITTER VANES
	ELBOW - ROUND
	ELBOW - RECTANGULAR SMOOTH RADIUS
	ELBOW DOWN - RECTANGULAR
	ELBOW DOWN - ROUND
	ELBOW UP - RECTANGULAR
	ELBOW UP - ROUND
	HEATING COIL
D	INCLINED DROP IN DIRECTION OF AIRFLOW
R	INCLINED RISE IN DIRECTION OF AIRFLOW
	TRANSITION - CONCENTRIC
	TRANSITION - ECCENTRIC

MECHANICAL DRAWING INDEX

STANDARD METHODS OF NOTATION

S-1 10ø 350-4	SUPPLY DIFFUSER WITH SCHEDULE TAG "1", 10" DIAMETER NECK SIZE 350 CFM TYPICAL FOR 4
R-1 22x22 640-2	RETURN REGISTER WITH SCHEDULE TAG "1", 22"x 22" NECK SIZE 640 CFM TYPICAL FOR 2 EXHAUST REGISTER E DESIGNATION SIMILAR.
TU-101	AIR TERMINAL UNIT WITH HEATING COIL NO. 101 WITH SERVICE CLEARANCE SHOWN
LTU-101	LABORATORY AIR TERMINAL WITH HEATING COIL NO. 101 WITH SERVICE CLEARANCE SHOWN
8	PIPE DIAMETER NOTATION ALL SIZES IN INCHES
8ø N/A 18x14ø	DUCT SIZE NOTATION ALL SIZES IN INCHES OVAL DUCT RECTANGULAR DUCT
1	CONSTRUCTION NOTE NUMBER
EF-1	EQUIPMENT DESIGNATION, (i.e. EXHAUST FAN NUMBER 1)
HW-1	PIPING RISER DESIGNATION (i.e. HOT WATER RISER NUMBER 1)
	NEW SYSTEM COMPONENT
	EXISTING SYSTEM COMPONENT TO REMAIN
	POINT OF NEW CONNECTION SYMBOL
1 M5.1	SECTION OR PLAN NUMBER SHEET WHERE SECTION IS DRAWN
	AREA OF ENLARGEMENT
1 M5.1	PLAN NUMBER SHEET WHERE ENLARGED PLAN IS DRAWN
1 M5.1	SECTION OR PLAN NUMBER **SECTION OR ENLARGED PLAN** **SCALE: 1/8" = 1' - 0"** SHEET WHERE SECTION IS CUT OR ENLARGED PLAN IS REFERENCED
SHEET M1.0 SHEET M1.1	MATCH LINE
	HEAVY LINE WEIGHT INDICATES NEW WORK
	LIGHT LINE WEIGHT INDICATES EXISTING EQUIPMENT OR REFERENCED INFORMATION
	GRAY LINE INDICATES BACKGROUND INFORMATION
	DASHED LINES INDICATE PIPING ROUTED BELOW SLAB OR GRADE
	HATCH MARKS INDICATE EQUIPMENT OR MATERIALS TO BE DISCONNECTED AND REMOVED.

NOTE: SOME SYMBOLS AND ABBREVIATIONS SHOWN MAY NOT APPLY TO THIS PROJECT.

REVISION

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CONSULTING ENGINEERS

PROJECT TITLE
WAYNE STATE UNIVERSITY
ENGINEERING DEVELOPMENT
CENTER UPGRADES
DETROIT, MI

SHEET TITLE
MECHANICAL STANDARDS
AND DRAWING INDEX

DATE
09/30/2014

ISSUE
BIDS

SHEET No.
M0.1

THE FOLLOWING DIMENSION EQUALS ONE INCH WHEN PRINTED TO SCALE. 1"

MECHANICAL GENERAL DEMOLITION NOTES:

1. ANY INTERRUPTION OF EXISTING SERVICES AND/OR EQUIPMENT SHALL BE PERFORMED AT A TIME APPROVED IN ADVANCE BY THE OWNER'S REPRESENTATIVE.
2. THESE DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL EXTENT OF THE WORK. ACTUAL ROUTING AND SIZES OF EXISTING PIPING AND DUCTWORK MIGHT DIFFER TO A LIMITED EXTENT FROM WHAT IS SHOWN. MAJOR DISCREPANCIES BETWEEN THE DRAWINGS AND ACTUAL EXISTING CONDITIONS SHALL BE REPORTED TO THE ENGINEER.
3. THE EXACT EXTENT OF DEMOLITION SHALL BE AS REQUIRED BY THE NEW WORK.
4. ALL MECHANICAL ITEMS TO BE REMOVED SHALL BE REMOVED COMPLETE, INCLUDING ALL RELATED ITEMS SUCH AS HANGERS, SUPPORTS, CONTROLS, ETC. CAP ALL OPEN ENDED PIPES AND DUCTWORK.

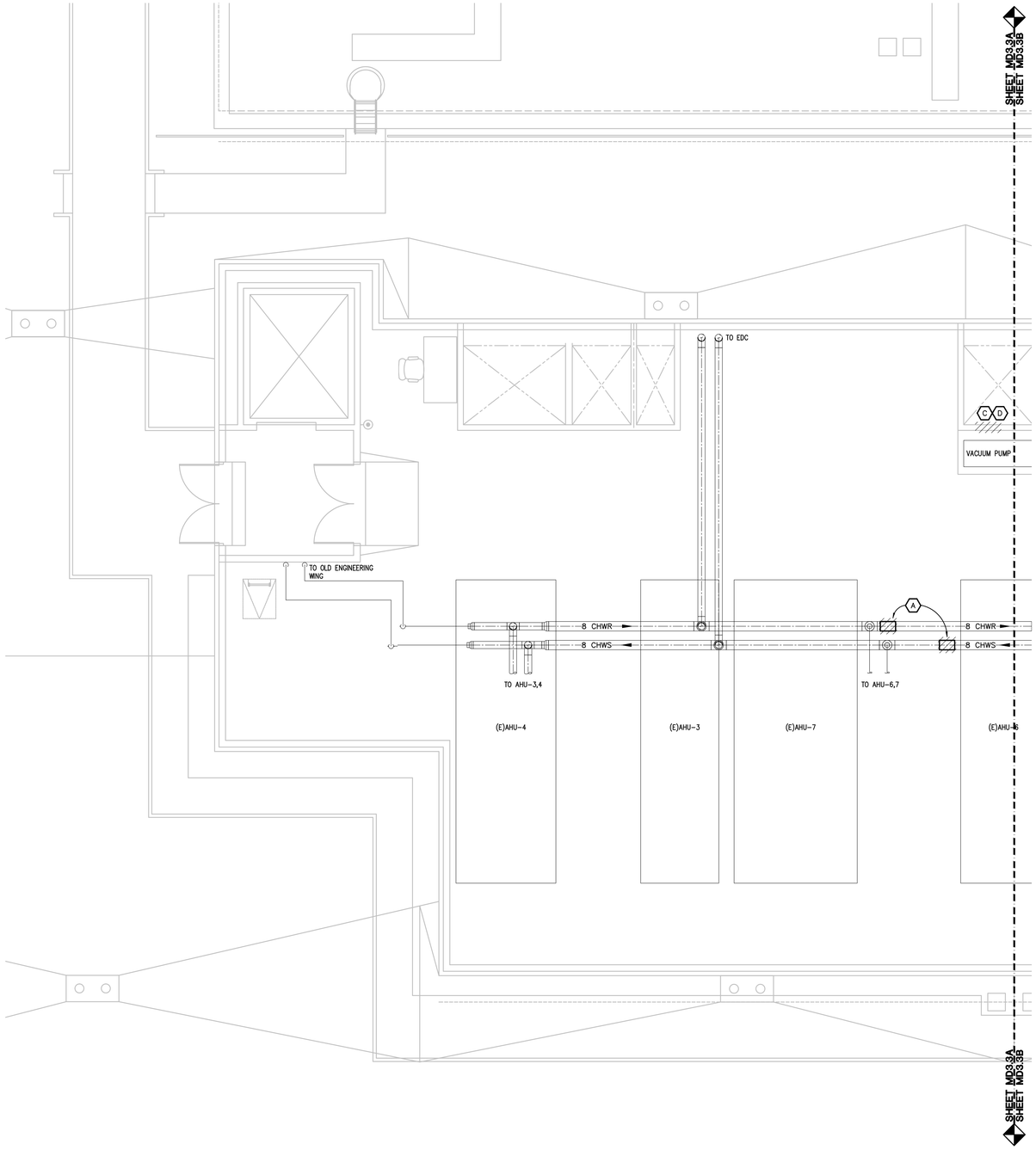
(#) DEMOLITION KEY NOTES:

A. DEMOLISH SECTION OF PIPE TO ALLOW FOR INSTALLATION OF NEW TEE AS SHOWN IN DRAWING ME3.3A.

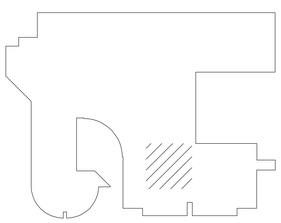
B. REMOVE EXISTING FEEDER FROM ENCLOSED CIRCUIT BREAKER BACK TO (E)MCC-P.

C. INSTALL A 24"x24" ACCESS DOOR IN THE EXISTING HOLE LOCATED AT THE DUCT SHAFT. PATCH SURROUNDING AREA WITH THE SAME SHAFT CONSTRUCTION MATERIALS THAT ARE EXISTING.

D. CUT INTO EXISTING DUCT SHAFT TO ACCOMODATE AND INSTALL A NEW 24"x24" ACCESS DOOR. PATCH SURROUNDING WITH THE SAME SHAFT CONSTRUCTION THAT IS EXISTING.



PENTHOUSE HVAC PIPING DEMOLITION PLAN
SCALE: 1/4" = 1' - 0"



KEY PLAN
NO SCALE

REVISION

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Peter Basso Associates Inc
CONSULTING ENGINEERS

PROJECT TITLE
WAYNE STATE UNIVERSITY
ENGINEERING DEVELOPMENT
CENTER UPGRADES
DETROIT, MI

SHEET TITLE
PENTHOUSE HVAC PIPING
DEMOLITION PLAN

DATE
09/30/2014

ISSUE
BIDS

SHEET No.
MD3.3A

THE FOLLOWING DIMENSION EQUALS ONE INCH WHEN PRINTED TO SCALE. 1"

MECHANICAL GENERAL DEMOLITION NOTES:

1. ANY INTERRUPTION OF EXISTING SERVICES AND/OR EQUIPMENT SHALL BE PERFORMED AT A TIME APPROVED IN ADVANCE BY THE OWNER'S REPRESENTATIVE.
2. THESE DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL EXTENT OF THE WORK. ACTUAL ROUTING AND SIZES OF EXISTING PIPING AND DUCTWORK MIGHT DIFFER TO A LIMITED EXTENT FROM WHAT IS SHOWN. MAJOR DISCREPANCIES BETWEEN THE DRAWINGS AND ACTUAL EXISTING CONDITIONS SHALL BE REPORTED TO THE ENGINEER.
3. THE EXACT EXTENT OF DEMOLITION SHALL BE AS REQUIRED BY THE NEW WORK.
4. ALL MECHANICAL ITEMS TO BE REMOVED SHALL BE REMOVED COMPLETE, INCLUDING ALL RELATED ITEMS SUCH AS HANGERS, SUPPORTS, CONTROLS, ETC. CAP ALL OPEN ENDED PIPES AND DUCTWORK.

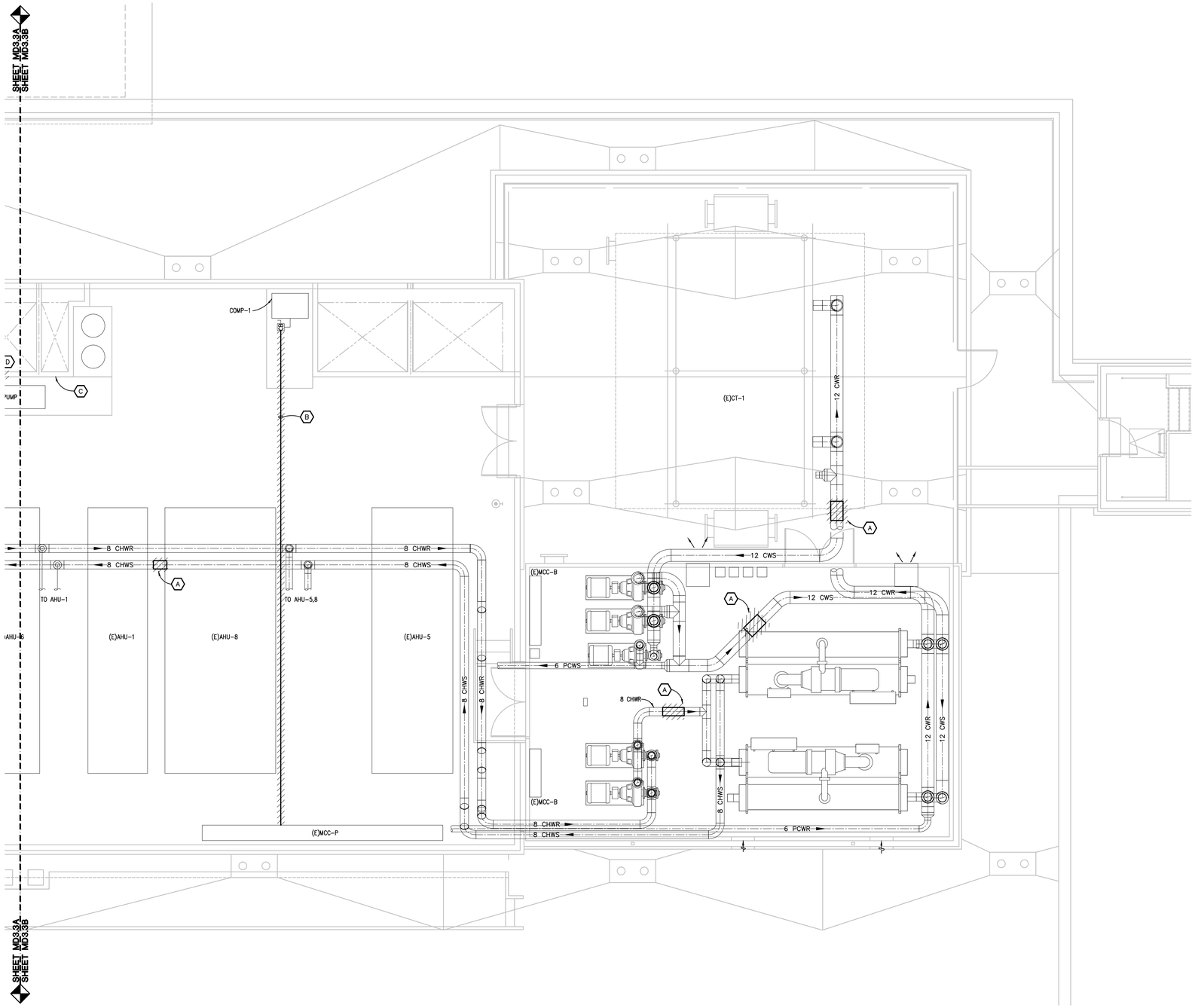
(#) DEMOLITION KEY NOTES:

A. DEMOLISH SECTION OF PIPE TO ALLOW FOR INSTALLATION OF NEW TEE AS SHOWN IN DRAWING ME3.3A.

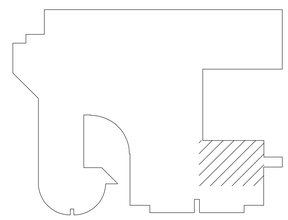
B. REMOVE EXISTING FEEDER FROM ENCLOSED CIRCUIT BREAKER BACK TO (E)MCC-P.

C. INSTALL A 24"x24" ACCESS DOOR IN THE EXISTING HOLE LOCATED AT THE DUCT SHAFT. PATCH SURROUNDING AREA WITH THE SAME SHAFT CONSTRUCTION MATERIALS THAT ARE EXISTING.

D. CUT INTO EXISTING DUCT SHAFT TO ACCOMODATE AND INSTALL A NEW 24"x24" ACCESS DOOR. PATCH SURROUNDING WITH THE SAME SHAFT CONSTRUCTION THAT IS EXISTING.



PENTHOUSE HVAC PIPING AND ELECTRICAL DEMOLITION PLAN
SCALE: 1/4" = 1' - 0"



KEY PLAN
NO SCALE

REVISION

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ENGINEERING DEVELOPMENT
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DETROIT, MI

SHEET TITLE
PENTHOUSE HVAC PIPING
AND ELECTRICAL
DEMOLITION PLAN

DATE
09/30/2014

ISSUE
BIDS

SHEET No.
MED3.3B

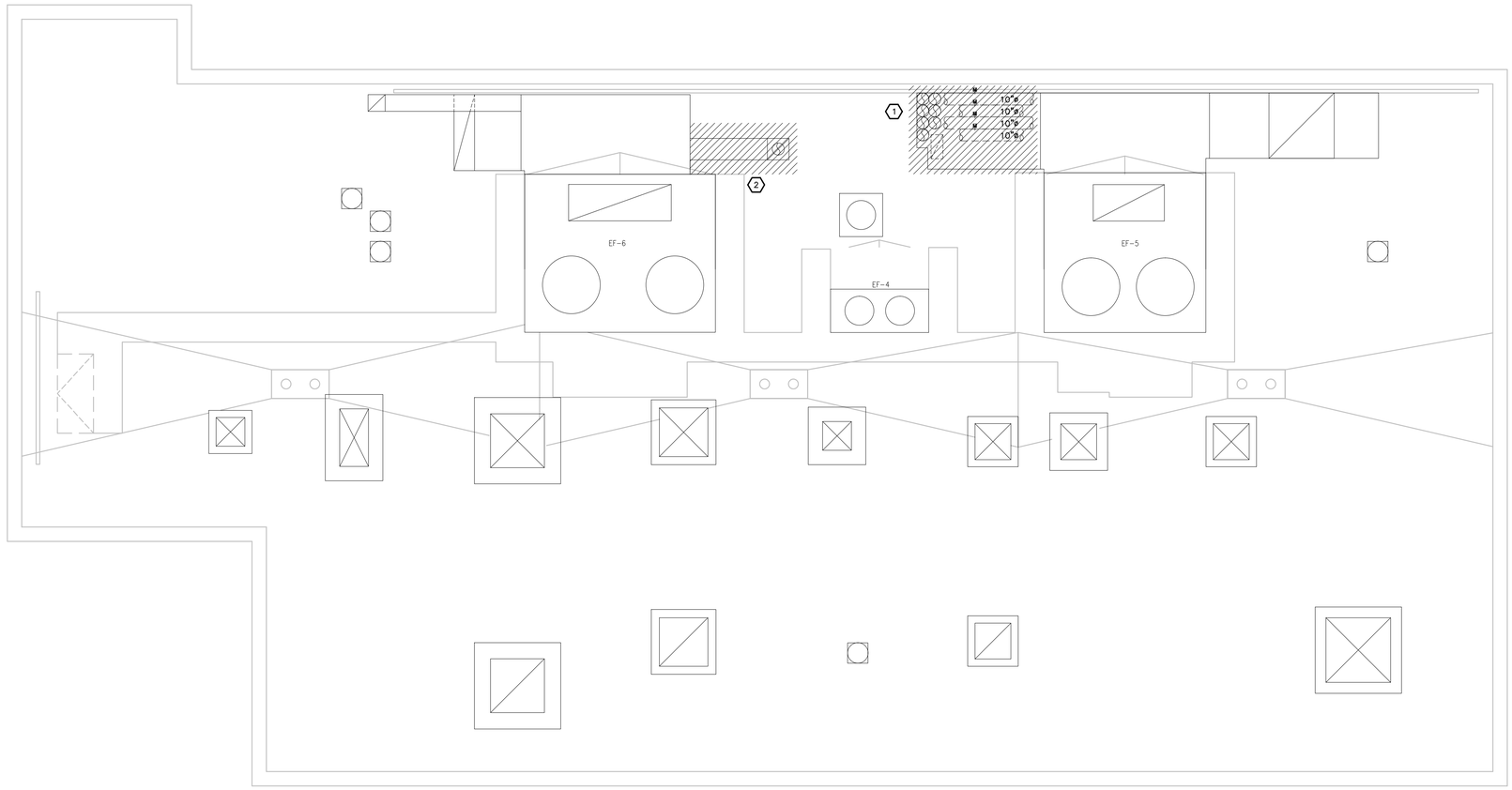
THE FOLLOWING DIMENSION EQUALS ONE INCH WHEN PRINTED TO SCALE. 1"

MECHANICAL GENERAL DEMOLITION NOTES:

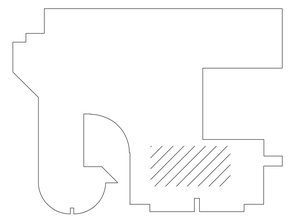
1. ANY INTERRUPTION OF EXISTING SERVICES AND/OR EQUIPMENT SHALL BE PERFORMED AT A TIME APPROVED IN ADVANCE BY THE OWNER'S REPRESENTATIVE.
2. THESE DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL EXTENT OF THE WORK. ACTUAL ROUTING AND SIZES OF EXISTING PIPING AND DUCTWORK MIGHT DIFFER TO A LIMITED EXTENT FROM WHAT IS SHOWN. MAJOR DISCREPANCIES BETWEEN THE DRAWINGS AND ACTUAL EXISTING CONDITIONS SHALL BE REPORTED TO THE ENGINEER.
3. THE EXACT EXTENT OF DEMOLITION SHALL BE AS REQUIRED BY THE NEW WORK.
4. ALL MECHANICAL ITEMS TO BE REMOVED SHALL BE REMOVED COMPLETE, INCLUDING ALL RELATED ITEMS SUCH AS HANGERS, SUPPORTS, CONTROLS, ETC. CAP ALL OPEN ENDED PIPES AND DUCTWORK.

(#) DEMOLITION KEY NOTES:

1. DEMOLISH EXISTING ALUMINUM JACKETING SURROUNDING THE EXISTING ENGINE EXHAUST DUCTS IN AREA SHOWN. ONCE REMOVED AND BEFORE PROCEEDING, CONTACT AND CONFIRM WITH THE ENGINEER THE IDENTIFICATION OF THE ENGINE EXHAUST DUCTS. ONCE CONFIRMED, REMOVE THE ENGINE EXHAUST DUCT FEEDING EF-5 COMPLETE, AS SHOWN AND CAP THE HOLES THAT ARE LEFT AT THE PLENUM. THE FOUR EXISTING PRICE TERMINAL UNITS SHALL BE CAREFULLY REMOVED AND SAVED FOR NEW WORK. PREPARE THE FOUR 10" ENGINE EXHAUST DUCT AND TERMINAL UNITS FOR NEW WORK AS SHOWN ON DRAWING M4.4.
2. DEMOLISH ALUMINUM JACKETING SURROUNDING THE ENGINE EXHAUST DUCT. ONCE REMOVED AND BEFORE PROCEEDING, CONTACT AND CONFIRM WITH THE ENGINEER THE USE OF THIS DUCT FOR ENGINE EXHAUST IN ROOM 1536.04. ONCE CONFIRMED, DEMOLISH EXISTING DUCT FEEDING EF-6 AND CAP THE HOLE IN THE EXHAUST FAN PLENUM. PREPARE THE DUCT FOR NEW WORK AS SHOWN ON DRAWING M4.4.



ROOF SHEET METAL DEMOLITION PLAN
SCALE: 1/4" = 1'-0"



KEY PLAN
NO SCALE

REVISION

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CENTER UPGRADES
DETROIT, MI

SHEET TITLE
ROOF SHEET METAL
DEMOLITION PLAN

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SHEET No.
MD4.4

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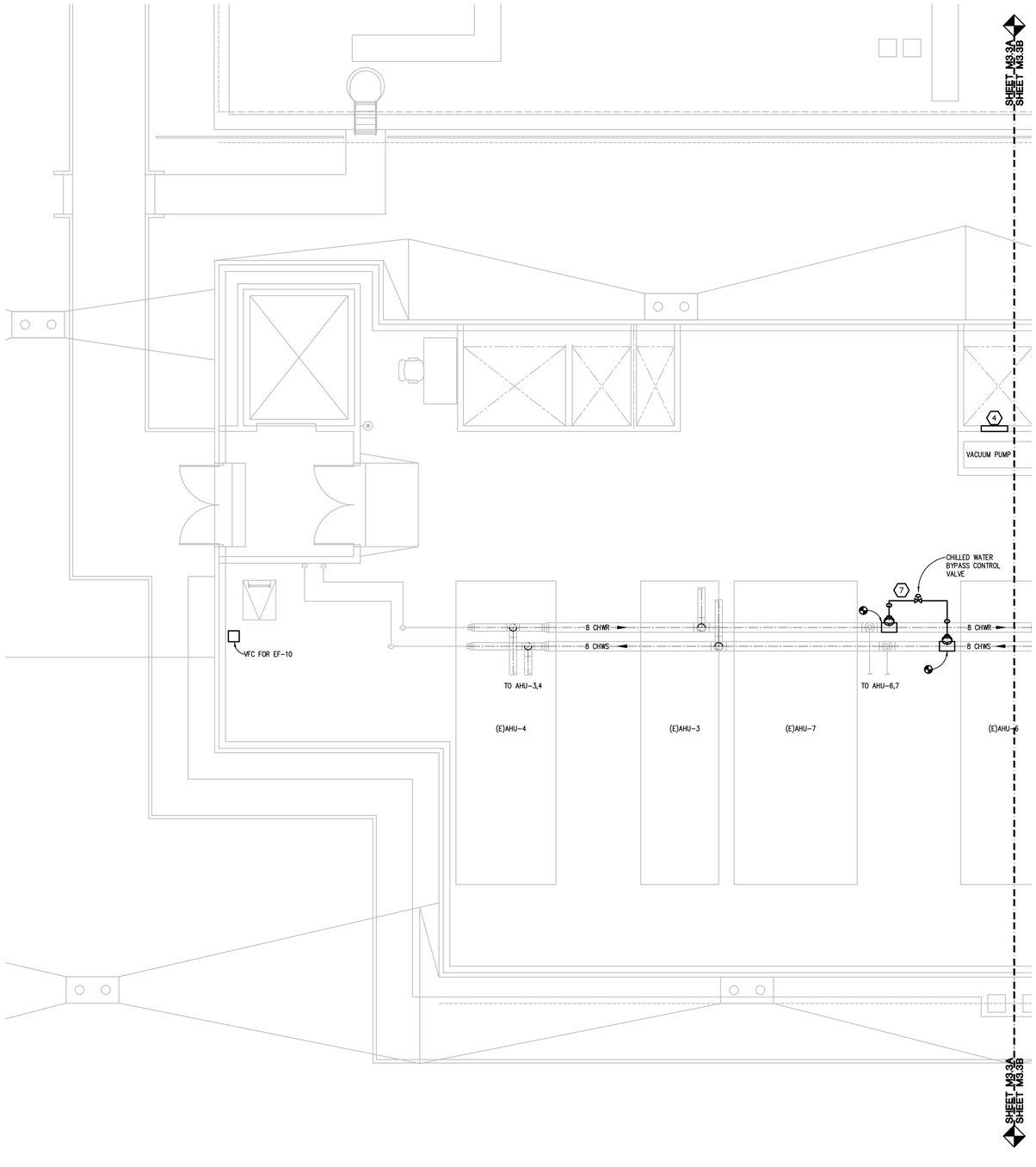


PENTHOUSE HVAC PIPING AND ELECTRICAL NEW WORK PLAN
SCALE: 1/4" = 1' - 0"

HVAC PIPING GENERAL NOTES:

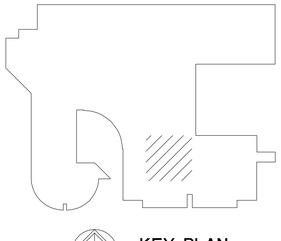
1. THESE DRAWINGS ARE DIAGRAMMATIC, AND REPRESENT THE GENERAL INTENT AND ARRANGEMENT OF SYSTEMS. THEY ARE NOT TO BE CONSIDERED FABRICATION/COORDINATION/SHOP DRAWINGS. COORDINATION WITH OTHER TRADES IS REQUIRED. PROVIDE THE ADDITIONAL FITTINGS AND OFFSETS THAT WILL BE REQUIRED TO COMPLETE EACH SYSTEM AND TO AVOID INTERFERENCES WITH ALL OTHER SYSTEMS INCLUDING THE STRUCTURE, SHEET METAL, OTHER PIPING SYSTEMS, ELECTRICAL CONDUITS, BUS DUCTS, CABLE TRAY, LIGHT FIXTURES, ETC. AND/OR OTHER SPACE CONSTRAINTS.
2. INSTALL SYSTEMS SUCH THAT REQUIRED CLEARANCE AND SERVICE ACCESS SPACE IS PROVIDED AROUND ALL MECHANICAL AND ELECTRICAL EQUIPMENT, AND AROUND ANY COMPONENTS WHICH REQUIRE SERVICE ACCESS.
3. PROVIDE SUPPLEMENTARY STEEL AS REQUIRED FOR THE PROPER SUPPORT OF ALL SYSTEMS.

ELECTRICAL GENERAL NOTES:

1. THESE DRAWINGS REPRESENT THE GENERAL EXTENT AND ARRANGEMENT OF SYSTEMS, BUT ARE NOT TO BE CONSIDERED FABRICATION DRAWINGS. COORDINATE WITH OTHER TRADES, AND PROVIDE EACH SYSTEM COMPLETE, INCLUDING ALL NECESSARY COMPONENTS, FITTINGS, AND OFFSETS.
2. INSTALL SYSTEMS SUCH THAT REQUIRED CLEARANCE AND SERVICE ACCESS SPACE IS PROVIDED AROUND ALL MECHANICAL AND ELECTRICAL EQUIPMENT, AND AROUND ANY COMPONENTS WHICH REQUIRE SERVICE ACCESS.
3. COORDINATE AND PROVIDE ACCESS DOORS WITHIN INACCESSIBLE CEILING, SHAFT, AND CHASE AREAS FOR ALL COMPONENTS WHICH REQUIRE SERVICE ACCESS. REFER TO ARCHITECTURAL DRAWINGS FOR CEILING TYPES.
4. PROVIDE SUPPLEMENTARY STEEL AS REQUIRED FOR THE PROPER SUPPORT OF ALL SYSTEMS.
5. TRANSFORMER SECONDARY CONDUCTORS SHALL BE SIZED IN ACCORDANCE WITH TRANSFORMER CIRCUIT SIZING SCHEDULE SHOWN ON "ELECTRICAL STANDARD SCHEDULES DRAWING" UNLESS OTHERWISE NOTED.
6. MOTOR CIRCUIT PROTECTION SHALL BE SIZED IN ACCORDANCE WITH MOTOR CIRCUIT SIZING SCHEDULES SHOWN ON "ELECTRICAL STANDARD SCHEDULES DRAWING" UNLESS OTHERWISE NOTED.
7. COORDINATE THE MOUNTING HEIGHTS OF DEVICES WITH ARCHITECTURAL ELEVATIONS AND THE TRADES INSTALLING THE WORK.
8. REFER TO MECHANICAL SCHEDULE SHEETS FOR ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT. PROVIDE ALL CONNECTIONS, STARTERS, DISCONNECTS, ETC. AS REQUIRED BY SCHEDULES AND WHERE NOTED ELSEWHERE. VERIFY REQUIREMENTS OF ALL MECHANICAL EQUIPMENT WITH SHOP DRAWINGS SUBMITTALS. NOTIFY ENGINEER OF ANY CONFLICTS BETWEEN EQUIPMENT SUBMITTALS AND ELECTRICAL DRAWINGS. WHERE CIRCUIT SIZES ARE SHOWN ON THE ELECTRICAL DRAWINGS THAT DIFFER FROM WHAT IS INDICATED ON THE MECHANICAL SCHEDULES, PROVIDE THE CIRCUIT OF HIGHER AMPACITY.

(#) CONSTRUCTION KEY NOTES:

1. PROVIDE METAL CHANNEL SUPPORTS ANCHORED TO FLOOR FOR MOUNTING OF DISTRIBUTION PANELBOARD DP-PH.
2. EXTEND THE EXISTING CONCRETE EQUIPMENT PAD AS REQUIRED FOR NEW PLATE AND FRAME HEAT EXCHANGER HX-9.
3. ROUTE PIPING HIGH SO AS TO AVOID EXISTING PIPING. MOVE CONDUIT AND PIPE HANGERS AS REQUIRED TO ALLOW ROUTING OF THE NEW PIPE.
4. 24"x24" FIRE RATED ACCESS DOOR TO BE INSTALLED IN THE SHAFT ENCLOSURE LOCATION AS INDICATED IN DRAWING M03.3B.
5. SUPPORT NEW PIPING FROM ROOF DECK.
6. HEAT TRACE AND INSULATE PIPING LOCATED OUTDOORS. EXPAND EXISTING HEAT TRACE CONTROLLER AS REQUIRED TO ACCOMMODATE NEW PIPING.
7. INSTALL NEW CHILLED WATER BYPASS CONTROL VALVE, AS SHOWN IN M6.2, IN A LOCATION THAT ALLOWS FOR EASE OF SERVICE.



KEY PLAN
NO SCALE

REVISION

REVISION

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PROJECT TITLE
WAYNE STATE UNIVERSITY
ENGINEERING DEVELOPMENT
CENTER UPGRADES
DETROIT, MI

SHEET TITLE
PENTHOUSE HVAC PIPING
AND ELECTRICAL NEW WORK
PLAN

DATE
09/30/2014

ISSUE
BIDS

SHEET No.
ME3.3A

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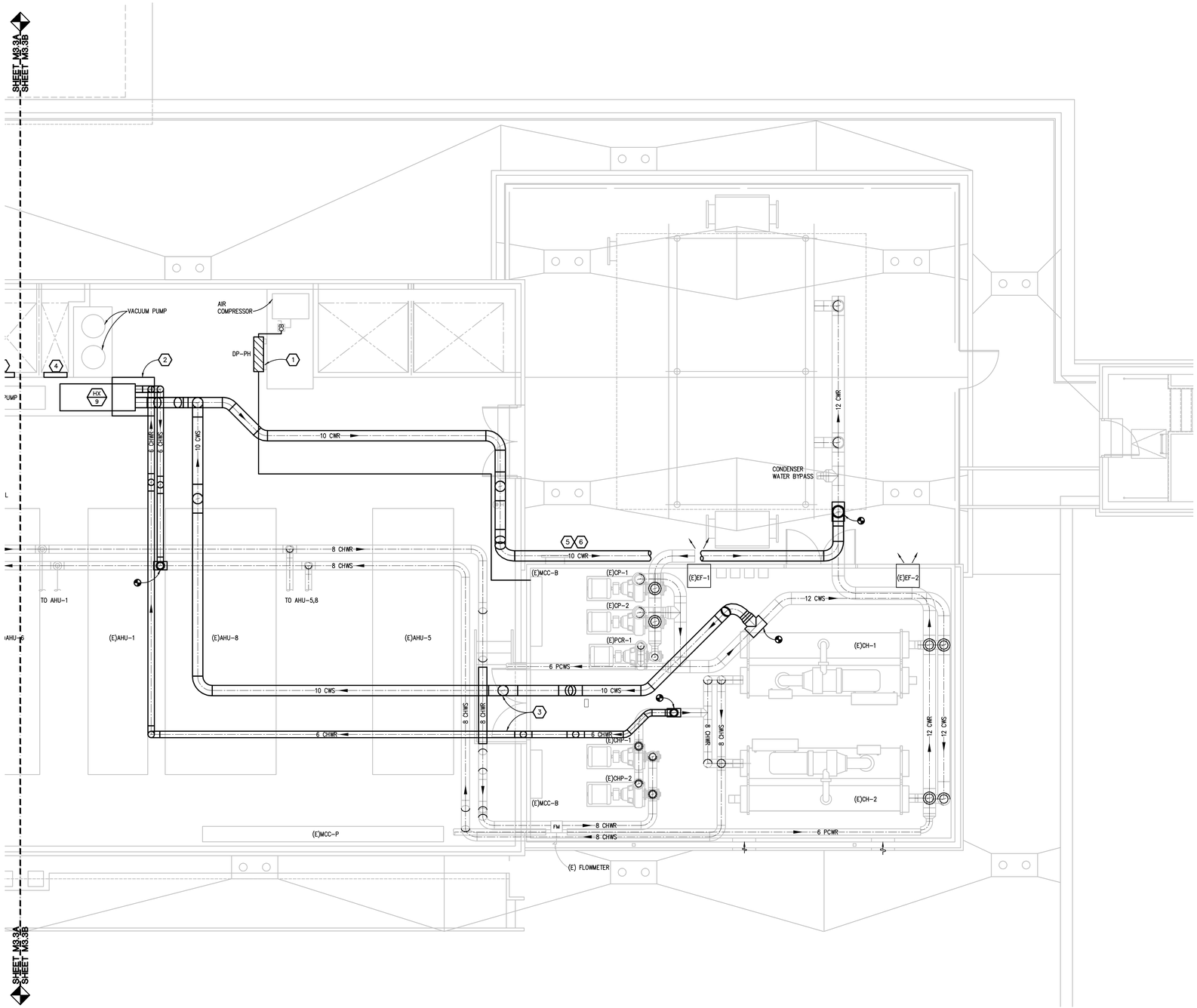

PENTHOUSE HVAC PIPING NEW WORK PLAN
SCALE: 1/4" = 1' - 0"

HVAC PIPING GENERAL NOTES:

1. THESE DRAWINGS ARE DIAGRAMMATIC, AND REPRESENT THE GENERAL INTENT AND ARRANGEMENT OF SYSTEMS. THEY ARE NOT TO BE CONSIDERED FABRICATION/COORDINATION/SHOP DRAWINGS. COORDINATION WITH OTHER TRADES IS REQUIRED. PROVIDE THE ADDITIONAL FITTINGS AND OFFSETS THAT WILL BE REQUIRED TO COMPLETE EACH SYSTEM AND TO AVOID INTERFERENCES WITH ALL OTHER SYSTEMS INCLUDING THE STRUCTURE, SHEET METAL, OTHER PIPING SYSTEMS, ELECTRICAL CONDUITS, BUS DUCTS, CABLE TRAY, LIGHT FIXTURES, ETC. AND/OR OTHER SPACE CONSTRAINTS.
2. INSTALL SYSTEMS SUCH THAT REQUIRED CLEARANCE AND SERVICE ACCESS SPACE IS PROVIDED AROUND ALL MECHANICAL AND ELECTRICAL EQUIPMENT, AND AROUND ANY COMPONENTS WHICH REQUIRE SERVICE ACCESS.
3. PROVIDE SUPPLEMENTARY STEEL AS REQUIRED FOR THE PROPER SUPPORT OF ALL SYSTEMS.

ELECTRICAL GENERAL NOTES:

1. THESE DRAWINGS REPRESENT THE GENERAL EXTENT AND ARRANGEMENT OF SYSTEMS, BUT ARE NOT TO BE CONSIDERED FABRICATION DRAWINGS. COORDINATE WITH OTHER TRADES, AND PROVIDE EACH SYSTEM COMPLETE, INCLUDING ALL NECESSARY COMPONENTS, FITTINGS, AND OFFSETS.
2. INSTALL SYSTEMS SUCH THAT REQUIRED CLEARANCE AND SERVICE ACCESS SPACE IS PROVIDED AROUND ALL MECHANICAL AND ELECTRICAL EQUIPMENT, AND AROUND ANY COMPONENTS WHICH REQUIRE SERVICE ACCESS.
3. COORDINATE AND PROVIDE ACCESS DOORS WITHIN INACCESSIBLE CEILING, SHAFT, AND CHASE AREAS FOR ALL COMPONENTS WHICH REQUIRE SERVICE ACCESS. REFER TO ARCHITECTURAL DRAWINGS FOR CEILING TYPES.
4. PROVIDE SUPPLEMENTARY STEEL AS REQUIRED FOR THE PROPER SUPPORT OF ALL SYSTEMS.
5. TRANSFORMER SECONDARY CONDUCTORS SHALL BE SIZED IN ACCORDANCE WITH TRANSFORMER CIRCUIT SIZING SCHEDULE SHOWN ON "ELECTRICAL STANDARD SCHEDULES DRAWING" UNLESS OTHERWISE NOTED.
6. MOTOR CIRCUIT PROTECTION SHALL BE SIZED IN ACCORDANCE WITH MOTOR CIRCUIT SIZING SCHEDULES SHOWN ON "ELECTRICAL STANDARD SCHEDULES DRAWING" UNLESS OTHERWISE NOTED.
7. COORDINATE THE MOUNTING HEIGHTS OF DEVICES WITH ARCHITECTURAL ELEVATIONS AND THE TRADES INSTALLING THE WORK.
8. REFER TO MECHANICAL SCHEDULE SHEETS FOR ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT. PROVIDE ALL CONNECTIONS, STARTERS, DISCONNECTS, ETC. AS REQUIRED BY SCHEDULES AND WHERE NOTED ELSEWHERE. VERIFY REQUIREMENTS OF ALL MECHANICAL EQUIPMENT WITH SHOP DRAWINGS SUBMITTALS. NOTIFY ENGINEER OF ANY CONFLICTS BETWEEN EQUIPMENT SUBMITTALS AND ELECTRICAL DRAWINGS. WHERE CIRCUIT SIZES ARE SHOWN ON THE ELECTRICAL DRAWINGS THAT DIFFER FROM WHAT IS INDICATED ON THE MECHANICAL SCHEDULES, PROVIDE THE CIRCUIT OF HIGHER AMPACITY.

(#) CONSTRUCTION KEY NOTES:

1. PROVIDE METAL CHANNEL SUPPORTS ANCHORED TO FLOOR FOR MOUNTING OF DISTRIBUTION PANELBOARD DP-PH.
2. EXTEND THE EXISTING CONCRETE EQUIPMENT PAD AS REQUIRED FOR NEW PLATE AND FRAME HEAT EXCHANGER HX-9.
3. ROUTE PIPING HIGH SO AS TO AVOID EXISTING PIPING. MOVE CONDUIT AND PIPE HANGERS AS REQUIRED TO ALLOW ROUTING OF THE NEW PIPE.
4. 24"x24" FIRE RATED ACCESS DOOR TO BE INSTALLED IN THE SHAFT ENCLOSURE LOCATION AS INDICATED IN DRAWING M03.3B.
5. SUPPORT NEW PIPING FROM ROOF DECK.
6. HEAT TRACE AND INSULATE PIPING LOCATED OUTDOORS. EXPAND EXISTING HEAT TRACE CONTROLLER AS REQUIRED TO ACCOMMODATE NEW PIPING.
7. INSTALL NEW CHILLED WATER BYPASS CONTROL VALVE, AS SHOWN IN M6.2, IN A LOCATION THAT ALLOWS FOR EASE OF SERVICE.

REVISION

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DETROIT, MI

SHEET TITLE
PENTHOUSE HVAC PIPING
NEW WORK PLAN

DATE
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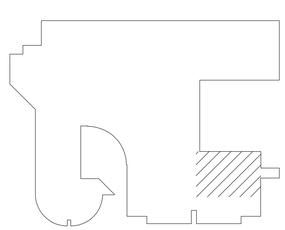

KEY PLAN
NO SCALE

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SHEET METAL GENERAL NOTES:

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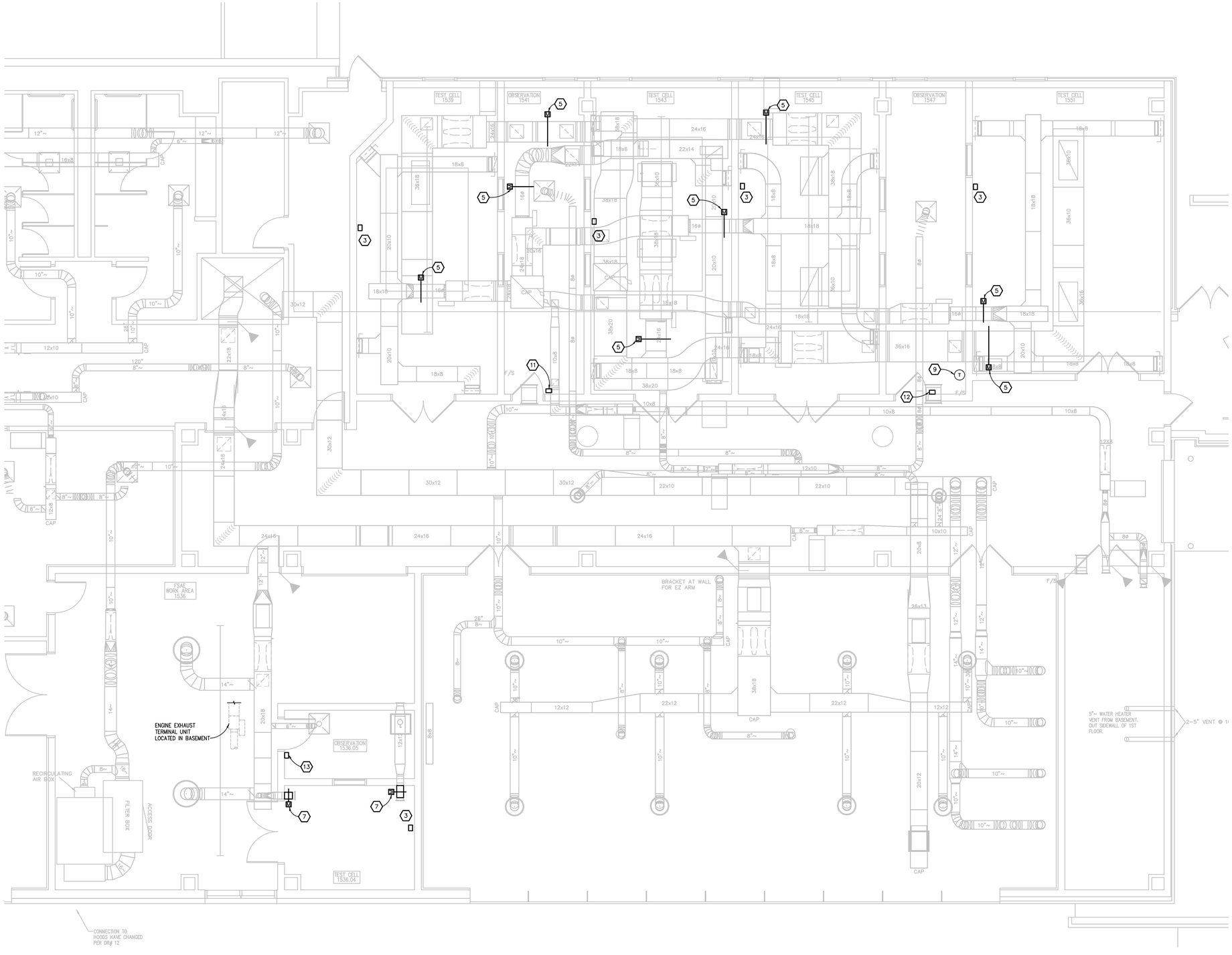
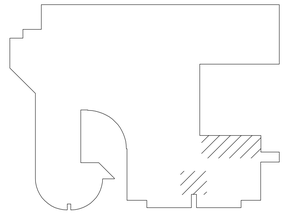
2. INSTALL SYSTEMS SUCH THAT REQUIRED CLEARANCE AND SERVICE ACCESS SPACE IS PROVIDED AROUND ALL MECHANICAL AND ELECTRICAL EQUIPMENT, AND AROUND ANY COMPONENTS WHICH REQUIRE SERVICE ACCESS.
3. PROVIDE SUPPLEMENTARY STEEL AS REQUIRED FOR THE PROPER SUPPORT OF ALL SYSTEMS.

CONSTRUCTION KEY NOTES:

1. FIVE(5) NEW ROUND ENGINE EXHAUST DUCTS SHALL BE ROUTED TO THE NEW EXHAUST FAN, EF-10. ROUTE NEW DUCT ABOVE EXISTING DUCTWORK FEEDING EF-6 AS INDICATED.
2. PROVIDE FITTINGS AS REQUIRED FOR EXISTING DUCTWORK TO BE ROUTED FROM UNDER EXISTING RECTANGULAR DUCT AND OVER EF-6 EXHAUST PLENUM. CONFIRM LOCATION OF EXISTING ENGINE EXHAUST DUCTS AND THE CORRESPONDING ROUTING. SEE PHOTO 1 FOR DETAIL OF EXISTING DUCT ENCLOSURE.
3. TEST CELL INDICATOR PANEL (SEE M9.2). REPLACE EXISTING CO MONITORS WITH NEW CO MONITORS CONTAINING DIGITAL READOUTS FOR EACH TEST CELL.
4. MODIFY EXISTING CORRUGATED ALUMINUM SHEET METAL DUCT ENCLOSURE AS REQUIRED. SEAL WATERTIGHT.
5. INSTALL ULTRA LOW LEAK MOTORIZED DAMPERS IN THE LOCATIONS INDICATED TO ISOLATE ROOMS DURING CHEMETRON FIRE SUPPRESSION SYSTEM DISCHARGE.
6. EXISTING ENGINE EXHAUST TERMINAL UNITS REMOVED DURING DEMOLITION SHALL BE RE-INSTALLED IN THE LOCATIONS INDICATED.
7. EXTEND DUCTWORK OFF OF THE WALL PARTITION TO ALLOW FOR INSTALLATION OF THE NEW MOTORIZED DAMPER.
8. INSTALL NEW EXHAUST FAN EF-10 WITH A SIDE INLET PLENUM.
9. DISCONNECT THE THERMOSTAT IN OBSERVATION ROOM 1541 AND RECONNECT THE CONTROL WIRING TO A NEW THERMOSTAT INSTALLED AS SHOWN IN OBSERVATION ROOM 1547.
10.
11. ADD NEW EMERGENCY STOPS FOR TEST CELLS 1539 AND 1543.
12. ADD NEW EMERGENCY STOPS FOR TEST CELLS 1545 AND 1551.
13. ADD NEW EMERGENCY STOP FOR TEST CELL 1536.04.
14. CORRUGATED STEEL ENCLOSURE TO MATCH EXISTING DUCT ENCLOSURE CONSTRUCTION.
15. EXTEND NEW ENCLOSURE FROM EXISTING TO NEW 28x70 COLLECTION PLENUM TO PROTECT NEW DAMPERS AND TERMINAL UNITS. ALL EQUIPMENT SHALL BE INSTALLED SO IT IS ACCESSIBLE. DEMONSTRATE ACCESSIBILITY TO OWNER AND ENGINEER.



FIRST FLOOR SHEET METAL NEW WORK PLAN
SCALE: 1/4" = 1' - 0"



KEY PLAN
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REVISION

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SHEET TITLE
FIRST FLOOR SHEET METAL
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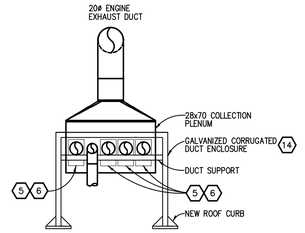
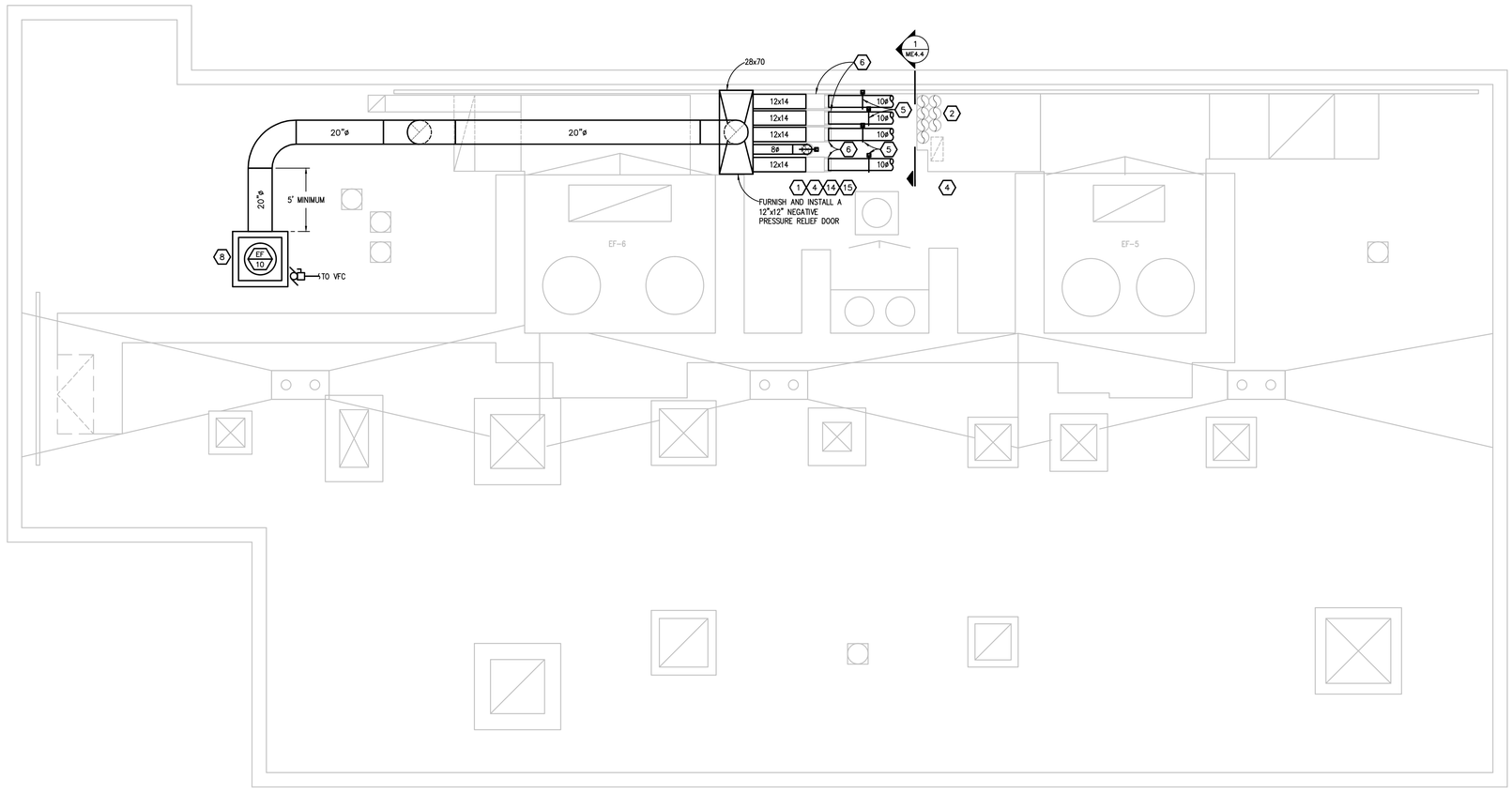
PHOTO 1 - EXISTING ENGINE EXHAUST DUCT ENCLOSURE
NO SCALE



SECTION 1 - ENGINE EXHAUST DUCT DETAIL
NO SCALE



ROOF SHEET METAL NEW WORK PLAN
SCALE: 1/4" = 1' - 0"

ELECTRICAL GENERAL NOTES:

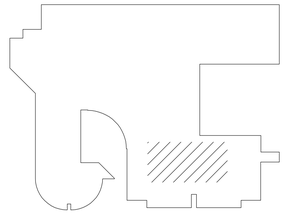
1. THESE DRAWINGS REPRESENT THE GENERAL EXTENT AND ARRANGEMENT OF SYSTEMS, BUT ARE NOT TO BE CONSIDERED FABRICATION DRAWINGS. COORDINATE WITH OTHER TRADES, AND PROVIDE EACH SYSTEM COMPLETE, INCLUDING ALL NECESSARY COMPONENTS, FITTINGS, AND OFFSETS.
2. INSTALL SYSTEMS SUCH THAT REQUIRED CLEARANCE AND SERVICE ACCESS SPACE IS PROVIDED AROUND ALL MECHANICAL AND ELECTRICAL EQUIPMENT, AND AROUND ANY COMPONENTS WHICH REQUIRE SERVICE ACCESS.
3. COORDINATE AND PROVIDE ACCESS DOORS WITHIN INACCESSIBLE CEILING, SHAFT, AND CHASE AREAS FOR ALL COMPONENTS WHICH REQUIRE SERVICE ACCESS. REFER TO ARCHITECTURAL DRAWINGS FOR CEILING TYPES.
4. PROVIDE SUPPLEMENTARY STEEL AS REQUIRED FOR THE PROPER SUPPORT OF ALL SYSTEMS.
5. TRANSFORMER SECONDARY CONDUCTORS SHALL BE SIZED IN ACCORDANCE WITH TRANSFORMER CIRCUIT SIZING SCHEDULE SHOWN ON "ELECTRICAL STANDARD SCHEDULES DRAWING" UNLESS OTHERWISE NOTED.
6. MOTOR CIRCUIT PROTECTION SHALL BE SIZED IN ACCORDANCE WITH MOTOR CIRCUIT SIZING SCHEDULES SHOWN ON "ELECTRICAL STANDARD SCHEDULES DRAWING" UNLESS OTHERWISE NOTED.
7. COORDINATE THE MOUNTING HEIGHTS OF DEVICES WITH ARCHITECTURAL ELEVATIONS AND THE TRADES INSTALLING THE WORK.
8. REFER TO MECHANICAL SCHEDULE SHEETS FOR ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT. PROVIDE ALL CONNECTIONS, STARTERS, DISCONNECTS, ETC. AS REQUIRED BY SCHEDULES AND WHERE NOTED ELSEWHERE. VERIFY REQUIREMENTS OF ALL MECHANICAL EQUIPMENT WITH SHOP DRAWINGS SUBMITTALS. NOTIFY ENGINEER OF ANY CONFLICTS BETWEEN EQUIPMENT SUBMITTALS AND ELECTRICAL DRAWINGS. WHERE CIRCUIT SIZES ARE SHOWN ON THE ELECTRICAL DRAWINGS THAT DIFFER FROM WHAT IS INDICATED ON THE MECHANICAL SCHEDULES, PROVIDE THE CIRCUIT OF HIGHER AMPACITY.

SHEET METAL GENERAL NOTES:

1. THESE DRAWINGS ARE DIAGRAMMATIC, AND REPRESENT THE GENERAL INTENT AND ARRANGEMENT OF SYSTEMS. THEY ARE NOT TO BE CONSIDERED FABRICATION/COORDINATION/SHOP DRAWINGS. COORDINATION WITH OTHER TRADES IS REQUIRED. PROVIDE THE ADDITIONAL FITTINGS AND OFFSETS THAT WILL BE REQUIRED TO COMPLETE EACH SYSTEM AND TO AVOID INTERFERENCES WITH ALL OTHER SYSTEMS INCLUDING THE STRUCTURE, SHEET METAL, OTHER PIPING SYSTEMS, ELECTRICAL CONDUITS, BUS DUCTS, CABLE TRAY, LIGHT FIXTURES, ETC. AND/OR OTHER SPACE CONSTRAINTS.
2. INSTALL SYSTEMS SUCH THAT REQUIRED CLEARANCE AND SERVICE ACCESS SPACE IS PROVIDED AROUND ALL MECHANICAL AND ELECTRICAL EQUIPMENT, AND AROUND ANY COMPONENTS WHICH REQUIRE SERVICE ACCESS.
3. PROVIDE SUPPLEMENTARY STEEL AS REQUIRED FOR THE PROPER SUPPORT OF ALL SYSTEMS.

(#) CONSTRUCTION KEY NOTES:

1. FIVE(5) NEW ROUND ENGINE EXHAUST DUCTS SHALL BE ROUTED TO THE NEW EXHAUST FAN, EF-10. ROUTE NEW DUCT ABOVE EXISTING DUCTWORK FEEDING EF-6 AS INDICATED.
2. PROVIDE FITTINGS AS REQUIRED FOR EXISTING DUCTWORK TO BE ROUTED FROM UNDER EXISTING RECTANGULAR DUCT AND OVER EF-6 EXHAUST PLENUM. CONFIRM LOCATION OF EXISTING ENGINE EXHAUST DUCTS AND THE CORRESPONDING ROUTING. SEE PHOTO 1 FOR DETAIL OF EXISTING DUCT ENCLOSURE.
3. TEST CELL INDICATOR PANEL (SEE M8.2). REPLACE EXISTING CO MONITORS WITH NEW CO MONITORS CONTAINING DIGITAL READOUTS FOR EACH TEST CELL.
4. MODIFY EXISTING CORRUGATED ALUMINUM SHEET METAL DUCT ENCLOSURE AS REQUIRED. SEAL WATERTIGHT.
5. INSTALL ULTRA LOW LEAK MOTORIZED DAMPERS IN THE LOCATIONS INDICATED TO ISOLATE ROOMS DURING CHEMETRON FIRE SUPPRESSION SYSTEM DISCHARGE.
6. EXISTING ENGINE EXHAUST TERMINAL UNITS REMOVED DURING DEMOLITION SHALL BE RE-INSTALLED IN THE LOCATIONS INDICATED.
7. EXTEND DUCTWORK OFF OF THE WALL PARTITION TO ALLOW FOR INSTALLATION OF THE NEW MOTORIZED DAMPER.
8. INSTALL NEW EXHAUST FAN EF-10 WITH A SIDE INLET PLENUM.
9. DISCONNECT THE THERMOSTAT IN OBSERVATION ROOM 1541 AND RECONNECT THE CONTROL WIRING TO A NEW THERMOSTAT INSTALLED AS SHOWN IN OBSERVATION ROOM 1547.
10.
11. ADD NEW EMERGENCY STOPS FOR TEST CELLS 1539 AND 1543.
12. ADD NEW EMERGENCY STOPS FOR TEST CELLS 1545 AND 1551.
13. ADD NEW EMERGENCY STOP FOR TEST CELL 1536.04.
14. CORRUGATED STEEL ENCLOSURE TO MATCH EXISTING DUCT ENCLOSURE CONSTRUCTION.
15. EXTEND NEW ENCLOSURE FROM EXISTING TO NEW 28x70 COLLECTION PLENUM TO PROTECT NEW DAMPERS AND TERMINAL UNITS. ALL EQUIPMENT SHALL BE INSTALLED SO IT IS ACCESSIBLE. DEMONSTRATE ACCESSIBILITY TO OWNER AND ENGINEER.



KEY PLAN
NO SCALE

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DETROIT, MI

SHEET TITLE
ROOF SHEET METAL NEW WORK PLAN

DATE
09/30/2014

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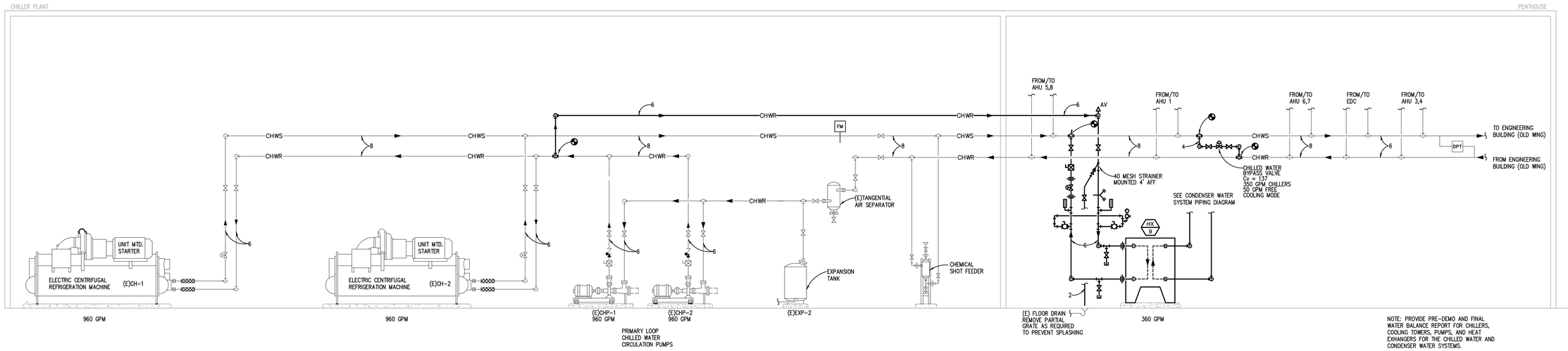
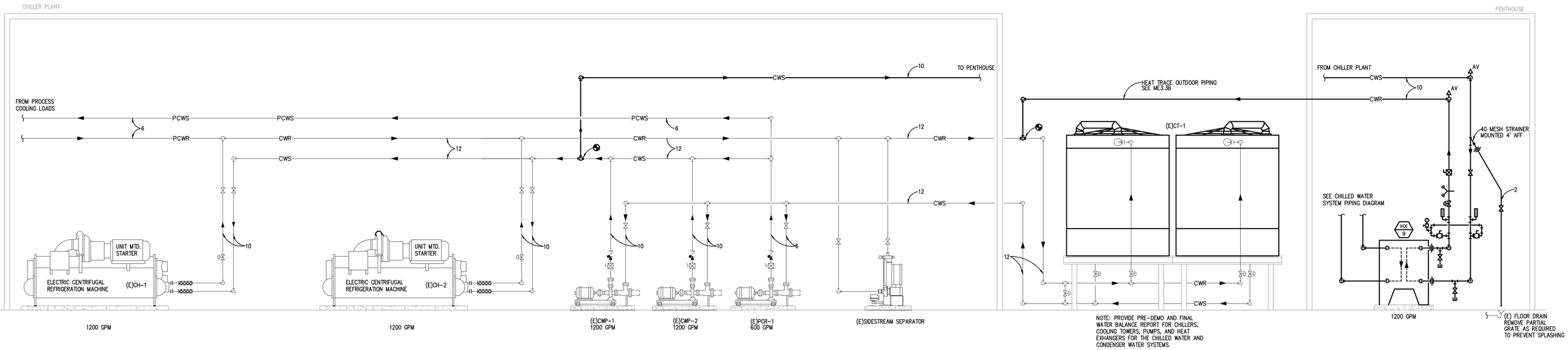
SHEET No.
M4.4



CHILLED WATER SYSTEM PIPING DIAGRAM
NO SCALE



CONDENSER WATER SYSTEM PIPING DIAGRAM
NO SCALE

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SHEET No.
M6.1

AUTOMATIC DAMPER SCHEDULE

SERVICE	LOCATION	DUCT/OPENING SIZE		MAXIMUM CFM	PANEL SIZE		CONFIGURATION	PANEL QUANTITY	MAXIMUM SHUT-OFF PRESSURE IN. WG.	MODEL NUMBER	NOTES
		WIDTH INCHES	HEIGHT INCHES		WIDTH INCHES	HEIGHT INCHES					
RM 1536.04 EXHAUST	RM 1536.04	8	6	200	11	9	PARALLEL	1	10	VCD-43	1,2,4,7
RM 1536.04 SUPPLY	RM 1536.04	8	6	200	11	9	PARALLEL	1	10	VCD-43	1,2,4,7
RM 1536.04 ENGINE EXHAUST	ROOF	8		500	8		SINGLE BLADE	1	4	VCDR-53	1,4,7,9,10
RM 1539 EXHAUST	RM 1539	16		4000	16		OPPOSED	1	5	VCDRM-53	1,4,7
RM 1539 SUPPLY	RM 1541	24	16	5000	27	19	PARALLEL	1	10	VCD-43	1,2,4,7
RM 1539 ENGINE EXHAUST	ROOF	10		1000	10		PARALLEL	1	5	VCDRM-53	1,4,7,9,10
RM 1543 EXHAUST	RM 1541	16		4000	16		OPPOSED	1	5	VCDRM-53	1,4,7
RM 1543 SUPPLY	RM 1543	24	16	5000	27	19	PARALLEL	1	10	VCD-43	1,2,4,7
RM 1543 ENGINE EXHAUST	ROOF	10		1000	10		PARALLEL	1	5	VCDRM-53	1,4,7,9,10
RM 1545 EXHAUST	RM 1543	16		4000	16		OPPOSED	1	5	VCDRM-53	1,4,7
RM 1545 SUPPLY	RM 1545	24	16	5000	27	19	PARALLEL	1	10	VCD-43	1,2,4,7
RM 1545 ENGINE EXHAUST	ROOF	10		1000	10		PARALLEL	1	5	VCDRM-53	1,4,7,9,10
RM 1551 EXHAUST	RM 1551	16		4000	16		OPPOSED	1	5	VCDRM-53	1,2,4,7
RM 1551 SUPPLY	RM 1551	36	16	5000	39	19	PARALLEL	1	10	VCD-43	1,2,4,7
RM 1551 ENGINE EXHAUST	ROOF	10		1000	10		PARALLEL	1	5	VCDRM-53	1,4,7,9,10

NOTE:
1. MODEL NUMBERS ARE GREENHECK.
2. SCHEDULED DAMPER WIDTHS ARE MEASURED ALONG AXIS OF BLADES.
3. BLANK OFF UNUSED PORTIONS OF DAMPER AT FAN INLET OR OUTLET, WHERE REQUIRED.
4. SCHEDULED MAXIMUM AIR PRESSURE DROP SHALL BE WITH SCHEDULED MAXIMUM AIRFLOW AND DAMPER IN THE FULLY OPENED POSITION.
5. DAMPER BLADES SHALL BE PERPENDICULAR TO FAN SHAFT.
6. DAMPER SHALL BE INSTALLED WITH BLADES IN THE VERTICAL POSITION.
7. DAMPERS OPERATIONS SHALL NOT BE INSTALLED INSIDE EXHAUST UNITS OR EXHAUST DUCTWORK. PROVIDE DAMPER JACKSHAFTS AS REQUIRED.
8. PROVIDE STRUCTURAL SUPPORT FOR MULTIPLE DAMPER PANELS AS RECOMMENDED BY DAMPER MANUFACTURER.
9. PROVIDE 304SS FRAME AND BLADE MATERIAL.
10. PROVIDE DAMPERS WITH END SWITCHES FOR FULLY OPEN.

ABOVEGROUND HVAC PIPING & VALVE APPLICATION SCHEDULE

PIPE SIZE (INCHES)	MATERIAL: SOFT, COPPER TYPE K	HARD COPPER TYPE L	HARD COPPER TYPE M	CARBON STEEL (SCHED. 40)	CARBON STEEL (SCHED. 80)	CARBON STEEL (STD.)	COPPER TYPE DWV	CONNECTION: SOLDERED	BRAZED	WELDED	THREADED	FLANGED	GROOVED	PRESSURE SEAL	MECHANICALLY FORMED TEE	ISOLATION VALVES: BALL	GENERAL SERVICE BUTTERFLY	HI-PERF BUTTERFLY	GATE	KEYED NOTES
CHILLED WATER SUPPLY & RETURN - MIN. WORKING PRESS. & TEMP. 125 PSIG AT 200 DEG F																				
UP TO 2				X							X					X				
2-1/2 TO 4				X						X		X	X				X			A
6 TO 8				X						X		X	X				X			A
CONDENSER WATER SUPPLY & RETURN - MIN. WORKING PRESS. & TEMP. 125 PSIG AT 200 DEG F																				
UP TO 2				X							X					X				
2-1/2 TO 4				X						X		X	X				X			A
6 TO 8				X						X		X	X				X			A
10				X						X		X	X				X			A

GENERAL NOTES

1. 'X' INDICATES ACCEPTABLE SELECTION. IF MORE THAN ONE SELECTION IS INDICATED FOR A PIPING SYSTEM, CONTRACTOR MAY SELECT FROM THOSE INDICATED SELECTIONS.
2. DISSIMILAR-METAL PIPING JOINTS: CONSTRUCT JOINTS USING DIELECTRIC FITTINGS COMPATIBLE WITH BOTH PIPING MATERIALS. IF A BRONZE VALVE CONNECTS THE DISSIMILAR METALS NO FURTHER DIELECTRIC ISOLATION IS REQUIRED.
   a. NPS 2 AND SMALLER: USE BRASS COUPLING, NIPPLE, OR UNION.
   b. NPS 2-1/2 AND LARGER: USE DIELECTRIC FLANGE KITS.
3. USE UNIONS OR FLANGES AT VALVE AND EQUIPMENT CONNECTIONS.
4. HVAC EQUIPMENT DRAINS, VENTS, SAFETY VALVE PIPING, BLOWDOWN PIPING AND THE LIKE SHALL BE SAME PIPING MATERIAL AS ASSOCIATED PIPING SYSTEM.
5. GROOVED END VALVES MAY BE USED WITH GROOVED PIPING.

KEYED NOTES

A. GROOVED FITTINGS, JOINTS, AND COUPLINGS, IF INDICATED AS AN ACCEPTABLE SELECTION, MAY BE USED IN ACCESSIBLE LOCATIONS FOR THIS PIPING SYSTEM ONLY.
B. BALL VALVE WITH 250 PSIG STEAM TRIM.
C. BALL VALVE WITH 150 PSIG STEAM TRIM.
D. GROOVED FITTINGS, JOINTS AND COUPLINGS MAY BE USED IN MECHANICAL ROOMS ONLY.

SCHEDULES GENERAL NOTES:

TYPICAL FOR ALL SCHEDULE SHEETS:

1. REFER TO ELECTRICAL STANDARD SCHEDULES, ONE LINE DIAGRAM AND PANEL SCHEDULES FOR ADDITIONAL ELECTRICAL INFORMATION
2. PROVIDE THE FOLLOWING FACTORY-WIRED ELECTRICAL OPTIONS/ACCESSORIES WHERE INDICATED IN SCHEDULE:
   A – NON-FUSED DISCONNECT SWITCH
   B – UNIT SHALL BE SINGLE POINT ELECTRICAL CONNECTION WITH FACTORY INSTALLED DISCONNECTING MEANS AND ALL REQUIRED STARTERS AND CONTROLS
   C – SERVICE RECEPTACLE
   D – FUSED DISCONNECT SWITCH
   E – COMBINATION STARTER
   F – UNIT SHALL HAVE (2) SINGLE POINT CONNECTIONS WITH FACTORY INSTALLED DISCONNECTING MEANS AND ALL REQUIRED STARTERS AND CONTROLS. (1) CONNECTION SHALL BE FOR CONDENSING SECTION AND (1) CONNECTION SHALL BE FOR THE REMAINDER OF THE UNIT.
3. FOR MODULATION/CONTROL TYPE COLUMN, "VFC" INDICATES VARIABLE FREQUENCY CONTROLLERS, "AUTO" INDICATES AUTOMATIC OPERATION (CONTROLLED BY TEMPERATURE CONTROLS OR SELF CONTAINED CONTROLS), "MANUAL" INDICATES HAND OPERATION.
4. IF VARIABLE FREQUENCY CONTROLLERS ARE INDICATED TO BE PROVIDED AND ARE NOT INSTALLED INTEGRAL TO THE UNIT, VARIABLE FREQUENCY CONTROLLERS SHALL BE SUPPLIED BY THE MECHANICAL CONTRACTOR (UNLESS OTHERWISE NOTED) AND INSTALLED BY THE ELECTRICAL CONTRACTOR INCLUDING THE LINE SIDE AND LOAD SIDE WIRING TO THE MOTOR AND INCLUDING MISCELLANEOUS STEEL REQUIRED FOR THE SUPPORT AND MOUNTING OF THE VFC. REFER TO FLOOR PLANS FOR LOCATION.
5. WHERE EQUIPMENT IS INDICATED TO HAVE A SINGLE POINT ELECTRICAL CONNECTION, THAT EQUIPMENT SHALL COME COMPLETE WITH FACTORY INSTALLED STARTERS, MOTOR OVERLOAD PROTECTION, CONTACTORS, FUSING AND ALL NECESSARY INTERNAL WIRING AND CONTROLS. PROVIDE A FACTORY MOUNTED UNIT DISCONNECTING MEANS WHERE THE ELECTRICAL CONTRACTOR SHALL MAKE SINGLE POINT CONNECTION. INSTALL PACKAGED EQUIPMENT SUCH THAT THE ELECTRICAL CONNECTION AND CONTROLS ARE ACCESSIBLE AND HAVE CLEARANCES MEETING THE NATIONAL ELECTRICAL CODE.
6. WHERE PACKAGED EQUIPMENT IS PROVIDED, NAMEPLATE MUST INDICATE MAXIMUM OVERCURRENT PROTECTION BY HACR RATED CIRCUIT BREAKERS OR FUSES. IF FUSE PROTECTION ONLY IS INDICATED, PROVIDE A FUSIBLE DISCONNECT AND FUSES WITH THE UNIT.
7. WHERE EQUIPMENT IS DESIGNATED BY MANUFACTURER AND MODEL NUMBER, THIS IS THE BASIS OF DESIGN. IF THE CONTRACTOR ELECTS TO PROVIDE EQUIPMENT BY OTHER SPECIFIED MANUFACTURERS OR PROPOSED ALTERNATE EQUIPMENT BY THE BASIS OF DESIGN MANUFACTURER, THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY REVISIONS TO ELECTRICAL REQUIREMENTS, STRUCTURAL LOADING, OR ARCHITECTURAL APPURTENANCES AND SHALL INCLUDE THE COST OF SUCH REVISIONS IN HIS BID.
8. WHERE EQUIPMENT IS SCHEDULED TO INCLUDE A SERVICE RECEPTACLE, PROVIDE A FACTORY MOUNTED SERVICE RECEPTACLE WITH APPROPRIATE FUSES AND TRANSFORMERS CONNECTED ON THE LINE SIDE OF THE UNIT DISCONNECT. PROVIDE A NAMEPLATE ON THE DISCONNECT SWITCH INDICATING THE PRESENCE OF LIVE POWER TO THE SERVICE RECEPTACLE WHEN HE UNIT DISCONNECT IS IN THE OFF POSITION.
9. SIZE ALL EQUIPMENT FEEDERS BASED ON THE LISTED MOP (MAXIMUM OVERCURRENT PROTECTION). REFER TO THE FEEDER AND BRANCH CIRCUIT SIZING SCHEDULE ON THE ELECTRICAL STANDARD SCHEDULES SHEET.

ABOVEGROUND HVAC PIPE & ACCESSORY INSULATION APPLICATION SCHEDULE

	INSULATION MATERIAL & THICKNESS (INCHES): FLEXIBLE ELASTOMERIC	FIBERGLASS	MINERAL WOOL	POLYISOCYANURATE	PHENOLIC	CELLULAR GLASS	CALCIUM SILICATE	FIELD-APPLIED JACKET MATERIAL: ALUMINUM	STAINLESS STEEL	PVC	SELF-ADHESIVE (FOR OUTDOOR APPLICATIONS)	PVDC (INDOOR)	PVDC (OUTDOOR)	KEYED NOTES
INDOOR PIPE SYSTEM AND SIZE (INCHES)														
CHILLED WATER & BRINE ABOVE 40 DEG F	1	1												
CONDENSER WATER	1	1						X						C

GENERAL NOTES

1. 'X' OR THICKNESS IN INCHES INDICATES ACCEPTABLE SELECTION. IF MORE THAN ONE SELECTION IS INDICATED, CONTRACTOR MAY SELECT FROM THOSE INDICATED SELECTIONS.
2. INSULATE PIPING WITHIN AIR HANDLING EQUIPMENT THE SAME AS INDOOR PIPING. PROVIDE ALUMINUM OR STAINLESS STEEL JACKET.

KEYED NOTES

A. PROVIDE FIELD APPLIED JACKET FOR PIPING EXPOSED IN EQUIPMENT ROOMS, STORAGE ROOMS, JANITORS CLOSETS, RECEIVING ROOMS, TEST AREAS, CIRCULATION AREAS AND SUCH AREAS SUBJECT TO DAMAGE WITHIN 10 FEET (3 METERS) OF FINISHED FLOOR.
B. PROVIDE MANUFACTURER'S RECOMMENDED PROTECTIVE COATING FOR FLEXIBLE ELASTOMERIC THERMAL INSULATION.
C. FOR HEAT TRACED PIPING LOCATED OUTDOORS PROVIDE INSULATION AND ALUMINUM JACKET. ALUMINUM JACKET IS ONLY REQUIRED ON OUTDOOR PIPING.

DUCT SYSTEM APPLICATION SCHEDULE

AIR SYSTEMS	DUCT MATERIAL: G90 GALV. SHEET METAL	DOUBLE-WALL LINED G90 GALV. SHEET METAL (SOLID INNER WALL)	DOUBLE-WALL LINED G90 GALV. SHEET METAL (PERF. INNER WALL)	G90 GALV. SHEET METAL WITH 1-INCH LINING	GALVANNEALED SHEET METAL	ALUMINUM	TYPE 304 STAINLESS STEEL	TYPE 316 STAINLESS STEEL	PVC COATED GALV. SHEET METAL (4X1)	PVC COATED GALV. SHEET METAL (1X4)	PVC COATED GALV. SHEET METAL (4X4)	16 GA. CARBON STEEL	ZERO-CLEARANCE PREFABRICATED RANGE HOOD EXHAUST DUCT	FABRIC	DESIGN PRESSURE CLASS (INCHES WG)	SEAL CLASS	MAX. ALLOWABLE LEAKAGE RATE (PERCENT)	KEYED NOTES
EXHAUST AIR								X							-6	A	5	

GENERAL NOTES

1. 'X' INDICATES ACCEPTABLE SELECTION. IF MORE THAN ONE SELECTION IS INDICATED FOR A DUCT SYSTEM, CONTRACTOR MAY SELECT FROM THOSE INDICATED SELECTIONS.
2. 4 X 1 PVC-COATED GALVANIZED STEEL: FACTORY-APPLIED PVC COATINGS SHALL BE 4 MILS (0.10 MM) THICK ON EXTERIOR SHEET METAL SURFACES OF DUCTS AND FITTINGS EXPOSED TO CORROSIVE CONDITIONS AND MINIMUM 1 MIL (0.025 MM) THICK ON INTERIOR SURFACES.
3. 1 X 4 (4 X 1 REVERSE COATED) PVC-COATED GALVANIZED STEEL: FACTORY-APPLIED PVC COATINGS SHALL BE 4 MILS (0.10 MM) THICK ON INTERIOR SHEET METAL SURFACES OF DUCTS AND FITTINGS EXPOSED TO CORROSIVE CONDITIONS AND MINIMUM 1 MIL (0.025 MM) THICK ON EXTERIOR SURFACES.
4. 4 X 4 PVC-COATED GALVANIZED STEEL: FACTORY-APPLIED PVC COATINGS SHALL BE 4 MILS (0.10 MM) THICK ON SHEET METAL SURFACES OF DUCTS AND FITTINGS EXPOSED TO CORROSIVE CONDITIONS AND 4 MILS (0.10 MM) THICK ON OPPOSITE SURFACES.

KEYED NOTES

A. SCREWS, DAMPERS, OR PROJECTIONS OF ANY TYPE ON INTERIOR OF DUCT SURFACE ARE PROHIBITED.
B. DUCT SHALL BE LINED WITHIN 25 FEET UPSTREAM OF FANS.
C. ALL WELDED CONSTRUCTION.

WATER TO WATER HEAT EXCHANGER SCHEDULE

UNIT IDENTIFICATION	SYSTEM SERVED	TYPE	CAPACITY MBH	PRIMARY WATER (CHILLED WATER): FLOW	E.W.T.	L.W.T.	MAXIMUM W.P.D. FT. HEAD	CONTROL VALVE W.P.D. FT. HEAD	SECONDARY WATER (CONDENSER WATER): FLOW	E.W.T.	L.W.T.	MAXIMUM W.P.D.	MODEL NUMBER	REMARKS
HX-9	CHILLED WATER	PLATE AND FRAME	1442	360	58	50	10	2-POSITION	1200	48	50.4	3.47	S-76-1500-116	1

NOTE:
1. MODEL NUMBERS ARE ARMSTRONG UNLESS OTHERWISE NOTED.

POWER VENTILATOR SCHEDULE

UNIT IDENTIFICATION	SYSTEM SERVED	TYPE	AIRFLOW CFM	T.S.P. IN. W.G.	TIP SPEED FPM	FAN RPM	MOTOR: BHP	HP	RPM	DRIVE TYPE	CURB HEIGHT INCHES	MODULATION/ CONTROL TYPE	ELECTRICAL: VOLTS	PHASE	OPTIONS/ ACCESSORIES	MAXIMUM SOUND POWER LEVELS: UNIT DISCHARGE Lw BY OCTAVE BAND: 63 HZ (DB)	125 HZ (DB)	250 HZ (DB)	500 HZ (DB)	1000 HZ (DB)	2000 HZ (DB)	4000 HZ (DB)	8000 HZ (DB)	UNIT INLET Lw BY OCTAVE BAND: 63 HZ (DB)	125 HZ (DB)	250 HZ (DB)	500 HZ (DB)	1000 HZ (DB)	2000 HZ (DB)	4000 HZ (DB)	8000 HZ (DB)	MODEL NUMBER	REMARKS
EF-10	ENGINE EXHAUST	LAB EXHAUST FAN	4500	4	4206	1997	5.87	7.5	1770	DIRECT	PLENUM 35.5 CURB 15.13	VFC	460	3	–	86	82	86	83	82	78	75	72	89	85	83	80	81	79	77	74	VEKTOR-MH-20-2-70-14	1,2,3,4,5

NOTE:
1. REFER TO SCHEDULES GENERAL NOTES.
2. MODEL NUMBERS ARE GREENHECK UNLESS OTHERWISE NOTED.
3. USE TEFC MOTOR
4. FAN SHALL BE RATED FOR SPARK B OR BETTER.
5. FURNISH THE FAN WITH A SIDE INLET PLENUM AND ISOLATION DAMPER.

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TEMPERATURE CONTROL - SYMBOLS LIST

SCHEMATIC SYMBOLS

SYMBOL	DESCRIPTION
AQ	AQUASTAT, STRAP ON BULB
CO2	CARBON DIOXIDE SENSOR – WALL MOUNTED
CS	CURRENT SWITCH
	DAMPER – OPPOSED BLADE
	DAMPER – PARALLEL BLADE
M	DAMPER MOTOR
DPT	DIFFERENTIAL PRESSURE TRANSMITTER
DPS	DIFFERENTIAL PRESSURE SWITCH
CM	FIRE ALARM SYSTEM, ADDRESSABLE CONTROL MODULE
FM	FLOW METER
FS	FLOW SWITCH
FZ	FREEZESTAT
P/	GAUGE – PRESSURE
	GUARD FOR STAT OR SENSOR
H	HUMIDITY SENSOR, DUCT MOUNTED
	LINE – ELECTRIC
	LINE – PNEUMATIC
M/S	MOTOR STARTER
OS	OCCUPANCY SENSOR
R	RELAY, ELECTRIC
AI	SIGNAL – DDC/BAS, ANALOG INPUT
AO	SIGNAL – DDC/BAS, ANALOG OUTPUT
DI	SIGNAL – DDC/BAS, DIGITAL INPUT
DO	SIGNAL – DDC/BAS, DIGITAL OUTPUT

SCHEMATIC SYMBOLS (CONT.)

SYMBOL	DESCRIPTION
DD	SMOKE DETECTOR – DUCT MOUNTED
SD	SMOKE DETECTOR – SPACE MOUNTED
S/S	START/STOP RELAY
SPT	STATIC PRESSURE TRANSMITTER
SP	STATIC PRESSURE SENSOR OR PROBE
SW	SWITCH
T	TEMPERATURE SENSOR – RIGID ELEMENT IN WELL
T	TEMPERATURE SENSOR – DUCT MOUNTED AVG ELEMENT
T	TEMPERATURE SENSOR – DUCT MOUNTED RIGID ELEMENT
T	THERMOSTAT OR TEMPERATURE SENSOR (AS DEFINED ON TC DRAWINGS)
XF	TRANSFORMER
	VALVE – 2 WAY CONTROL VALVE
	VALVE – 3 WAY CONTROL VALVE
VFC	VARIABLE FREQUENCY CONTROLLER

WIRING SYMBOLS

SYMBOL	DESCRIPTION
M/S	COIL – MOTOR STARTER CONTACTOR
	COIL – EP OR SOLENOID VALVE
	CONTACT – INSTANT OPERATING, NO
	CONTACT – INSTANT OPERATING, NC
	GROUND
	MOTOR, SINGLE PHASE

WIRING SYMBOLS (CONT.)

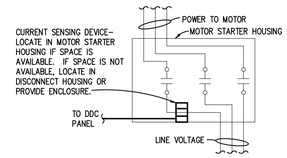
SYMBOL	DESCRIPTION
H O A	SWITCH – 3 POSITION SELECTOR HAND/OFF/AUTO
	SWITCH – MANUAL SPST, NO
	SWITCH – MANUAL SPST, NC
	SWITCH – MANUAL SPDT
	SWITCH – PRESSURE & VACUUM, NO
	SWITCH – PRESSURE & VACUUM, NC
	SWITCH – TEMPERATURE ACTUATED, NO
	SWITCH – TEMPERATURE ACTUATED, NC
	THERMAL OVERLOAD, SINGLE PHASE
OLs	THERMAL OVERLOAD CONTACTS – 3 PHASE
	TRANSFORMER
	WIRE TERMINATION AT DEVICE
	WIRE TO WIRE TERMINATION
	WIRING NOT CONNECTED

WIRING TERMS

ABBREVIATION	DESCRIPTION
SPST	SINGLE POLE SINGLE THROW
SPDT	SINGLE POLE DOUBLE THROW
DPST	DOUBLE POLE SINGLE THROW
DPDT	DOUBLE POLE DOUBLE THROW
NO	NORMALLY OPEN
NC	NORMALLY CLOSED

NOTE: SOME SYMBOLS & ABBREVIATIONS SHOWN MAY NOT APPLY TO THIS PROJECT.

NOTE: REFER TO MECHANICAL STANDARDS ON DRAWING M0.1 FOR ADDITIONAL SYMBOLS & ABBREVIATIONS THAT MAY BE USED ON TEMPERATURE CONTROL DRAWINGS.

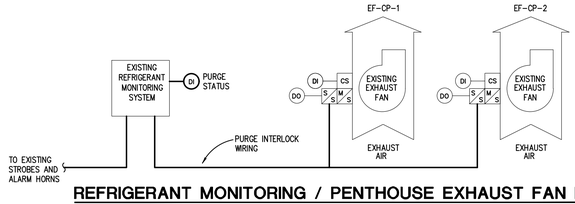


CURRENT SWITCH INSTALLATION DETAIL

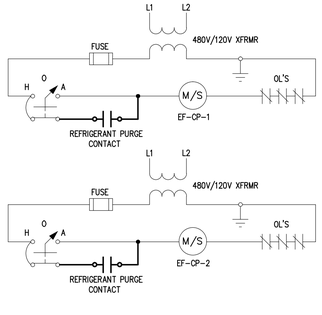
NO SCALE

GENERAL NOTES:

1. THESE GENERAL NOTES SHALL BE APPLICABLE FOR ALL TC DRAWINGS.
2. "PROVIDE" IS DEFINED AS "FURNISH AND INSTALL".
3. CONTRACTOR SHALL BE RESPONSIBLE TO COMPLY WITH ALL APPLICABLE CODES AND STANDARDS.
4. FOR TEMPERATURE CONTROL DRAWINGS ONLY: ALL DETAILED INFORMATION IDENTIFIED WITH HEAVY LINE WEIGHT SHALL BE PROVIDED BY INSTALLING ELECTRICAL CONTRACTOR. ALL OTHER INFORMATION IDENTIFIED WITH LIGHT LINE WEIGHT SHALL BE PROVIDED BY OTHER TRADES. ELECTRICAL CONTRACTOR SHALL COORDINATE WITH SIEMENS FOR ACTUAL CONTROL WIRING REQUIREMENTS.
5. ALL CONTROL SCHEMATICS AND WIRING DIAGRAMS ARE FOR THE CLARIFICATION OF EQUIPMENT INTERLOCKING FUNCTIONS AND THE INTERFACE OF VARIOUS CONTRACTOR'S WORK AND SHALL NOT BE MISTAKEN AS SHOP DRAWINGS FOR ACTUAL INSTALLATION.
6. TC SYSTEM PROVIDER SHALL PROVIDE DDC CONTROLLERS AS REQUIRED TO MEET INTENT OF DESIGN DOCUMENTS. REFER TO THE PLANS FOR THE DDC FUNCTIONS THAT APPLY TO EACH MECHANICAL SYSTEM.
7. ALL TC PROVIDED COMPONENTS AND ALL ELECTRICAL CONTRACTOR INSTALLED WIRING SHALL BE LABELED PER SPECIFICATIONS.
8. ALL WIRING AND SYSTEM CONTROL VOLTAGES SHALL BE IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURER'S RECOMMENDATION AND THE ELECTRICAL SPECIFICATIONS.
9. FAN MOTOR STARTERS, STARTER WIRING, CONTROL VOLTAGE TRANSFORMERS AND ASSOCIATED POWER WIRING SHALL BE PROVIDED BY OTHER TRADES.
10. ALL DDC AND CONTROL INTERLOCK WIRING SHALL BE BY ELECTRICAL CONTRACTOR UNLESS OTHERWISE NOTED. COORDINATE WITH TC CONTROLS SUPPLIER AND MOTOR STARTER SUPPLIERS TO DETERMINE EXACT WIRING REQUIREMENTS AND TERMINATION POINTS.
11. ALL DDC AND CONTROL INTERLOCK WIRING BETWEEN COMPONENTS SHALL BE INSTALLED WITHOUT INTERMEDIATE STOPS. WIRE SPLICING AT INTERMEDIATE TERMINAL STRIPS IS NOT ACCEPTABLE.
12. ALL ELECTRICAL WIRING AND RACEWAY SYSTEMS SHALL COMPLY WITH ELECTRICAL SPECIFICATION REQUIREMENTS. WHERE RACEWAY IS REQUIRED, TWO SEPARATE ELECTRICAL RACEWAY SYSTEMS SHALL BE PROVIDED: ONE FOR 120V WIRING AND THE OTHER FOR 24V WIRING.
13. ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR ALL POWER SUPPLIES REQUIRED FOR TC SYSTEM UNLESS OTHERWISE NOTED. REFER TO ELECTRICAL PANEL SCHEDULES FOR SPARE CIRCUITS IF NOTED, OTHERWISE, FIELD VERIFY AVAILABLE SPARE CIRCUIT.
14. ELECTRICAL CONTRACTOR SHALL VERIFY EXACT LOCATION OF ALL FIELD MOUNTED COMPONENTS.
15. REMOTELY MOUNTED FIELD DEVICES SUCH AS RELAYS, CONTROL TRANSFORMERS, ETC., SHALL BE HOUSED IN AN ENCLOSURE PROVIDED BY THE ELECTRICAL CONTRACTOR.
16. CONTROL TRANSFORMERS WHEN REQUIRED SHALL BE SIZED FOR 150% OF ACTUAL LOAD.
17. CURRENT SWITCHES USED FOR OPERATIONAL STATUS SHALL HAVE CURRENT THRESHOLD SETPOINT ADJUSTED TO INDICATE BELT OR DRIVE FAILURE.
18. ALL CONTROL VALVES AND ASSOCIATED CONTROL ACTUATORS IDENTIFIED ON TC DRAWINGS SHALL BE FURNISHED BY TC SYSTEM PROVIDER UNLESS OTHERWISE NOTED.
19. ALL CONTROL VALVES FURNISHED BY THE TC SYSTEM PROVIDER SHALL BE INSTALLED BY THE MECHANICAL CONTRACTOR. ALL PIPE PENETRATIONS AND BASIC FITTINGS REQUIRED FOR SENSOR INSTALLATIONS SHALL BE PROVIDED BY MECHANICAL CONTRACTOR.
20. ALL INSTRUMENTATION TUBING REQUIRED FOR DPS AND DPT COMPONENT INSTALLATIONS SHALL BE PROVIDED BY ELECTRICAL CONTRACTOR.
21. ELECTRICAL CONTRACTOR SHALL FIELD MOUNT ALL REQUIRED PACKAGED CONTROL COMPONENTS FURNISHED BY EQUIPMENT SUPPLIERS WHERE INDICATED. ALL REQUIRED 24V AND 120V FIELD WIRING SHALL BE PROVIDED BY ELECTRICAL CONTRACTOR UNLESS NOTED OTHERWISE. ELECTRICAL CONTRACTOR SHALL COORDINATE SPECIFIC SYSTEM WIRING REQUIREMENTS WITH PACKAGED EQUIPMENT SUPPLIERS AND TC SYSTEM PROVIDER..
22. TEMPERATURE CONTROLS WILL BE PROVIDED BY SIEMENS AND WILL BE CONTRACTED DIRECTLY THROUGH WSU. REFER TO FRONT END DOCUMENTS.



REFRIGERANT MONITORING / PENTHOUSE EXHAUST FAN DETAIL



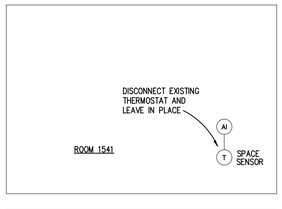
NOTES:

1. PROVIDE INTERCONNECTING REFRIGERANT MONITOR CONTROL WIRING TO ALLOW PURGE OPERATION OF THE PENTHOUSE EXHAUST FANS.

SEQUENCE OF OPERATION

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 EF RUN STATUS THRU CURRENT SWITCH. ABNORMAL STATUS CONDITION SHALL ACTIVATE ALARM.

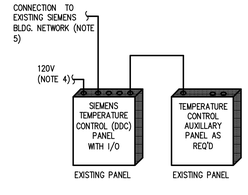
PENTHOUSE EXHAUST FAN WIRING DIAGRAM



THERMOSTAT RELOCATION

NOTES:

1. DISCONNECT EXISTING SPACE TEMPERATURE SENSOR IN OBSERVATION ROOM 1541 THAT CONTROLS EXISTING VAV BOX SV1541. EXISTING SPACE TEMPERATURE SENSOR SHALL BE LEFT IN PLACE.
2. ADD A NEW SPACE TEMPERATURE SENSOR TO THE OBSERVATION ROOM 1547 ADJACENT TO ROOM 1551 TO CONTROL EXISTING VAV BOX SV1541.



DDC SYSTEM ARCHITECTURE

NO SCALE

NOTES:

1. EXISTING BUILDING AUTOMATION SYSTEM (BAS) IS SIEMENS APOGEE. NEW DDC SYSTEM COMPONENTS SHALL BE PROVIDED BY SIEMENS. INTEGRATE NEW SIEMENS DDC CONTROLS TO EXISTING SIEMENS DDC NETWORK. SIEMENS SHALL UPDATE THE EXISTING BAS FRONT–END HARDWARE/SOFTWARE/DATABASE/GRAPHICS AS NECESSARY TO ACCOMMODATE NEW WORK.
2. REFER TO TEMPERATURE CONTROL SCHEMATICS FOR THE REQUIRED POINTS ASSOCIATED FOR EACH SYSTEM.
3. ELECTRICAL CONTRACTOR SHALL INSTALL ALL NEW TC COMPONENTS AND PROVIDE WIRING PER SIEMENS SHOP DRAWINGS AND AS COORDINATED WITH SIEMENS PROJECT REPRESENTATIVE INCLUDING NETWORK COMMUNICATION INTERFACE TO EXISTING TC COMPONENTS. ELECTRICAL CONTRACTOR SHALL FIELD VERIFY LOCATIONS AND COORDINATE WITH OTHER TRADES.
4. TC CONTRACTOR SHALL PROVIDE REQUIRED 120V/24V POWER SUPPLY TRANSFORMER(S) FOR CONTROLLERS AND OTHER CONTROL COMPONENTS AS REQUIRED. ELECTRICAL CONTRACTOR SHALL PROVIDE REQUIRED 120V POWER SUPPLIES FROM DEDICATED AND/OR SPARE CIRCUITS IDENTIFIED ON ELECTRICAL PANEL SCHEDULES. COORDINATE WITH ELEC CONTRACTOR. REFER TO ELECTRICAL DWGS FOR PANEL SCHEDULES AND PANEL LOCATIONS.
5. IN–LIEU–OF NEW PANELS USE EXISTING CONTROL PANELS AND WIRE TO EXISTING PANELS AS DIRECTED BY SIEMENS. ADD EXPANSION MODULES AS NECESSARY TO ACCOMODATE NEW WORK.

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PROJECT TITLE
WAYNE STATE UNIVERSITY
ENGINEERING DEVELOPMENT CENTER UPGRADES
DETROIT, MI

SHEET TITLE
TEMPERATURE CONTROL STANDARDS AND GENERAL NOTES

DATE
09/30/2014

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BIDS

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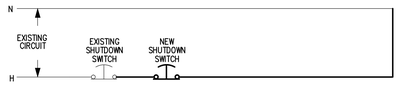
M8.1

TC GENERAL NOTES

TC GENERAL NOTES ON DRAWING M8.1 APPLY TO THIS DRAWING.



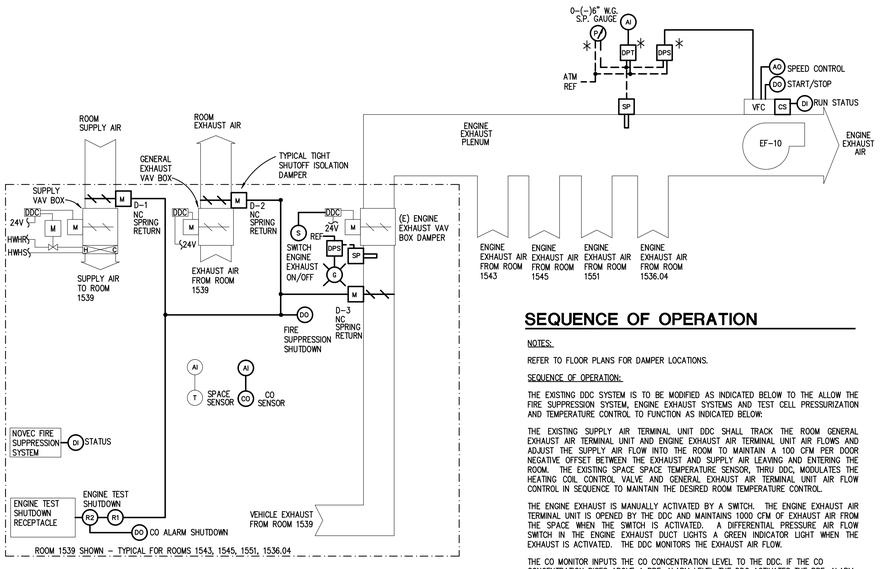
EMERGENCY SHUTDOWN WIRING

NOTES:

1. REFER TO FLOOR PLANS FOR LOCATIONS AND FIELD VERIFY INSTALLATION REQUIREMENTS.
2. TC CONTRACTOR SHALL PROVIDE SIGN (NAME PLATE) TO BE PLACED DIRECTLY ABOVE OR BELOW EACH PUSH BUTTON SWITCH THAT READS: "EMERGENCY SHUTDOWN". COORDINATE LOCATION WITH ALL OTHER TRADES.
3. TC CONTRACTOR SHALL WIRE CONTROL CIRCUITS TC CONTRACTOR SHALL MOUNT SHUTDOWN CONTROL RELAYS AT RESPECTIVE BOILER CONTROL PANELS.
4. TC CONTRACTOR SHALL PROVIDE PUSH BUTTON SWITCH (PUSH TO LATCH) WITH MUSHROOM HEAD OPERATOR AND NORMALLY CLOSED (NC) CONTACTS. PROVIDE WITH PROPER ENCLOSURE. ONE SWITCH IS EXISTING AND A SECOND SWITCH IS BEING ADDED TO THE CIRCUIT. MATCH EXISTING SWITCH IF POSSIBLE.

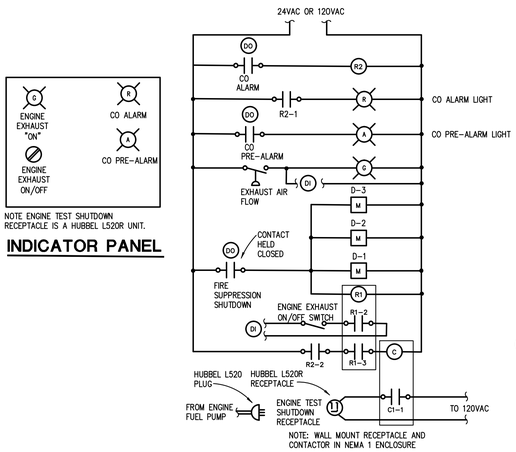
SEQUENCE OF OPERATION:

1. UNDER NORMAL OPERATING CONDITIONS THE CIRCUIT SHALL BE ENERGIZED. WHEN A SWITCH IS PUSHED (LATCHED) CONTACTS SHALL OPEN AND INTERRUPT CIRCUIT.



ENGINE TEST CELL MODIFICATIONS

TYPICAL FOR FIVE CELLS * DENOTES PANEL MOUNTED EQUIPMENT



INDICATOR PANEL

SHUT-OFF DAMPER/ALARM WIRING DIAGRAM

TYPICAL FOR EACH ROOM

SEQUENCE OF OPERATION

NOTES:

REFER TO FLOOR PLANS FOR DAMPER LOCATIONS.

SEQUENCE OF OPERATION:

THE EXISTING DDC SYSTEM IS TO BE MODIFIED AS INDICATED BELOW TO THE 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, THRU 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. A DIFFERENTIAL PRESSURE AIR FLOW SWITCH IN THE ENGINE EXHAUST DUCT LIGHTS A GREEN INDICATOR LIGHT WHEN THE EXHAUST IS ACTIVATED. THE DDC MONITORS THE EXHAUST AIR FLOW.

THE CO MONITOR INPUTS THE CO CONCENTRATION LEVEL TO THE DDC. IF THE CO CONCENTRATION RISES ABOVE A PRE-ALARM LEVEL THE DDC ACTIVATES THE PRE-ALARM LIGHT ON THE PANEL. IF THE CO CONCENTRATION RISES ABOVE A SAFE LEVEL THE DDC ACTIVATES THE RED ALARM INDICATOR LIGHT IN THE PANEL, A RELAY IS DEACTIVATED SHUTTING DOWN THE ENGINE BEING TESTED AND AN ALARM IS GENERATED IN THE DDC SYSTEM. THE DDC SHUT OFF THE PRE-ALARM LIGHT WHEN THE ALARM LIGHT IS ACTIVATED.

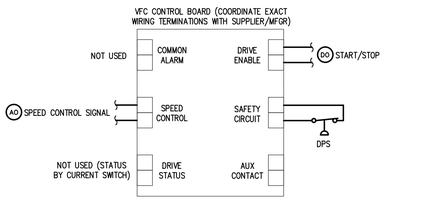
WHEN THE ENGINE IS REQUIRED TO BE SHUT DOWN, FROM EITHER THE FIRE SUPPRESSION OR CO MONITOR SYSTEMS, IT IS ACCOMPLISHED THRU A DEDICATED HUBBEL RECEPTACLE OUTLET LOCATED IN THE ROOM. THE ENGINE FUEL PUMP WILL "PLUG INTO" THE RECEPTACLE COMPLETING THE ENGINE TEST SAFETY CIRCUIT AND ALLOWING THE ENGINE TO RUN UNLESS EITHER OF THESE SYSTEMS ARE IN ALARM.

WHENEVER ANY ENGINE EXHAUST TERMINAL UNIT DAMPER OPENS, THE DDC STARTS THE ENGINE 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 DIFFERENTIAL PRESSURE SWITCH STOPS THE EXHAUST FAN IF A HIGH NEGATIVE PRESSURE SET POINT IS EXCEEDED.

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, ROOM GENERAL EXHAUST AND ENGINE EXHAUST AIR SHUTOFF DAMPERS AND STOPS THE ENGINE BEING TESTED. WHEN THIS OCCURS AN ALARM IS GENERATED IN THE DDC SYSTEM.

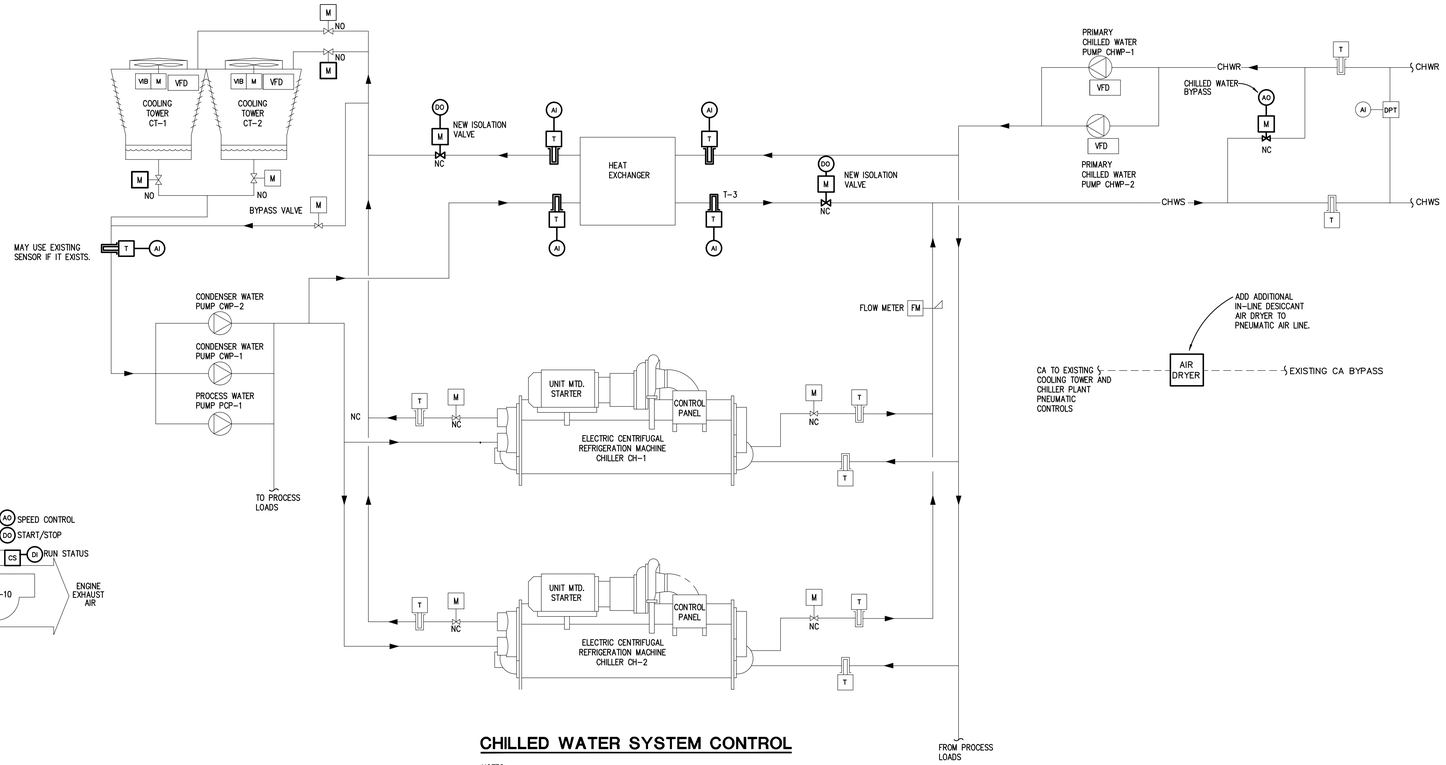
FOR FIRE SUPPRESSION TESTING, CONTRACTOR MUST FOLLOW THE SEQUENCE OUTLINED BY NFPA 72 AND 2001, AS WELL AS THE MANUFACTURER'S GUIDELINES FOR TESTING FUNCTIONALITY AND EFFECTIVENESS OF THE FIRE SUPPRESSION AGENT CONCENTRATION.



ENGINE EXHAUST FAN EF-10 WIRING DIAGRAM

NOTE:

1. WIRING DETAIL IDENTIFIES INTENT AND DOES NOT INDICATE ACTUAL WIRING REQUIREMENTS. CONSULT WITH VFC SUPPLIER FOR THE ACTUAL WIRING REQUIREMENTS.



CHILLED WATER SYSTEM CONTROL

NOTES:

1. THE CHILLED WATER SYSTEM IS EXISTING AND A NEW HEAT EXCHANGER IS BEING ADDED FOR FREE COOLING WHEN AVAILABLE.
2. SEPARATE BYPASS VALVES ARE ADDED TO MAINTAIN CHILLER MINIMUM FLOW REQUIREMENTS DURING CHILLER OPERATION, AND OPERATE TO MAINTAIN MINIMUM PUMP FLOW DURING FREE COOLING.

SEQUENCE OF OPERATION:

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 WET 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 WET BULB TEMPERATURE IS ABOVE 42°F. (INSURE 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 CHILLERS 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.
5. THE DDC SHALL MODULATE THE COOLING TOWER FAN TO MAINTAIN 48°F CONDENSER WATER SUPPLY TEMPERATURE TO THE HEAT EXCHANGER. WHEN THE FAN REACHES MINIMUM SPEED, THE TOWER FAN SHUTS DOWN AND THE WATER CONTINUES FLOW OVER THE TOWER. THE HEAT EXCHANGER IN TURN OUTPUTS 50°F CHILLED WATER SUPPLY TEMPERATURE TO THE SYSTEM. IF THE CONDENSER WATER TEMPERATURE DROPS BELOW 45°F THE DDC OPENS THE EXISTING COOLING TOWER BYPASS VALVE AND BY PASSES WATER FROM THE TOWER. THE BYPASS REMAINS OPEN UNTIL THE WATER TEMPERATURE INCREASES TO 50°F (ADJUSTABLE DEAD BAND).
6. DURING FREE COOLING MODE WHEN OUTDOOR AIR TEMPERATURE IS BELOW 32°F, TOWER SHALL OPERATE WITH FAN REVERSED IN A DEFROST 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 IN 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.

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PROJECT TITLE
WAYNE STATE UNIVERSITY
ENGINEERING DEVELOPMENT
CENTER UPGRADES
DETROIT, MI

SHEET TITLE
TEMPERATURE CONTROLS

DATE
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ISSUE
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SHEET No.
M8.2

ELECTRICAL SYMBOL LIST

(NOTE: SOME SYMBOLS AND ABBREVIATIONS SHOWN MAY NOT APPLY TO THIS PROJECT)

SYMBOL	DESCRIPTION
FX	FIXTURE TYPE
	LIGHTING FIXTURE
	DIRECT/INDIRECT LIGHTING FIXTURE
	EMERGENCY FIXTURE
FX-NL	NIGHT LIGHTING FIXTURE
	LIGHTING FIXTURE
	EMERGENCY FIXTURE
	WALL MOUNTED LIGHTING FIXTURE
	LIGHTING FIXTURE
	EMERGENCY FIXTURE
	DIRECTIONAL LIGHTING FIXTURE
	PENDANT LIGHTING FIXTURE
	WALL SCONCE
	LIGHTING TRACK
	TRACK LIGHTING FIXTURE
	POLE MOUNTED LIGHTING FIXTURE
	POLE MOUNTED LIGHTING FIXTURE – POST TOP
	BOLLARD LIGHTING FIXTURE
	EMERGENCY LIGHTING UNIT
	EXIT LIGHTING FIXTURE WITH DIRECTIONAL ARROWS (SHADED AREA INDICATES FACE)
	EXIT LIGHTING FIXTURE WITH DIRECTIONAL ARROWS (SHADED AREA INDICATES FACE)
	EXIT LIGHTING FIXTURE – WALL MOUNTED
ELTD	EMERGENCY LOAD TRANSFER DEVICE
S	SINGLE POLE TOGGLE SWITCH
S2	TWO POLE TOGGLE SWITCH
S3	3 WAY TOGGLE SWITCH
S4	4 WAY TOGGLE SWITCH
K	KEY OPERATED SWITCH
K3	3 WAY KEY OPERATED SWITCH
K4	4 WAY KEY OPERATED SWITCH
D	DIMMER SWITCH
D3	3 WAY DIMMER SWITCH
SP	PILOT SWITCH

SYMBOL	DESCRIPTION
TWC	TWO–WAY COMMUNICATION SYSTEM CALL STATION
TWCD	TWO–WAY COMMUNICATION SYSTEM AUTO DIALER
TWCA	TWO–WAY COMMUNICATION SYSTEM ANNUNCIATOR & COMMUNICATION PANEL
TWCP	TWO–WAY COMMUNICATION SYSTEM POWER SUPPLY WITH BATTERY BACK–UP
TWCDP	TWO–WAY COMMUNICATION SYSTEM AUTO DIALER POWER SUPPLY WITH BATTERY BACK–UP
RGP	REMOTE GENERATOR ANNUCIATOR PANEL
ATS	AUTOMATIC TRANSFER SWITCH
UPS	UN–INTERRUPTABLE POWER SUPPLY
CSX	LOW VOLTAGE CONTROL STATION "X" INDICATES TYPE
	SINGLE RECEPTACLE
	DUPLEX RECEPTACLE
	QUAD RECEPTACLE
	ABOVE COUNTER DUPLEX RECEPTACLE (SIMILAR FOR TAMPER RESISTANT, QUADS, EMERGENCY AND GFI RECEPTACLES)
	DUPLEX RECEPTACLE–GROUND FAULT CIRCUIT INTERRUPTER
	DUPLEX EMERGENCY RECEPTACLE
	TAMPER RESISTANT RECEPTACLE
	QUAD TAMPER RESISTANT RECEPTACLE
	ABOVE COUNTER DUPLEX TAMPER RESISTANT RECEPTACLE
	DUPLEX UPS RECEPTACLE
	USB RECEPTACLE
	CEILING MOUNTED DUPLEX RECEPTACLE
	SPECIAL RECEPTACLE – REFER TO ELECTRICAL STANDARD SCHEDULES
	MULTI–OUTLET RACEWAY
"X"	MULTI–SERVICE DROP SEE ELECTRICAL DETAILS AND DIAGRAMS SHEET "X" INDICATES TYPE
PTX	POKE THRU SERVICE FITTING "X" INDICATES TYPE
FBX	FLOOR BOX SERVICE FITTING "X" INDICATES TYPE
AFX	ACCESS FLOOR SERVICE FITTING "X" INDICATES TYPE
RX	CORD REEL "X" INDICATES TYPE
	DUAL SWITCHING FOR INNER/OUTER LAMPS OF FLUORESCENT LIGHT FIXTURES
	3–WAY DUAL SWITCHING FOR INNER/OUTER LAMPS OF FLUORESCENT LIGHT FIXTURES
	4–WAY DUAL SWITCHING FOR INNER/OUTER LAMPS OF FLUORESCENT LIGHT FIXTURES
ST	DIGITAL TIME SWITCH
SI	ILLUMINATED TOGGLE SWITCH FOR CONTROL OF LIGHTING ON CRITICAL POWER–ILLUMINATED WHEN SWITCH IS IN "OFF" POSITION
SL	LOW VOLTAGE SWITCH
SO	OCCUPANCY SENSOR
SO2	OCCUPANCY SENSOR (REFER TO ELECTRICAL STANDARD SCHEDULES)
OS X	OCCUPANCY SENSOR "X" INDICATES TYPE
S MD	MUSIC/DISASTER SPEAKER

SYMBOL	DESCRIPTION
CP	CONTROL PANEL
	MOTOR
VFC	VARIABLE FREQUENCY CONTROLLER.
	MANUAL CONTROLLER
	MAGNETIC CONTROLLER
	COMBINATION MAGNETIC CONTROLLER
	NON–FUSIBLE DISCONNECT SWITCH
	FUSIBLE DISCONNECT SWITCH
CB	ENCLOSED CIRCUIT BREAKER
	PUSH BUTTON STATION
J	JUNCTION BOX
	HARD WIRE POWER CONNECTION
DP	AUTOMATIC DOOR CONTROLLER
PP	AUTOMATIC DOOR PUSH PAD OPERATOR
	GROUND ROD
	GROUND CONNECTION
X	CONDUIT SLEEVE WITH BUSHINGS LENGTH AS REQUIRED "X" INDICATES CONDUIT SIZE
	CONDUIT UP
	CONDUIT DOWN
	EMPTY BOX FOR FUTURE TELECOMMUNICATION OUTLET
	ABOVE COUNTER EMPTY BOX FOR FUTURE TELECOMMUNICATION OUTLET
	EMPTY BOX FOR FUTURE CEILING MOUNTED TELECOMMUNICATION OUTLET
X	TELECOMMUNICATION OUTLET "X" INDICATES TYPE
X	ABOVE COUNTER TELECOMMUNICATION OUTLET "X" INDICATES TYPE
X	TELECOMMUNICATION CEILING MOUNTED OUTLET "X" INDICATES TYPE
	TELECOMMUNICATION BACKBOARD
TGB	TELECOMMUNICATION GROUNDING BUS BAR
TMGB	TELECOMMUNICATION MAIN GROUNDING BUS BAR
IC	INTERCOM OUTLET
S	HOSPITAL PAGING SPEAKER
S	SPEAKER – WALL MOUNTED
MIC	MICROPHONE
VC	VOLUME CONTROL/STATION SELECTOR
B	SIGNALING BELL
S	SINGLE FACE CLOCK – CEILING MOUNTED
S	SINGLE FACE CLOCK – WALL MOUNTED
S	DOUBLE FACE CLOCK – CEILING MOUNTED
S	DOUBLE FACE COMBINATION CLOCK/SPEAKER CEILING MOUNTED
S	DOUBLE FACE CLOCK – WALL MOUNTED
S	DOUBLE FACE COMBINATION CLOCK/SPEAKER WALL MOUNTED
T/C	TIME CLOCK
C	CONTACTOR
P	PHOTOCELL
TT	TWIST TIMER

REFER TO ELECTRICAL STANDARD SCHEDULES

SYMBOL	DESCRIPTION
	SECURITY CAMERA
MD	MOTION DETECTOR
K	SECURITY KEY SWITCH
DC	DOOR CONTACT
KP	KEY PAD
CR	ACCESS CONTROL STATION
DB	DURESS PUSH BUTTON STATION
DE	DELAYED EGRESS
REX	REQUEST TO EXIT STATION
	CIRCUIT BREAKER
	DRAWOUT CIRCUIT BREAKER MANUALLY/ OPERATED
	DRAWOUT CIRCUIT BREAKER ELECTRICALLY/ OPERATED
	SWITCH
	AUTOMATIC OR MANUAL TRANSFER SWITCH
	FUSE
	TRANSFORMER
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	LIGHTNING ARRESTOR
X	PANELBOARD "X" INDICATES PANELBOARD NAME
	GROUND
	STRESS CONE TERMINATION
K	SECURITY KEY INTERLOCK
G	ENGINE GENERATOR
M	UTILITY METER
EMU	ELECTRONIC METERING UNIT
A	AMMETER
V	VOLTMETER
AS	AMMETER SWITCH
VS	VOLTMETER SWITCH
SPD	SURGE PROTECTIVE DEVICE
CR	CONTROL RELAY
TDR	TIME DELAY RELAY
	THERMAL OVERLOAD RELAY
	NORMALLY OPEN CONTACTS
	NORMALLY CLOSED CONTACTS
	N.O. PUSH BUTTON SINGLE CIRCUIT
	N.C. PUSH BUTTON SINGLE CIRCUIT
X–X	CABLE VAULT "X–X" INDICATES TYPE
	BRANCH CIRCUIT PANELBOARD
	MOTOR CONTROL CENTER
T	TRANSFORMER
	DISTRIBUTION PANEL
GB	GROUND BUS
PB	PLUG IN BUSWAY
FB	FEEDER BUSWAY

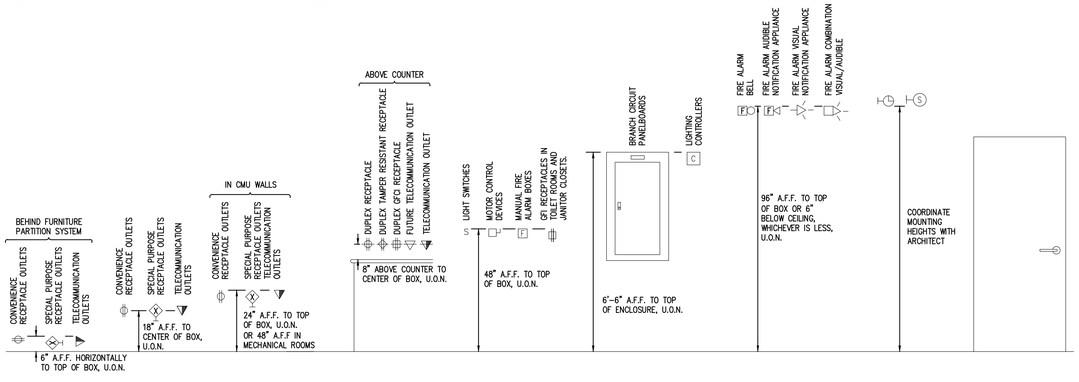
SYMBOL	DESCRIPTION
F	MANUAL FIRE ALARM BOX
SD	SMOKE DETECTOR
DD	DUCT SMOKE DETECTOR
RT	REMOTE TEST STATION (FOR DUCT DETECTOR)
TD	THERMAL DETECTOR
BD	PROJECTED BEAM DETECTOR
F	FIRE ALARM BELL
F	FIRE ALARM AUDIBLE NOTIFICATION APPLIANCE
F XX	FIRE ALARM VISUAL NOTIFICATION APPLIANCE "XX" INDICATES CANDELA RATING IF NO RATING SHOWN, APPLIANCE IS 15cd
F XX	FIRE ALARM COMBINATION VISUAL/ AUDIBLE "XX" INDICATES CANDELA RATING IF NO RATING SHOWN, APPLIANCE IS 15cd
F XX	FIRE ALARM COMBINATION VISUAL/ AUDIBLE NOTIFICATION APPLIANCE– CEILING MOUNTED "XX" INDICATES CANDELA RATING IF NO RATING SHOWN, APPLIANCE IS 15cd
XX	FIRE ALARM VISUAL NOTIFICATION APPLIANCE CEILING MOUNTED "XX" INDICATES CANDELA RATING IF NO RATING SHOWN, APPLIANCE IS 15cd
F	FIREFIGHTERS PHONE JACK
FACP	FIRE ALARM CONTROL PANEL
FAA	FIRE ALARM ANNUNCIATOR PANEL
NAC	NOTIFICATION APPLIANCE CIRCUIT EXTENDER PANEL
IM	ADDRESSABLE MONITORING MODULE
CM	ADDRESSABLE CONTROL MODULE
TS	TAMPER SWITCH
FS	FLOW SWITCH
DR	MAGNETIC DOOR RELEASE

ELECTRICAL DRAWING INDEX

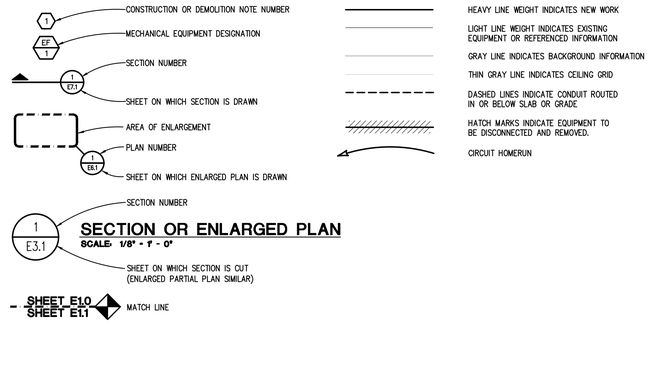
ELECTRICAL ABBREVIATION LIST

ABBREVIATION	DESCRIPTION
A	AMPERES
AF	AMPERES FRAME (BREAKER RATING)
A.F.F.	ABOVE FINISH FLOOR
AIC	AMPS INTERRUPTING CAPACITY
AL	AUDIENCE LEFT
AR	AUDIENCE RIGHT
AT	AMPERES TRIP (BREAKER SETTING)
ATS	AUTOMATIC TRANSFER SWITCH
AUX	AUXILIARY
BKR	BREAKER
BPS	BOLTED PRESSURE SWITCH
C	CONDUIT
CB	CIRCUIT BREAKER
CFCI	CONTRACTOR FURNISHED, CONTRACTOR INSTALLED
CKT	CIRCUIT
CT	CURRENT TRANSFORMER
DEMO	DEMOLITION
DIM	DIMENSION
DISC	DISCONNECT
DP	DISTRIBUTION PANEL
DS	DOWNSTAGE
DWG	DRAWING
EBU	EMERGENCY BATTERY UNIT
EC	ELECTRICAL CONTRACTOR
ELEC	ELECTRICAL
EM/ EMERG	EMERGENCY
EMT	ELECTRICAL METALLIC TUBING
EO	ELECTRICALLY OPERATED
EPO	EMERGENCY POWER OFF
EWC	ELECTRIC WATER COOLER
EXIST	EXISTING
FA	FIRE ALARM
FLA	FULL LOAD AMPS
FLR	FLOOR
FOH	FRONT OF HOUSE
FU	FUSE
G/GRD/EG	GROUND
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
HOA	HAND–OFF–AUTO
HP	HORSEPOWER
HV	HIGH VOLTAGE
HZ	HERTZ
IG	ISOLATED GROUND
JB	JUNCTION BOX
KV	KILOVOLT
KVA	KILOVOLT – AMPERES
KW	KILOWATT
KWH	KILOWATT – HOURS
LA	LIGHTNING ARRESTOR
LP	LIGHTING PANEL
LDP	LIGHTING DISTRIBUTION PANEL
MAX	MAXIMUM
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MDP	MAIN DISTRIBUTION PANEL
MECH	MECHANICAL
MIN	MINIMUM
MISC.	MISCELLANEOUS
MLO	MAIN LUGS ONLY
MTD	MOUNTED
MTG	MOUNTING
MTR	MOTOR
N	NEUTRAL
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
NF	NON–FUSIBLE
NIC	NOT IN CONTRACT
NL	NIGHT LIGHT
NO	NORMALLY OPEN
NTS	NOT TO SCALE
OC	ON CENTER
OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
OFOI	OWNER FURNISHED, OWNER INSTALLED
P	POLE
PB	PUSHBUTTON STATION
PH	PHASE
PT	POTENTIAL TRANSFORMER
PDP	POWER DISTRIBUTION PANEL
RECEPT.	RECEPTACLE
RDP	RECEPTACLE DISTRIBUTION PANEL
RP	RECEPTACLE PANEL
RSC	RIGID STEEL CONDUIT
SCHED	SCHEDULE
SW	SWITCH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
TB	TERMINAL BOX
TELECOM	TELECOMMUNICATIONS
TP	TAMPER PROOF
TTB	TELEPHONE TERMINAL BACKBOARD
TYP	TYPICAL
U.O.N.	UNLESS OTHERWISE NOTED
US	UPSTAGE
V	VOLTS
W	WIRE
WP	WEATHERPROOF
XFMR	TRANSFORMER
XP	EXPLOSION PROOF
(E)	EXISTING
(R)	RELOCATED

STANDARD MOUNTING HEIGHTS



STANDARD METHODS OF NOTATION



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WAYNE STATE UNIVERSITY
ENGINEERING DEVELOPMENT
CENTER UPGRADES
DETROIT, MI

SHEET TITLE
ELECTRICAL STANDARDS AND DRAWING INDEX

DATE
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E0.1

FEEDER AND BRANCH CIRCUIT SIZING SCHEDULE - GENERAL PURPOSE

	OVERCURRENT DEVICE RATING (AMPERES)	COPPER CONDUCTORS					
		WIRE SIZE (AWG OR KCMIL)		CONDUIT SIZE			
		PHASE & NEUTRAL	GROUND	SINGLE PHASE 2 WIRE+G (1PH, 1N, 1G)	SINGLE PHASE 3 WIRE+G (2PH, 1N, 1G)	THREE PHASE 3 WIRE+G (3PH, 1G)	THREE PHASE & NEUTRAL 4 WIRE+G (3PH, 1N, 1G)
	15–20	12	12	3/4"	3/4"	3/4"	3/4"
	25–30	10	10	3/4"	3/4"	3/4"	3/4"
	35–40	8	10	3/4"	3/4"	3/4"	3/4"
*	45–50	8 (6)	10	3/4"	3/4"	3/4"	3/4"
*	60	6 (4)	10	3/4" (1")	3/4" (1")	3/4" (1")	3/4" (1")
	70	4	8	1"	1 1/4"	1 1/4"	1 1/4"
*	80	4 (3)	8	1"	1 1/4"	1 1/4"	1 1/4"
*	90–100	3 (2)	8	1 1/4"	1 1/4"	1 1/4"	1 1/4"
*	110	2 (1)	6	–	1 1/4"	1 1/4"	1 1/4" (1 1/2")
*	125	1 (1/0)	6	–	1 1/4" (1 1/2")	1 1/4" (1 1/2")	1 1/2"
	150	1/0	6	–	1 1/2"	1 1/2"	1 1/2"
	175	2/0	6	–	2"	2"	2"
	200	3/0	6	–	2"	2"	2 1/2"
	225	4/0	4	–	2"	2"	2 1/2"
	250	250	4	–	2 1/2"	2 1/2"	2 1/2"
	300	350	4	–	2 1/2"	2 1/2"	3"
	350	500	3	–	3"	3"	3"
	400	500	3	–	3"	3"	3"
	450	2–4/0	2–2	–	2–2"	2–2"	2–2 1/2"
	500	2–250	2–2	–	2–2 1/2"	2–2 1/2"	2–2 1/2"
	600	2–350	2–1	–	2–2 1/2"	2–2 1/2"	2–3"
	700	2–500	2–1/0	–	2–3"	2–3"	2–3"
	800	2–500	2–1/0	–	2–3"	2–3"	2–3 1/2"
	1000	3–400	3–2/0	–	3–3"	3–3"	3–3"
	1200	3–600	3–3/0	–	3–3 1/2"	3–3 1/2"	3–3 1/2"
	1600	4–600	4–4/0	–	4–3 1/2"	4–3 1/2"	4–3 1/2"
	2000	5–600	5–250	–	5–3 1/2"	5–3 1/2"	5–3 1/2"

* = SEE NOTE 4

NOTES:

1. CONTRACTOR TO SIZE FEEDERS AND BRANCH CIRCUITS BASED ON THIS SCHEDULE AND OVER CURRENT DEVICE SIZE, UNLESS NOTED OTHERWISE.
2. CONTRACTOR MAY COMBINE 20A CIRCUITS AS NOTED IN SPECIFICATION.
3. CONDUCTORS ARE BASED ON THHN/THWN UP TO AND INCLUDING #4/0. LARGER THAN #4/0 ARE BASED ON TYPE XHHW.
4. CONDUCTORS ARE BASED ON 90°C, 600V. INSULATED COPPER WIRE APPLIED AT 75°C FOR TERMINATION RATED 60/75°C OR 75°C. FOR TERMINATION RATED AT 60°C, USE CONDUCTORS AND CONDUIT SIZES INDICATED IN PARENTHESES.
5. CONDUIT SIZES ARE VALID FOR EMT OR RGS. CONDUIT SIZES SHALL BE ADJUSTED AS REQUIRED FOR OTHER TYPES OF CONDUIT.
6. ELECTRICAL CONTRACTOR TO COORDINATE WITH MECHANICAL CONTRACTOR AND PROVIDE REQUIRED WIRE SIZES TO ACCOMMODATE MECHANICAL EQUIPMENT LUG SIZES.
7. SIZE OF DISCONNECT SWITCH LOCATED AT EQUIPMENT SHALL BE SIZED BASED UPON OVERCURRENT PROTECTION OF THAT DEVICE.
8. OBTAIN APPROVAL FROM ENGINEER PRIOR TO INSTALLING DIFFERENT SIZE/QUANTITY OF CONDUCTORS TO OBTAIN AN EQUIVALENT AMPACITY.
9. SPLICE FROM ALUMINUM TO COPPER PRIOR TO ENTERING EQUIPMENT LISTED FOR USE WITH COPPER CONDUCTORS ONLY OR USE COPPER CONDUCTORS FOR THE ENTIRE LENGTH OF FEEDER.

BRANCH CIRCUIT VOLTAGE DROP WIRING SCHEDULE FOR SINGLE PHASE CIRCUITS

BRANCH CKT RATING (A)	WIRE SIZE (AWG)	MAXIMUM BRANCH CIRCUIT LENGTH (IN FEET)				
		120V	208V	240V	277V	480V
20A	12	83	143	165	191	331
	10	128	222	256	295	511
	8	201	348	402	464	804
	6	313	542	625	721	1250
30A	10	85	148	170	197	341
	8	134	232	268	309	536
	6	208	361	417	481	833
	4	313	542	625	721	1250

NOTES:

1. THE ABOVE TABLE VALUES ARE BASED ON COPPER CONDUCTORS, IN STEEL CONDUIT, WITH A LOAD POWER FACTOR OF 0.85 PER NEC CHAPTER 9, TABLE 9.
2. PROVIDE BRANCH CIRCUIT CONDUCTORS AS INDICATED IN THE TABLE ABOVE FOR ALL LIGHTING AND RECEPTACLE BRANCH CIRCUITS. WHERE BRANCH CIRCUITS SERVE DEDICATED EQUIPMENT, THE CONTRACTOR MAY PERFORM VOLTAGE DROP CALCULATIONS BASED ON ACTUAL EQUIPMENT CONNECTED LOAD AND PROVIDE CONDUCTORS APPROPRIATELY SIZED TO LIMIT VOLTAGE DROP TO A MAXIMUM OF 3%.
3. CONDUCTOR SIZES ARE BASED ON MAXIMUM OF 9 CURRENT CARRYING CONDUCTORS IN A SINGLE CONDUIT.
4. LIMITS FOR CONDUCTOR LENGTHS SHOWN ARE BASED ON A MAXIMUM BRANCH CIRCUIT LOADING OF 64% OF THE BRANCH BREAKER RATING AND A MAXIMUM OF 3 PERCENT VOLTAGE DROP TO COMPLY WITH ASHRAE/IES 90.1 – 1999 AND THE NEC. FOR CIRCUITS LOADED GREATER THAN 64% OF BRANCH BREAKER RATING, THE CONTRACTOR SHALL PROVIDE CONDUCTORS APPROPRIATELY SIZED TO LIMIT VOLTAGE DROP TO 3%.

NOTE: SOME SYMBOLS AND ABBREVIATIONS SHOWN MAY NOT APPLY TO THIS PROJECT.

MOTOR CIRCUIT SIZING SCHEDULE (480V, 3 PHASE)

MOTOR HP	SWITCH/ FUSE	CIRCUIT BREAKER	STARTER SIZE/TYPE	MOTOR DISCONNECT (NOTE 3)
1/2	30/3A	15A	1	30A
3/4	30/3A	15A	1	30A
1	30/6A	15A	1	30A
1 1/2	30/6A	15A	1	30A
2	30/6A	15A	1	30A
3	30/10A	15A	1	30A
5	30/15A	15A	1	30A
7 1/2	30/20A	20A	1	30A
10	30/20A	25A	1	30A
15	30/30A	40A	2	30A
20	60/40A	60A	2	60A
25	60/50A	70A	2	60A
30	60/60A.	80A	3	60A
40	100/80A.	90A	3	100A
50	100/100A.	100A	3	100A
60	200/125A.	125A	4	200A
75	200/150A.	150A	4	200A
100	200/200A.	200A	4	200A
125	200/200A.	225A	5	200A
150	400/250A.	250A	5	400A
200	400/350A.	350A	5	400A

NOTES:

1. BASED ON MOTOR FULL LOAD AMPERES AS PROVIDED BY THE N.E.C.
2. BASED ON MOTOR RUNNING OVERLOAD PROTECTIONS PROVIDED BY THERMAL OVERLOAD RELAYS.
3. WHERE THE STARTER IS LOCATED REMOTE FROM THE MOTOR, PROVIDE DISCONNECT LOCATED AT THE MOTOR, SIZE AS INDICATED.

RACEWAY APPLICATION SCHEDULE

RACEWAY		ELECTRICAL METALLIC TUBING (EMT)	SURFACE RACEWAY	FLEXIBLE METAL CONDUIT (FMC)	INTERMEDIATE METAL CONDUIT (IMC)	LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)	RIGID STEEL CONDUIT	KEYED NOTES
INDOOR	EXPOSED NOT SUBJECT TO PHYSICAL DAMAGE – UNFINISHED SPACES	X						
	EXPOSED NOT SUBJECT TO PHYSICAL DAMAGE – FINISHED SPACES		X					
	EXPOSED SUBJECT TO SEVERE PHYSICAL DAMAGE				X		X	[RIGID STEEL CONDUIT UP TO 10'–0"AFF.] LOCATIONS INCLUDE: LOADING LOCKS, CORRIDORS USED FOR TRAFFIC OF MECHANIZED CARTS AND PALLET HANDLING UNITS, MECHANICAL ROOMS
	CONNECTED TO VIBRATING EQUIPMENT			X		X		EQUIPMENT INCLUDING: TRANSFORMERS, HYDRAULIC PNEUMATIC, ELECTRIC SOLENOID, MOTOR DRIVEN EQUIPMENT USE LFMC IN DAMP/WET LOCATIONS
	DAMP AND WET LOCATIONS				X		X	

GENERAL NOTES

1. 'X' INDICATES ACCEPTABLE SELECTION.
2. REFER TO "CONDUCTORS AND CABLES" SPECIFICATION FOR APPLICATION LIMITATIONS OF AC/MC CABLE.

REVISION

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PROJECT TITLE
WAYNE STATE UNIVERSITY
ENGINEERING DEVELOPMENT
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DETROIT, MI

SHEET TITLE
ELECTRICAL STANDARD
SCHEDULES

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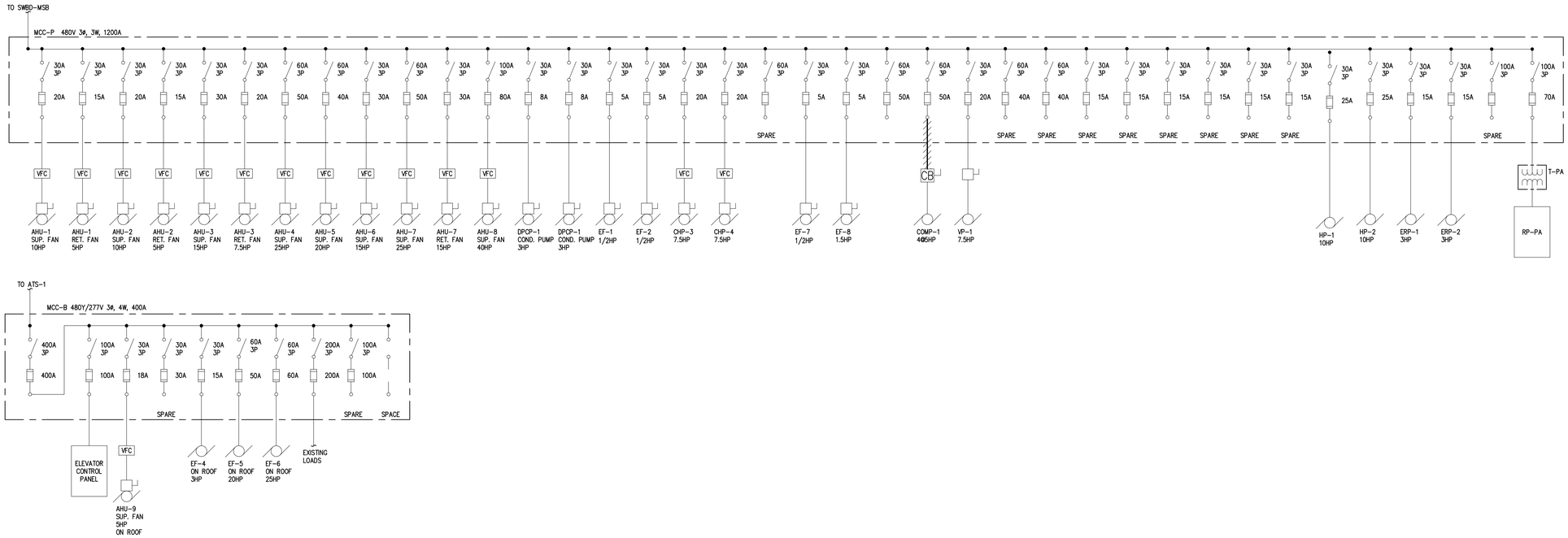
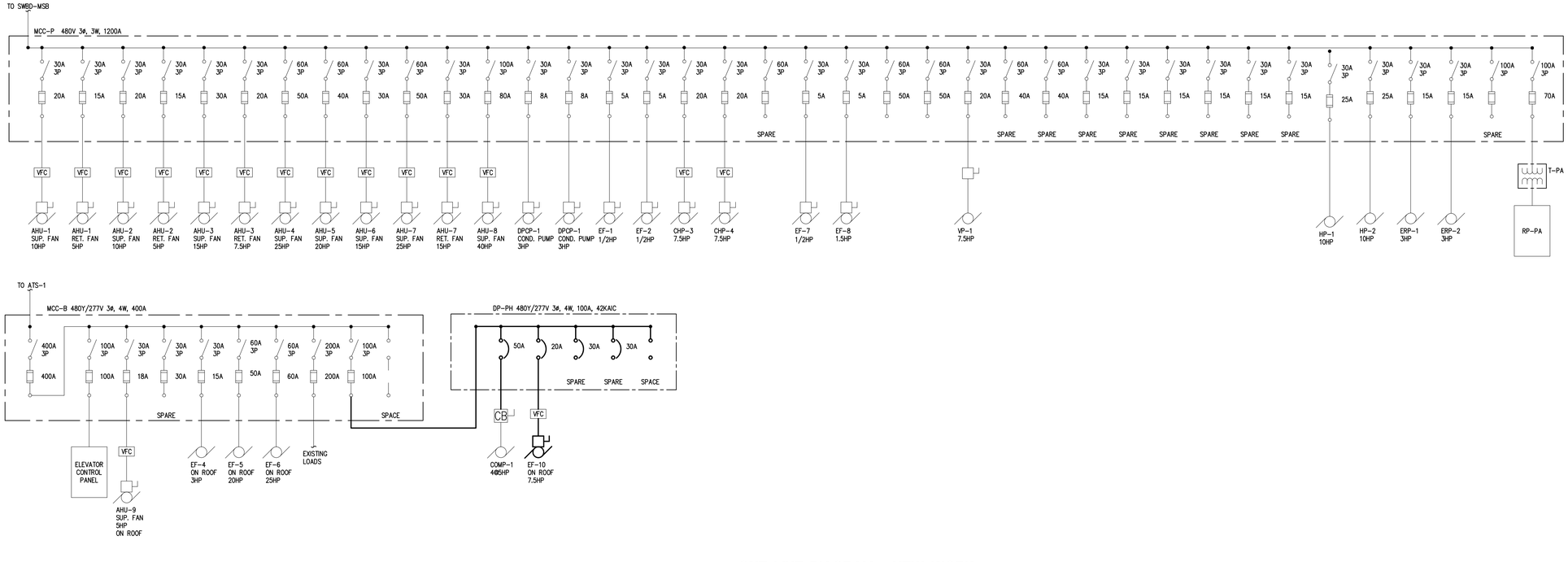


ONE LINE DIAGRAM - DEMOLITION

NO SCALE



ONE LINE DIAGRAM - NEW WORK

NO SCALE

GENERAL NOTES:

1. THESE DRAWINGS REPRESENT THE GENERAL EXTENT AND ARRANGEMENT OF SYSTEMS, BUT ARE NOT TO BE CONSIDERED FABRICATION DRAWINGS. COORDINATE WITH OTHER TRADES, AND PROVIDE EACH SYSTEM COMPLETE, INCLUDING ALL NECESSARY COMPONENTS, FITTINGS, AND OFFSETS.
2. FEEDER AND BRANCH CIRCUIT CONDUCTORS SHALL BE SIZED IN ACCORDANCE WITH THE "FEEDER AND BRANCH CIRCUIT SIZING SCHEDULE-GENERAL PURPOSE" ON THE "ELECTRICAL STANDARD SCHEDULES DRAWING" UNLESS SPECIFICALLY NOTED OTHERWISE.
3. TRANSFORMER SECONDARY CONDUCTORS SHALL BE SIZED IN ACCORDANCE WITH THE "TRANSFORMER CIRCUIT SIZING SCHEDULE-GENERAL PURPOSE" ON THE "ELECTRICAL STANDARD SCHEDULES DRAWING" UNLESS SPECIFICALLY NOTED OTHERWISE.
4. MOTOR CIRCUIT PROTECTION SHALL BE SIZED IN ACCORDANCE WITH THE MOTOR CIRCUIT SIZING SCHEDULES ON THE "ELECTRICAL STANDARD SCHEDULES DRAWING" UNLESS SPECIFICALLY NOTED OTHERWISE.
5. BASIS OF DESIGN IS DISTRIBUTION EQUIPMENT AND ASCO TRANSFER SWITCHES. IF THE CONTRACTOR ELECTS TO PROVIDE EQUIPMENT FROM OTHER APPROVED MANUFACTURERS, THE CONTRACTOR SHALL BE RESPONSIBLE TO COORDINATE THE LAYOUT AND CLEARANCE REQUIREMENTS IN ALL SPACES CONTAINING ELECTRICAL EQUIPMENT AND PROVIDE EQUIPMENT MEETING THE SPECIFICATIONS AND ACHIEVING CODE REQUIRED CLEARANCES WITHIN THE SPACE PROVIDED.
6. SELECTIVE COORDINATION (PER NEC ARTICLE 700.27) IS BASED ON [illegible] DISTRIBUTION EQUIPMENT AND ASCO TRANSFER SWITCHES. ELECTRICAL CONTRACTOR SHALL SUBMIT SELECTIVE COORDINATION STUDY WITH TIME CURRENT CHARACTERISTIC CURVES (AND TABLES FOR TESTED PAIR INSTANTANEOUS COORDINATION) FOR THE EMERGENCY SYSTEMS. ELECTRICAL CONTRACTORS SHALL RECEIVE APPROVED SHOP DRAWINGS BACK FROM ENGINEER OF RECORD PRIOR TO PURCHASING OR INSTALLING ANY ELECTRICAL DISTRIBUTION EQUIPMENT. BREAKERS MUST BE COORDINATED WITH AUTOMATIC TRANSFER SWITCHES 3-CYCLE WITHSTAND RATING. ALTERNATE MANUFACTURERS SHALL MEET SELECTIVE COORDINATION CRITERIA AT NO ADDITIONAL COST TO THE PROJECT.
7. BRANCH CIRCUIT CONDUCTORS, FEEDERS, AND BRANCH CIRCUIT OVERCURRENT PROTECTION ARE SIZED AT 125% OF THE TOTAL CONTINUOUS AND NON CONTINUOUS LOAD FOR LIGHTING AND MOTOR LOADS THAT RUN CONTINUOUSLY FOR THREE HOURS OR MORE (NEC 210.19 A, 210.20 A, AND 215.2 A). DEMAND AND CONNECTED LOADS ARE CALCULATED PER NEC 220.

(#) CONSTRUCTION KEY NOTES:

1. xxx
2. xxx

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SHEET TITLE
ONE LINE DIAGRAM

DATE
09/30/2014

ISSUE
BIDS

SHEET No.
E5.1

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PROPOSAL DATA FOR
WSU EDC UPGRADES

Detroit, MI

44OP-999999

ARCHITECT

Peter Basso Associates
ENGINEER

CONTRACTOR

DWG	DESCRIPTION
	GENERAL
SPEC1	ELECTRICAL INSTALL SPEC.
SPEC2	ELECTRICAL INSTALL SPEC. 2
SPEC3	ELECTRICAL INSTALL SPEC. 3
TTRM1	TX-I/O TERMINATION SPEC.
TTRM2	TX-I/O TERMINATION SPEC. 2
TWIR	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

REVISION HISTORY

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

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ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
KAB	KAB		09/25/14	09/25/14

TABLE OF CONTENTS

44OP-999999
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TOCA

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900 – ELECTRICAL INSTALLATION AND WIRING FOR HVAC TEMPERATURE AND LAB CONTROLS

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 control 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 responsibilities 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 control drawings Bill of Materials to include but not limited to:

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

The Electrical Installation & Wiring Contractor (EIWC) 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 control drawings for specific equipment quantities and locations.

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

D. EIWC shall install all control equipment provided by Siemens. The EIWC shall furnish, install, and terminate all necessary wiring, conduit, hangers, 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 EIWC.

E. The EIWC 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 EIWC, Siemens Building Technologies will conduct verification of point to point wiring and any pneumatic tubing. The EIWC 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 EIWC's responsibility reverts to a standard warranty (12 months) for labor and material installed by the EIWC and labor only for equipment supplied by others.

J. Siemens assumes the manufacturers warranty for all equipment supplied to the EIWC 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 EIWC installation and final checkout and approval.

L. Equipment provided by others may require specific cable type and terminations. It is up to EWIC 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 control network technology platform for designing and implementing interoperable control devices and networks.

D. MS/TP: Master slave/token passing.

E. PC: Personal computer.

F. PID: Proportional plus integral plus derivative.

G. RTD: Resistance temperature detector.

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

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ELECTRICAL INSTALL SPEC.

44OP-999999
0
SPEC1

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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, final valves & tubing into pipe pressure taps and variable frequency drives.

B. Electrical Contractor: Provide 120/60 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 EIWC 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 23 – 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:

1. NFPA – National Fire Protection Association.
2. UL – Underwriter's Laboratories.
3. Rules and Regulations of the Michigan Department of Fire Prevention and Safety.

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 EIWC

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

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1.8 QUALITY ASSURANCE

A. Installer Qualifications: EIWC 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. EIWC contactor 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 complimentary to installation of similar components in other systems.

B. Coordinate work with other Contractors and subcontractors 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 pre project general conditions.

1.11 CONTROL WIRING

A. The EIWC is required to use the cable below.
Refer to temperature control drawing ABAC Building Automation Cable Specification Catalog.
If a wire type is required that is not referenced on the ABAC sheet then it is up to the EWIC to provide the appropriate wire for the application.

B. The EIWC 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 demo'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 control wiring required and equipment locations.

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

ELECTRICAL INSTALLATION AND WIRING FOR HVAC TEMPERATURE AND LAB CONTROLS

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

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WSU EDC UPGRADES
Detroit, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
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ELECTRICAL INSTALL SPEC. 2

44OP-999999
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SPEC2

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1.1 ELECTRICAL WIRING INSTALLATION BY THE EIWC (Project Plans and Specifications Prevail)

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.

4. Ceiling Returns (accessible, permanent, acoustical): Approved plenum rated cable.

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 EIWC – Electrical (controls) installation & wiring contractor
2. The equipment manufacturers 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 0900

ELECTRICAL INSTALLATION AND WIRING FOR HVAC TEMPERATURE AND LAB CONTROLS

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ELECTRICAL INSTALL SPEC. 3

44OP-999999
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SPEC3

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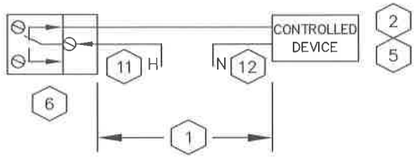
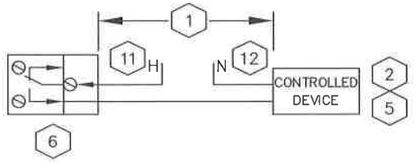
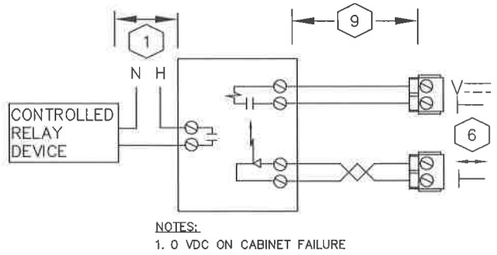


A 00 — DIGITAL OUTPUT (6R) NC
PULSED OR LATCHED

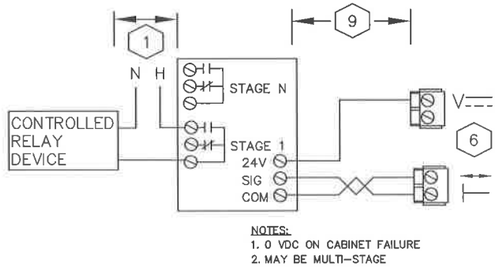


B 00 — DIGITAL OUTPUT (6R) NO
PULSED OR LATCHED



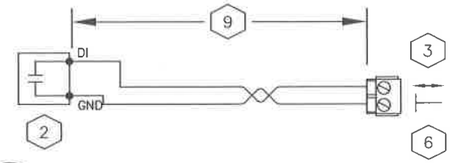
NOTES:
1. 0 VDC ON CABINET FAILURE

C 00 — DIGITAL OUTPUT (8U,8X) Latched
VOLTAGE TO SOLID STATE RELAY

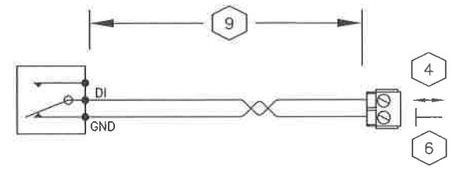


NOTES:
1. 0 VDC ON CABINET FAILURE
2. MAY BE MULTI-STAGE

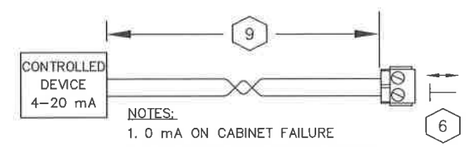
D 00 — DIGITAL OUTPUT (8U,8X) Sequenced
VOLTAGE TO SEQUENCING MODULE



E 00 — DIGITAL INPUT (8D,16D,8U,8x)
DRY CONTACT

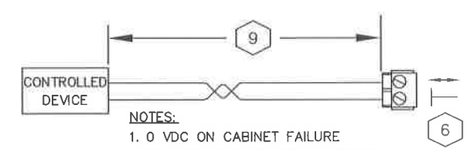


F 00 — DIGITAL INPUT (8D,16D,8U,8X)
PULSE ACCUMULATOR



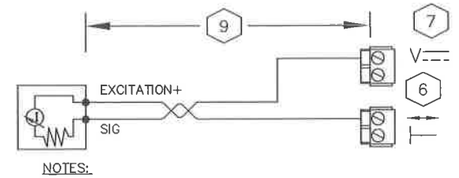
NOTES:
1. 0 mA ON CABINET FAILURE
2. THIS POINT TYPE CANNOT SHARE A MODULE WITH A SELF-POWERED TYPE INPUT POINT.

H 00 — ANALOG OUTPUT (8X) 4-20 mA



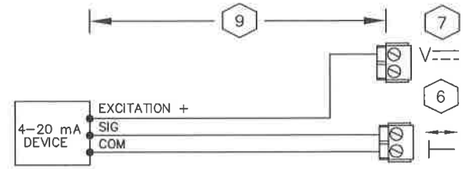
NOTES:
1. 0 VDC ON CABINET FAILURE
2. THIS POINT TYPE CANNOT SHARE A MODULE WITH A SELF-POWERED TYPE INPUT POINT.

I 00 — ANALOG OUTPUT (8U,8X) 0-10VDC

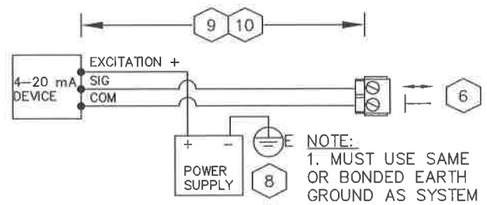


NOTES:
1. COMMON NOT CONNECTED

M 00 — ANALOG INPUT (8X) 4-20 mA
2-WIRE INTERNAL POWERED



N 00 — ANALOG INPUT (8X) 4-20mA
3-WIRE INTERNAL POWERED



NOTE:
1. MUST USE SAME OR BONDED EARTH GROUND AS SYSTEM NEUTRAL

O 00 — ANALOG INPUT (8X) 4-20mA
3-WIRE EXTERNAL POWERED

NOTES:

1. MAXIMUM WIRE RUN LENGTHS ARE BASED ON THE CURRENT DRAW AND WIRE GAGE. SEE DRAWING TWIR.
2. SEE CONTROL DRAWINGS FOR NORMAL DE-ENERGIZED CONTACT STATE
3. MAXIMUM CONTACT CLOSURE RATE IS
   10 PER SECOND
   8D, 16d EXCITATION = 24VDC, 8mA
   8U, 8X EXCITATION = 24VDC, 8mA, 20ms, 100mA
4. 8D, 16D MAXIMUM PULSE RATE = 10Hz (50ms PER STATE, 100ms PER PULSE)
   8U, 8X MAXIMUM PULSE RATE = 20Hz (25ms PER STATE, 50ms PER PULSE)
5. PXC MODULAR DO CONTACT RATINGS
   AC OPERATION:
   4A @ 240VAC (RESISTIVE)
   3A @ 240VAC (INDUCTIVE)
   SIZE 4 MOTOR STARTER
   DC OPERATION:
   40W @ < 50VDC
   20W @ > 50VDC
6. REFER TO PXC MODULAR PANEL FOR ACTUAL POINT ADDRESSES. REFER TO TXMI TERMINATION TABLES FOR ACTUAL TERMINALS FOR EACH PANEL ADDRESS. COMMON TERMINAL MAY BE SHARED BY 2 POINTS.
7. REFER TO DRAWING P1 ON TWIR FOR MAXIMUM CURRENT PROVIDED BY THE 24VDC SENSOR SUPPLY ON P1 BIM OR BUS POWER SUPPLY
8. EXTERNAL POWER SUPPLY CAN EITHER BE A 24VDC POWER SUPPLY OR A 24VAC TRANSFORMER DEPENDING ON THE SENSOR SELECTED. IF NOT AN ISOLATED NC CLASS 2 CIRCUIT THEN POWER SOURCE, NEUTRAL AND PXC MODULAR COMMON MUST BE BOTH CONNECTED TO THE SAME OR BONDED BUILDING APPROVED EARTH GROUND. FOR FURTHER DETAILS SEE EARTH GROUNDING RULES (125-3002) APOGEE WIRING GUIDELINES FOR FIELD PANELS AND EQUIPMENT CONTROLLERS.
9. 50mA OR LESS - 750ft/230m
   50mA TO 100mA - 375ft/115m
10. 100mA TO 150mA - 250ft/76m
    150mA TO 200mA - 187ft/57m
    200mA TO 250mA - 150ft/46m
11. WHERE H TERMINAL IS NOT A NEC CLASS 2 CIRCUIT, RELAY COMMON TERMINAL BRANCH CURRENT MUST BE EXTERNALLY LIMITED TO 10A MAXIMUM BY AN NEC APPROVED MEANS. NOT A FUSE.
12. WHERE REQUIRED, N TERMINAL BRANCH CURRENT MUST BE EXTERNALLY LIMITED BY AN NEC APPROVED MEANS.

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TX-I/O TERMINATION SPEC.

440P-999999
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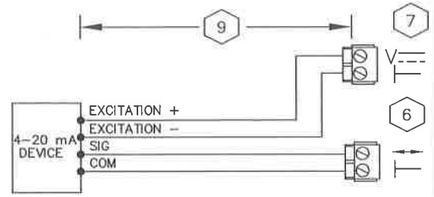
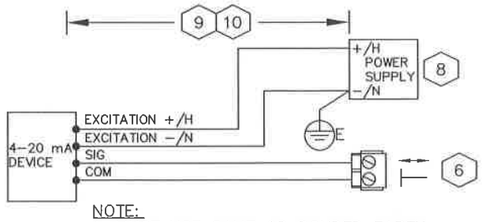
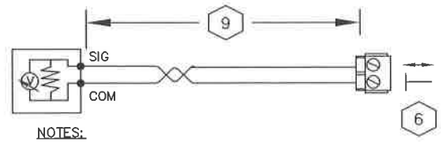


P 00 — ANALOG INPUT (8X) 4–20mA
4–WIRE INTERNAL POWERED



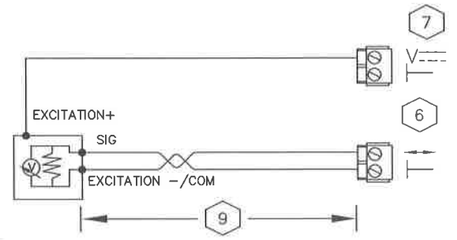
NOTE:
1. MUST USE SAME OR BONDED EARTH GROUND AS SYSTEM NEUTRAL

Q 00 — ANALOG INPUT (8X) 4–20mA
4–WIRE EXTERNAL POWERED

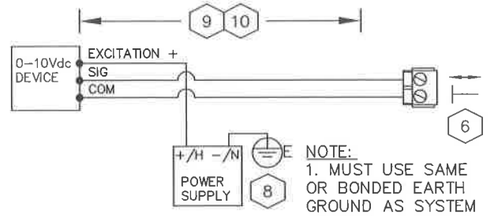


NOTES:
1. TRANSDUCER POWERED FROM ISOLATED INPUT
2. TRANSDUCER OUTPUT VOLTAGE

R 00 — ANALOG INPUT (8U,8X) 0–10 Vdc
SELF POWERED TRANSDUCER

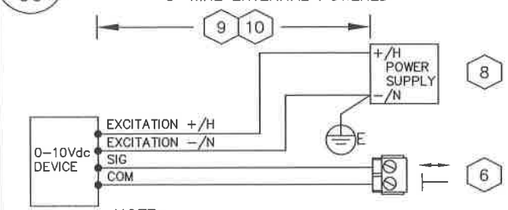


S 00 — ANALOG INPUT (8U,8X) 0–10VDC
3–WIRE INTERNAL POWERED



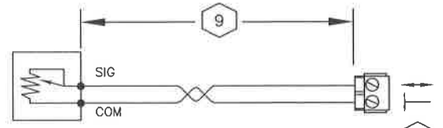
NOTE:
1. MUST USE SAME OR BONDED EARTH GROUND AS SYSTEM NEUTRAL

T 00 — ANALOG INPUT (8U,8X) 0–10VDC
3–WIRE EXTERNAL POWERED



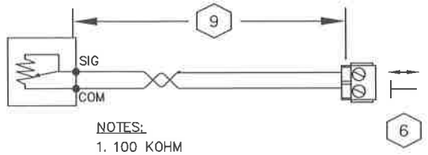
NOTE:
1. MUST USE SAME OR BONDED EARTH GROUND AS SYSTEM NEUTRAL

U 00 — ANALOG INPUT (8U,8X) 0–10VDC
4–WIRE EXTERNAL POWERED



NOTES:
1. 1000 OHM PLATINUM (375)
2. 1000 OHM PLATINUM (385)
3. 1000 OHM NICKEL
4. CUSTOM

V 00 — ANALOG INPUT (8X,8U) RTD



NOTES:
1. 100 KOHM
2. 10 KOHM
3. CUSTOM

W 00 — ANALOG INPUT (8X,8U) THERMISTOR

TXM1 TERMINATION TABLES

1. ALL TXM1 TERMINALS (MEASURING, NEUTRAL, RELAY, SUPPLY) ARE CONNECTED IN THE PLUG–IN I/O MODULE, NOT IN THE TERMINAL BUS.

	TXM1.8D, TXM1.16D							
I/O POINT	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SYSTEM NEUTRAL[1] ⊥ (–)	1	3	5	7	9	11	13	15
DIGITAL INPUT ⏐ (+)	2	4	6	8	10	12	14	16

1. NEUTRAL CAN BE CONNECTED TO ANY NEUTRAL TERMINAL ON SAME MODULE AND SEVERAL CAN SHARE SAME NEUTRAL TERMINAL.

	TXM1.16D							
I/O POINT	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
SYSTEM NEUTRAL ⊥ (–)	18	20	22	24	26	28	30	32
DIGITAL INPUT[1] ⏐ (+)	19	21	23	25	27	29	31	33

1. NO PULSE ACCUMULATOR

	TXM1.8U, TXM1.8U–ML							
I/O POINT	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SYSTEM NEUTRAL ⊥ (–)	2	6	10	14	19	23	27	31
UNIVERSAL I/O ⏐ (+)	4	8	12	16	21	25	29	33
24V AC/DC ACTUATOR SUPPLY[1] ~		7		15		24		32

1. 24V DC ONLY AVAILABLE WITH BUS CONNECTOR MODULE (BCM) POWERED EXTERNALLY BY DC SUPPLY.

	TXM1.8X, TXM1.8X–ML							
I/O POINT	(1)	(2)	(3)	(4)	(5)[1]	(6)[1]	(7)[1]	(8)[1]
SYSTEM NEUTRAL ⊥ (–)	2	6	10	14	19	23	27	31
UNIVERSAL I/O ⏐ (+)	4	8	12	16	21	25	29	33
24V AC/DC ACTUATOR SUPPLY[2] ~		7		15		24		32
24V DC SENSOR SUPPLY[3] ⎓	3		11		20		28	

1. 4–20 mA OUTPUT AVAILABLE ON POINTS 5–8 ONLY.

2. 24V DC ONLY AVAILABLE WITH BUS CONNECTOR MODULE (BCM) POWERED EXTERNALLY BY DC SUPPLY.

3. MAY POWER EXTERNAL SENSORS 0.6w (25mA) OR 1.2w (50mA) PER TERMINATION UP TO 2.4w (100mA) MAXIMUM FOR ALL TERMINATIONS.

	TXM1.6R, TXM1.6R–M					
I/O POINT	(1)	(2)	(3)	(4)	(5)	(6)
COMMON[1] ⏐ (C)	3	9	15	20	26	32
NORMALLY CLOSED ⌐ (NC)	4	10	16	19	25	31
NORMALLY OPEN ⏐ (NO)	2	8	14	21	27	33

1. COMMONS ARE NOT INTERNALLY CONNECTED.

NOTE: REFER TO TERMINATION SHEET #1 FOR INSTALLATION DETAILS.

REVISION HISTORY

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TX-I/O TERMINATION SPEC. 2

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TTRM2

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PXC MODULAR WIRING TYPE AND GAUGE REQUIREMENTS

TABLE 1

CIRCUIT TYPE	CLASS	WIRE TYPE	MAX. DISTANCE	CONDUIT SHARING [2]
AC LINE POWER [1]	POWER	#12–14 THHN	REFER TO NEC	CHECK LOCAL CODES
DIGITAL OUTPUT	1 & 2	TP not required, check job specs & local codes #18 to #24 AWG	SEE TABLE 3	CHECK LOCAL CODES
DIGITAL INPUT	2	TP not required, check job specs & local codes #18 to #24 AWG	750ft (230 m)	CHECK LOCAL CODES
ANALOG INPUT [4] 100K/10K Thermistor	2	#18–#24 TP [3,6] or TSP [5] CM(FT4) or CMP(FT6)	750ft (230 m)	CHECK LOCAL CODES
ANALOG INPUT [4] 1K Ni OR RTD	2	#18–#24 TP [3,6] or TSP [5] CM(FT4) or CMP(FT6)	750ft (230 m)	CHECK LOCAL CODES
ANALOG INPUT 0–10 V	2	#18–#24 TP [3,6] or TSP [5] CM(FT4) or CMP(FT6)	750ft (230 m)	CHECK LOCAL CODES
ANALOG INPUT 4–20 mA	2	#18–#24 TP [3,6] or TSP [5] CM(FT4) or CMP(FT6)	750ft (230 m)	CHECK LOCAL CODES
ANALOG OUTPUT 0–10 V	2	#18–#24 TP [3,6] or TSP [5] CM(FT4) or CMP(FT6)	750ft (230 m)	CHECK LOCAL CODES
ANALOG OUTPUT 4–20 mA	2	#18–#24 TP [3,6] or TSP [5] CM(FT4) or CMP(FT6)	750ft (230 m)	CHECK LOCAL CODES
ETHERNET ALN	2	#24 (4) TP [6] CAT5 OR BETTER	295ft (90 m)	CHECK LOCAL CODES
ALN TRUNK	2	#24 TSP	SEE TABLE 4	CHECK LOCAL CODES

1. WHEN DAISY–CHAINING 24VAC POWER TO CONTROLLERS USE #14 WIRE.

2. CONDUIT SHARTING RULES: ONLY WHERE LOCAL CODES PERMIT. BOTH CLASS1 AND CLASS 2 WIRING CAN BE RUN TO THE PXCC PROVIDED THE CLASS 2 WIRE IS UL LISTED 300V 75°C(167°F) OR HIGHER OR THE CLASS 2 WIRE IS NEC TYPE CM (FT4) (75°C OR HIGHER) OR CMP(FT6) (75°C OR HIGHER). NEC TYPE CL2 AND CL2P IS NOT ACCEPTABLE UNLESS ALSO UL LISTED AND MARKED 300V 75°C (167°F) OR HIGHER

3. TWISTED PAIR, NON–JACKETED UL LISTED 75°C(167°F) AND 300V, CABLE CAN BE USED IN PLACE OF CM(FT4) OR CMP(FT6)(BOTH MUST BE RATED 75°C OR HIGHER) CABLE WHEN CONTAINED IN CONDUIT PER LOCAL CODES. SEE THE FIELD PURCHASING GUIDE FOR WIRE.

4. WIRE LENGTH AFFECTS POINT INTERCEPT ENTRY. ADJUST INTERCEPT ACCORDINGLY FOR EACH WIRE GAUGE AND SENSOR TYPE.

5. SHIELDED TWISETED PAIR (TSP) IS NOT REQUIRED FOR ELECTRICAL NOISE LEVELS UPTO 10 V/M. AT HIGHER LEVELS TSP MAY BE NEEDED.TERMINATE SHIELD ON ENCLOSURE AND TAPE BACK ON POINT END.

6. FOR 24AWG INSTALL CATEGORY5 OR BETTER CABLE PER ANSI/TIA/EIA–568–B.1 OR HIGHER. USE SOLID COPPER BETWEEN JACK BOXES. USE STRANDED COPPER PATCH CABLES 13ft (4m) TO CONNECT PXCC AND 20ft (6m) TO CONNECT SWITCH OR HUB.

MAXIMUM DO WIRE RUN LENGHTS

TABLE 3

NOMINAL INRUSH	STARTER SIZE	WIRE SIZE		
		#18	#16	#14
200 VA	0 1	500ft (152m)	900ft (274m)	1400ft (427m)
550 VA	2	200ft (61m)	300ft (91m)	500ft (152m)
1150 VA	3	100ft (30m)	150ft (46m)	250ft (76m)
1500 VA	4	70ft (21m)	100ft (30m)	200ft (61m)

TABLE 3 NOTES:

1. DISTANCES SHOWN ASSURE LESS THAN 10% VOLTAGE DROP ACROSS THE WIRE FOR A TYPICAL STARTER.
2. PXCM DO CONTACT RATINGS
   4A @ 250VAC & 30VDC
   SIZE 4 MOTOR STARTER

MAXIMUM NUMBER HSTIE IN SERIES ON ALN TRUNK

TABLE 4

SPEED	1200 BAUD	4800 BAUD	9600 – 38.4K BAUD	57.6K – 115.2K BAUD
SERIES TIE'S	10	7	6	6
ALN TRUNK DISTANCE	4000ft (1.2km)	4000ft (1.2km)	4000ft (1.2km)	3280ft (1km)

- TIE MUST BE USED TO ISOLATE ALN BETWEEN PXCM CONNECTED TO DIFFERENT SERVICE GROUNDS OR ON BOTH SIDES OF THE ALN CABLE THAT EXITS BUILDING.
- THE MAX ALN DISTANCE APPLIES TO EACH SIDE OF THE TIE.

GENERAL NOTES:

- COMPLY WITH LOCAL BUILDING CODES
- SIZE WIRE FOR LOAD, CURRENT, AND VOLTAGE.
- ALL WIRE TO BE APPROVED OR LISTED FOR THE INTENDED APPLICATION BY AGENCIES SUCH AS UL, NEC, CSA.
- ALWAYS REFER TO LOCAL CODES FOR CONDUIT SHARING.
- WIRING MUST HAVE INSULATION RATED FOR HIGHEST VOLTAGE CIRCUIT IN CONDUIT.
- THE ALN TRUNK MUST BE AN UNINTERRUPTED RUN BETWEEN CABINETS. NO SPLICES ALLOWED.
- CM/CMP/MM/MMP WIRE IS NOT USABLE FOR CLASS 1 CIRCUITS.
- FOR EXTENDED TEMPERATURE INSTALLATIONS USE ONLY COPPER WIRE LISTED FOR 90°C OR HIGHER

PXCM WIRE SPECIFICATIONS

TABLE 2

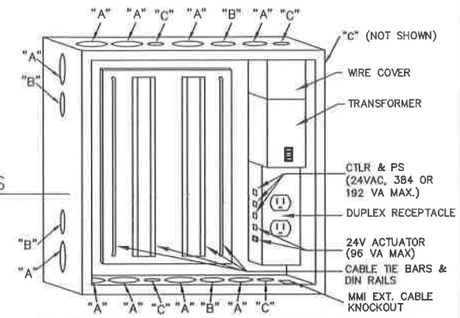
	LOW–VOLTAGE POINT APPLICATIONS	POINT USAGE	ALN TRUNK	EALN
CABLE CONFIGURATION	TWISTED PAIR OR TSP	TWISTED PAIR (UNJACKETED) OR TSP	TWISTED SHIELDED PAIR	(4) TWISTED PAIR
GAUGE	#18 TO #22 AWG (STRANDED)	#18 TO #22 AWG (STRANDED)	24 AWG (STRANDED)	24AWG(STRANDED)
CAPACITANCE	n.a.	n.a.	12.5 pf/ft OR LESS	13 pf/ft OR LESS
TWISTS PER FOOT	6 MINIMUM	6 MINIMUM	6 MINIMUM	CATEGORY 5 Min
SHIELDS	NOT REQUIRED (IN CASE OF TSP, 100% FOIL W/ DRAIN WIRE)	NOT REQUIRED (IN CASE OF TSP, 100% FOIL W/ DRAIN WIRE)	100% FOIL W/ DRAIN WIRE	NOT REQUIRED
NEC CLASS	CM, CMP (75°C OR HIGHER)	NOT SPECIFIED	CM, CMP (75°C OR HIGHER)	MM, MMP
CEC CLASS	FT4, FT6 (75°C OR HIGHER)	NOT SPECIFIED	FT4, FT6 (75°C OR HIGHER)	NOT SPECIFIED
UL VOLTAGE RATING	NOT SPECIFIED	300 VAC [2]	NOT SPECIFIED	NOT SPECIFIED
UL TEMP. RATING	NOT SPECIFIED	75°C (167°F)	NOT SPECIFIED	NOT SPECIFIED

1. UL RECOGNIZED WIRE (LABELED WITH A BACKWARDS 'RU') IS NOT FIELD INSTALLABLE. USE ONLY UL–LISTED WIRE.
2. 300 VAC WIRE CAN BE USED IN FIELD PANELS CONTAINING VOLTAGES BELOW 150 VAC.

ENCLOSURE H x W x D (IN)
PXA–ENC–19 19 x 22 x 5 3\4
PXA–ENC–34 34 x 22 x 5 3\4
PXA–ENC–18 18 x 22 x 6

KNOCKOUT TYPES
A= 1" & 1–1/4"
B= 3/4" & 1"
C= 1/2" & 3/4"

T1 00 PXCM CONDUIT PENETRATIONS



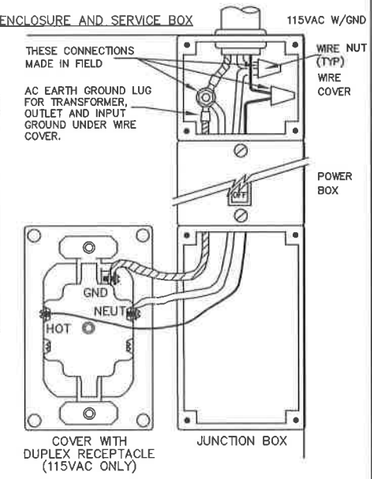
PXA–ENC19 ENCLOSURE & PXA–SB115V384VA SERVICE BOX

SERVICE BOX MAX POWER SOURCE REQUIREMENTS	
VOLTAGE:	102–132 VAC 204–264 VAC
LINE FREQUENCY:	50 / 60 Hz
115V OUTLETS:	200 VA (MAX.)
PXA–SB115V384VA [2]	440 VA (MAX.)
PXA–SB115V192VA [2]	220 VA (MAX.)
PXA–SB230V384VA	440 VA (MAX.)
PXA–SB230V192VA	220 VA (MAX.)

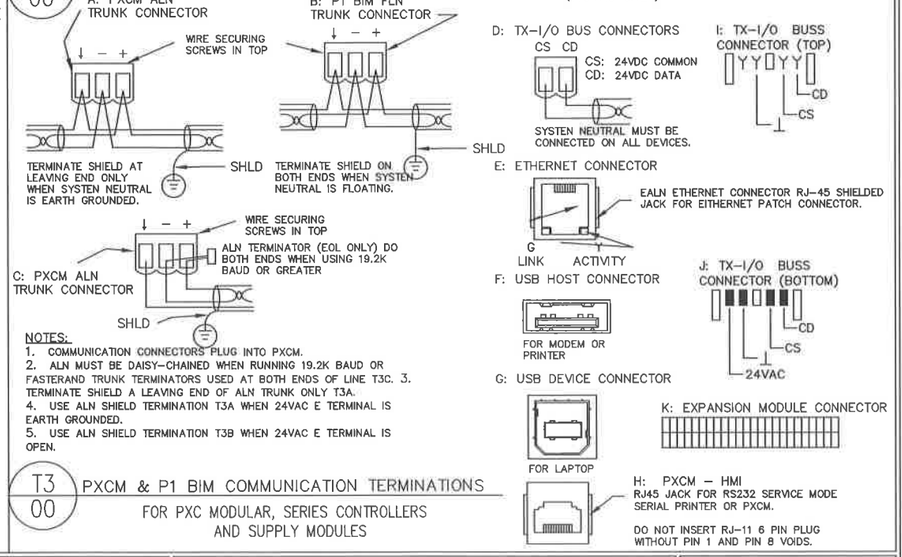
PXCM FAMILY VA RATINGS & SENSOR SUPPLY			
PRODUCT	24VDC (W)	24VAC INPUT VA	24VAC OUTPUT VA
PXC00–X	0	24	0
PXC100–X	0	24	0
TXB1.P1	14.4	125	96
TXS1.12F4	28.8	150	96
TXS1.EF4	0	96	96
TX–I/O MODULE	24VDC LOAD (W) MAX.		
TXM1.8D	1.1		
TXM1.16D	1.4		
TXM1.8U	1.5		
TXM1.8U–ML	1.8		
TXM1.8X	2.2		
TXM1.8X–ML	2.3		
TXM1.6R	1.7		
TXM1.6R–M	1.9		

NOTES:
1. NO MORE THAN THREE (3) 384VA OR FIVE (5) 192VA FULLY LOADED PXA CABINETS ALLOWED ON A SINGLE 3–WIRE 115V, 15A CIRCUIT.
2. RECEPTACLE IS PREWIRED AND MOUNTED IN FACTORY, FOR 115VAC SERVICE BOX ONLY.
3. DC INPUT/OUTPUT ONLY AVALABLE ON BUSS CONNECTION MODULES.

PXA ENCLOSURE AND SERVICE BOX



T2 00 PXCM POWER WIRING



NOTES:
1. COMMUNICATION CONNECTORS PLUG INTO PXCM.
2. ALN MUST BE DAISY–CHAINED WHEN RUNNING 19.2K BAUD OR FASTERAND TRUNK TERMINATORS USED AT BOTH ENDS OF LINE T3C. 3. TERMINATE SHIELD A LEAVING END OF ALN TRUNK ONLY T3A.
4. USE ALN SHIELD TERMINATION T3A WHEN 24VAC E TERMINAL IS EARTH GROUNDED.
5. USE ALN SHIELD TERMINATION T3B WHEN 24VAC E TERMINAL IS OPEN.

T3 00 PXCM & P1 BIM COMMUNICATION TERMINATIONS
FOR PXC MODULAR, SERIES CONTROLLERS AND SUPPLY MODULES

REVISION HISTORY

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

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TX–I/O WIRING SPECIFICATION

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TWIR

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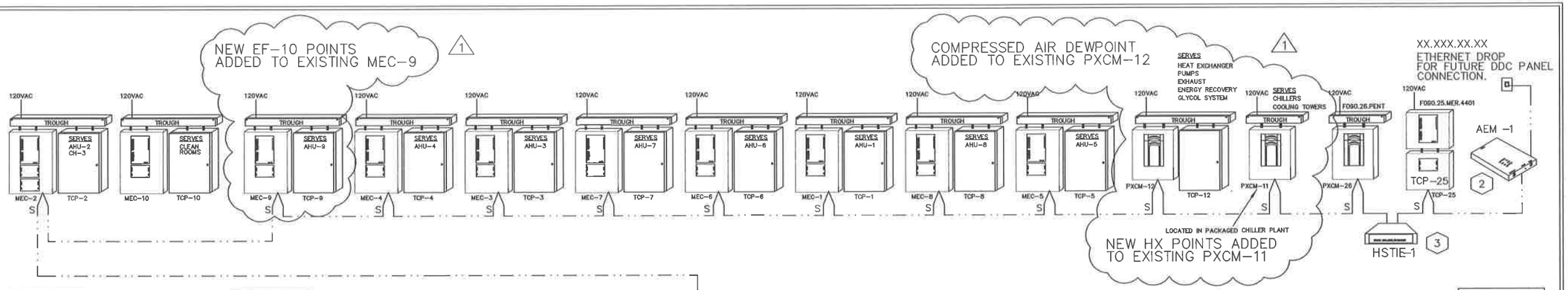

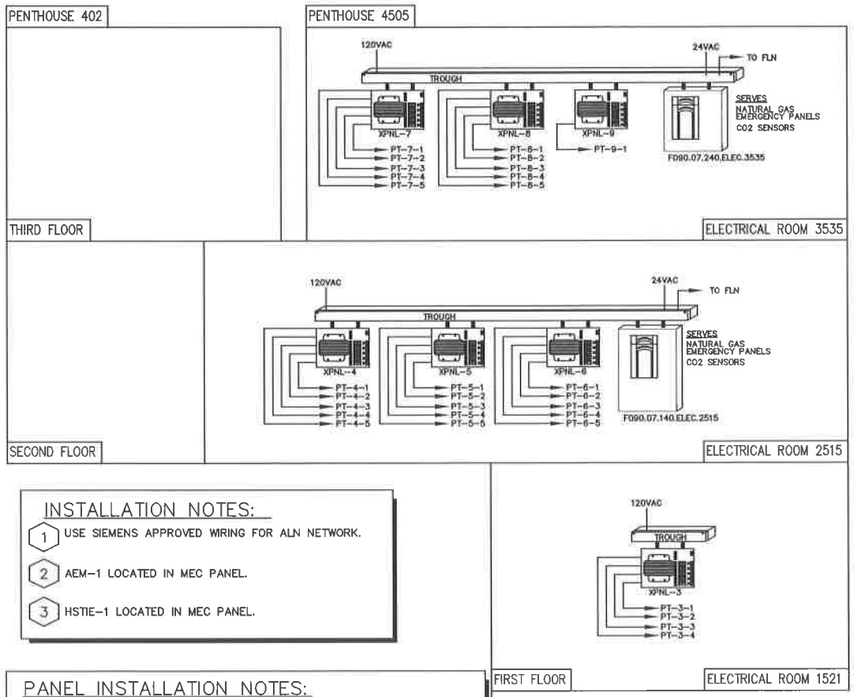

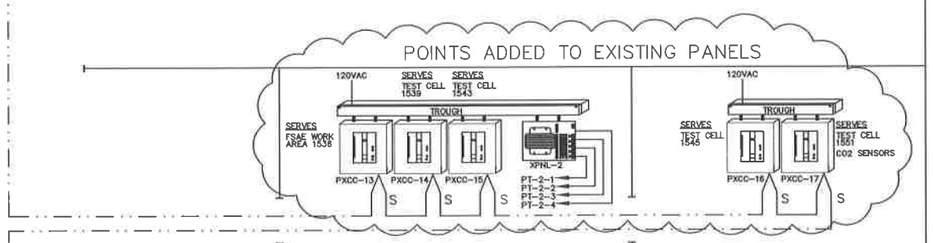

Reference Only

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INSTALLATION NOTES:

1. USE SIEMENS APPROVED WIRING FOR ALN NETWORK.
2. AEM-1 LOCATED IN MEC PANEL.
3. HSTIE-1 LOCATED IN MEC PANEL.

PANEL INSTALLATION NOTES:

- *DDC PANELS PROVIDED BY SIEMENS.
- *TROUGH PROVIDED BY INSTALLING ELECTRICAL CONTRACTOR.
- *120VAC CIRCUITS PROVIDED BY DIV. 16 ELECTRICAL
- *SEE JOB DOCUMENTS FOR CIRCUIT LOCATIONS AND NUMBERS.
- *120VAC SHALL BE WIRED INTO THE PANELS WITHOUT RUNNING IN THE WIRING TROUGH.
- *HIGH VOLTAGE & LOW VOLTAGE CABLE SHALL NOT MIX IN WIRING TROUGH.
- *DDC PANELS TO BE MOUNTED AND TERMINATED BY INSTALLING ELECTRICAL CONTRACTOR.
- *INSTALLING ELECTRICAL CONTRACTOR TO PROVIDE MINIMUM OF (2) 1" NIPPLES BETWEEN EACH PANEL AND TROUGH.
- *REFER TO AFTRM DRAWING FOR WIRING TAGGING REQUIREMENTS.
- *USE ONLY SIEMENS APPROVED WIRING.

ENGINEERING DESIGN CENTER

REVISION HISTORY

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DDC COMMUNICATIONS RISER

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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 WET 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 WET BULB TEMPERATURE IS ABOVE 42°F. (INSURE 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.

5. THE DDC SHALL MODULATE THE COOLING TOWER FAN TO MAINTAIN 48°F CONDENSER WATER SUPPLY TEMPERATURE TO THE HEAT EXCHANGER. WHEN THE FAN REACHES MINIMUM SPEED, THE TOWER FAN SHUTS DOWN AND THE WATER CONTINUES FLOW OVER THE TOWER. THE HEAT EXCHANGER IN TURN OUTPUTS 50°F CHILLED WATER SUPPLY TEMPERATURE TO THE SYSTEM. IF THE CONDENSER WATER TEMPERATURE DROPS BELOW 45°F THE DDC OPENS THE EXISTING COOLING TOWER BYPASS VALVE AND BY PASSES WATER FROM THE TOWER. THE BYPASS REMAINS OPEN UNTIL THE WATER TEMPERATURE INCREASES TO 50°F (ADJUSTABLE DEAD BAND).

6. DURING FREE COOLING MODE WHEN OUTDOOR AIR TEMPERATURE IS BELOW 32°F TOWER SHALL OPERATE WITH FAN REVERSED IN A DEFROST 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.

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CHILLED WATER SYSTEM CONTROL

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CS-6 F090.11.CTR.1SS (PROOF) 0.11.0.5.9 DETAIL TC
RIB-8 F090.11.CTR.1SS (ON/OFF) 0.11.0.4.1 DETAIL TB
F090.11.CTR.1VS 0.11.0.7.7 DETAIL TL
F090.11.CTR.1AL 0.11.0.5.15 DETAIL TC
F090.11.CTR.1VBS 0.11.0.6.2 DETAIL TC
F090.11.CTR.1RVS 0.11.0.3.2 DETAIL TB
V-5 4/20 mA F090.11.CTR.BPV 0.11.0.10.4 DETAIL TK
NO
V-6 4/20 mA F090.11.CTR.1RIV 0.11.0.10.5 DETAIL TK
NC
STR-1
STR-2
V-7 4/20 mA F090.11.CTR.2RIV 0.11.0.10.6 DETAIL TK
NC
CT-1 CELL #1
CT-1 CELL #2
VFD-6
VFD-7
LS-1 F090.11.CTR.1HAL 0.11.0.6.5 DETAIL TC
F090.11.CTR.1LAL 0.11.0.6.6 DETAIL TC
LS-2 F090.11.CTR.2HAL 0.11.0.6.8 DETAIL TC
F090.11.CTR.2LAL 0.11.0.6.9 DETAIL TC
NOTE: EWIC ELECTRICIAN TO REPLACE DEFECTIVE POSITIONER
V-8 4/20 mA F090.11.CTR.1SIV 0.11.0.10.7 DETAIL TK
NC
TTE-7 -40/240deg F F090.11.CTR.1SUMP 0.11.0.9.1 DETAIL TH
TTE-8 -40/240deg F F090.11.CTR.2SUMP 0.11.0.9.2 DETAIL TH
V-9 4/20 mA F090.11.CTR.2SIV 0.11.0.10.8 DETAIL TK
NC
V-2 OPEN/CLOSE F090.11.HX1.TIV (ON/OFF) 0.11.0.2.2 DETAIL B
F090.11.HX1.TIV (PROOF) 0.11.0.5.12 DETAIL E
1
NC
TTE-9 -40/240deg F F090.11.HX1.CTS 0.11.0.8.3 DETAIL V
HEAT EXCHANGER
TTE-8 -40/240deg F F090.11.HX1.CHR 0.11.0.8.3 DETAIL V
V-2 OPEN/CLOSE F090.11.HX1.CIV (ON/OFF) 0.11.0.2.2 DETAIL B
F090.11.HX1.CIV (PROOF) 0.11.0.5.12 DETAIL E
1
TTE-10 -40/240deg F F090.11.HX1.CTR 0.11.0.8.3 DETAIL V
TTE-7 -40/240deg F F090.11.HX1.CHS 0.11.0.8.3 DETAIL V
NC
CWP-1 (1200 GPM)
VFD-3
F090.11.CWP.1VS 0.11.0.7.5 DETAIL TL
CS-3 F090.11.CWP.1SS (PROOF) 0.11.0.5.5 DETAIL TC
RIB-3 F090.11.CWP.1SS (ON/OFF) 0.11.0.1.5 DETAIL TB
TTE-6 -40/240deg F F090.11.CTR.CWS 0.11.0.8.6 DETAIL TH
CWP-2 (1200 GPM)
VFD-4
F090.11.CWP.2VS 0.11.0.7.6 DETAIL TL
CS-4 F090.11.CWP.2SS (PROOF) 0.11.0.5.6 DETAIL TC
RIB-4 F090.11.CWP.2SS (ON/OFF) 0.11.0.1.6 DETAIL TB
TTE-5 -40/240deg F F090.11.CTR.CWR 0.11.0.8.5 DETAIL TH
PCP-1 (600 GPM)
VFD-5
F090.11.PCP.1VS 0.11.0.10.2 DETAIL TL
CS-5 F090.11.PCP.1SS (PROOF) 0.11.0.6.7 DETAIL TC
RIB-5 F090.11.PCP.1SS (ON/OFF) 0.11.0.2.5 DETAIL TB
PROCESS WATER DIFFERENTIAL PRESSURE LOCATION TO BE DETERMINED
DPTE-3 0-60 PSI F090.11.CTR.CDP1 0.11.0.9.8 DETAIL TF
L H
PROCESS COOLING LOOP
PCR
PCS
V-2 0/24 VOLTS F090.11.CHL.1WV (ON/OFF) 0.11.0.2.2 DETAIL TB
F090.11.CHL.1WV (PROOF) 0.11.0.5.12 DETAIL TC
1
CHILLER CH-1
V-1 0/24 VOLTS F090.11.CHL.1CV (ON/OFF) 0.11.0.2.1 DETAIL TB
F090.11.CHL.1CV (PROOF) 0.11.0.5.11 DETAIL TC
NC
NC
RIB-6 F090.11.CHL.1SS (ON/OFF) 0.11.0.1.1 DETAIL TB
F090.11.CHL.1CLSP 0.11.0.10.1 DETAIL TL
TTE-3 -40/240deg F F090.11.CHL.1CS 0.11.0.8.1 DETAIL TH
1
F090.11.CHL.1SS (PROOF) 0.11.0.5.1 DETAIL TC
F090.11.CHL.1AL 0.11.0.5.7 DETAIL TC
F090.11.CHL.1SP 0.11.0.7.1 DETAIL TL
NOTE: PROVIDE (4) PAIRS OF WIRES FROM DDC CONTROL PANEL TO CHILLER CONTROL PANEL FOR FUTURE USE.
V-4 0/24 VOLTS F090.11.CHL.2WV (ON/OFF) 0.11.0.2.4 DETAIL TB
F090.11.CHL.2WV (PROOF) 0.11.0.5.14 DETAIL TC
1
CHILLER CH-2
V-3 0/24 VOLTS F090.11.CHL.2CV (ON/OFF) 0.11.0.2.3 DETAIL TB
F090.11.CHL.2CV (PROOF) 0.11.0.5.13 DETAIL TC
NC
NC
RIB-7 F090.11.CHL.2SS (ON/OFF) 0.11.0.1.2 DETAIL TB
F090.11.CHL.2CLSP 0.11.0.7.8 DETAIL TL
TTE-4 -40/240deg F F090.11.CHL.2CS 0.11.0.8.2 DETAIL TH
1
F090.11.CHL.2SS (PROOF) 0.11.0.5.2 DETAIL TC
F090.11.CHL.2AL 0.11.0.5.8 DETAIL TC
F090.11.CHL.2SP 0.11.0.7.2 DETAIL TL
NOTE: PROVIDE (4) PAIRS OF WIRES FROM DDC CONTROL PANEL TO CHILLER CONTROL PANEL FOR FUTURE USE.
VERTICAL EXPANSION TANK ET-2
PRE-ASSEMBLED PENTHOUSE ENCLOSURE
CS-7 F090.11.CTR.2SS (PROOF) 0.11.0.5.10 DETAIL TC
RIB-9 F090.11.CTR.2SS (ON/OFF) 0.11.0.2.6 DETAIL TB
F090.11.CTR.2VS 0.11.0.10.3 DETAIL TL
F090.11.CTR.2AL 0.11.0.5.16 DETAIL TC
F090.11.CTR.2VBS 0.11.0.6.3 DETAIL TC
F090.11.CTR.2RVS 0.11.0.3.4 DETAIL TB
CT-1 CELL #1 BASIN SUMP HEATER
CT-1 CELL #2 BASIN SUMP HEATER
RIB-11 F090.11.CTR.1HTR 0.11.0.3.1 DETAIL TB
RIB-12 F090.11.CTR.2HTR 0.11.0.3.3 DETAIL TB
NORTH WALL
HTTE-1A RANGE DEG F F090.11.OAT 0 DETAIL TF
0/100 % RH F090.11.OAH 0.11.0.9.6 DETAIL TF
PENTHOUSE #4505
PXCM-11
XDR-2 0/15 PSI F090.11.CHL.BPV 0.2.0.0.10 DETAIL I
XFMR-1 100 VA
XFMR-2 100 VA
XFMR-3 100 VA
CHILLED WATER DIFFERENTIAL PRESSURE SENSOR TO BE LOCATED IN PENTHOUSE #4505
CHILLED WATER DIFFERENTIAL PRESSURE SENSOR TO BE LOCATED IN PENTHOUSE #402
DPTE-1 0-60 PSI F090.11.SCP.CDP1 0.11.0.9.3 DETAIL TF
DPTE-2 0-60 PSI F090.11.SCP.CDP2 0.11.0.9.4 DETAIL TF
L H
TTE-1 -40/240deg F F090.11.CHL.CHR 0.11.0.8.3 DETAIL TH
CHWR
CHP-1 (960 GPM)
VFD-1
F090.11.CHP.1VS 0.11.0.7.3 DETAIL TL
CS-1 F090.11.CHP.1SS (PROOF) 0.11.0.5.3 DETAIL TC
RIB-1 F090.11.CHP.1SS (ON/OFF) 0.11.0.1.3 DETAIL TB
FM-1 0/2000 GPM F090.11.CHL.FLW 0.11.0.9.7 DETAIL TS
TRANSMITTER
24VAC
V-1 3-8 PSI
NO
CHWS
FLOWMETER
TTE-2 -40/240deg F F090.11.CHL.CHS 0.11.0.8.4 DETAIL TH
UNCLOUDED DEVICES ARE EXISTING & TO REMAIN.
CHP-2 (960 GPM)
VFD-2
F090.11.CHP.2VS 0.11.0.7.4 DETAIL TL
CS-2 F090.11.CHP.2SS (PROOF) 0.11.0.5.4 DETAIL TC
RIB-2 F090.11.CHP.2SS (ON/OFF) 0.11.0.1.4 DETAIL TB
CS-8 F090.11.BC1.SAF (PROOF) 0.11.0.6.11 DETAIL TC
RIB-10 F090.11.BC1.SAF (ON/OFF) 0.11.0.4.2 DETAIL TB
TTE-9 20/120 deg F F090.11.BC1.RMT 0.11.0.8.8 DETAIL TF
SPACE SENSOR
NOTE: LOCATED ON TEMPERATURE CONTROL CABINET.
RA
SF-1 2400 CFM 1.5 HP
SA
V-12 0/10 VOLTS F090.11.BC1.CCV 0.11.0.11.1 DETAIL TL
V-13 0/10 VOLTS F090.11.BC1.HCV 0.11.0.11.2 DETAIL TL
CHWS
CHWR
NC
NO
HWS
HWR
BLOWER COIL BC-1

REVISION HISTORY

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

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Detroit, MI

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CHILLED WATER SYSTEM CONTROL

440P-999999
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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 EF RUN STATUS THRU CURRENT SWITCH. ABNORMAL STATUS CONDITION SHALL ACTIVATE ALARM,

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CHILLER PENTHOUSE EXHAUST

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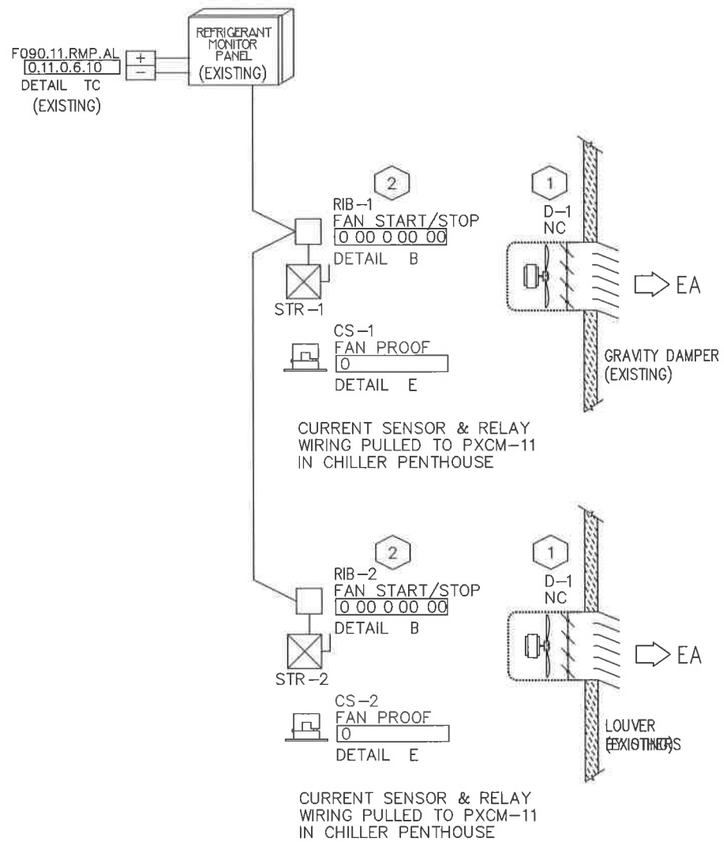
INSTALLATION NOTES:

1. EXHAUST FAN, CONTACTORS, & DAMPERS ARE EXISTING. INTERLOCK WIRING FROM REFRIGERATION MONITOR ALARM CONTACTS & FAN CONTACTORS BY EWIC ELECTRICIAN.
2. IF REFRIGERATION ALARM PANEL HAS AVAILABLE SHUTDOWN CONTACTS, DIGITAL OUTPUTS FROM PXCM-11 & RELAYS MAY BE OMITTED.



Reference Only

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1/003 MECHANICAL ROOM EXHAUST FAN
LOCATION: CHILLER PENTHOUSE

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CHILLER PENTHOUSE EXHAUST

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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 THRU 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 ENGINE EXHAUST TERMINAL UNIT DAMPER OPENS, THE DDC STARTS THE ENGINE 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.

REVISION HISTORY

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

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EXHAUST FAN 10

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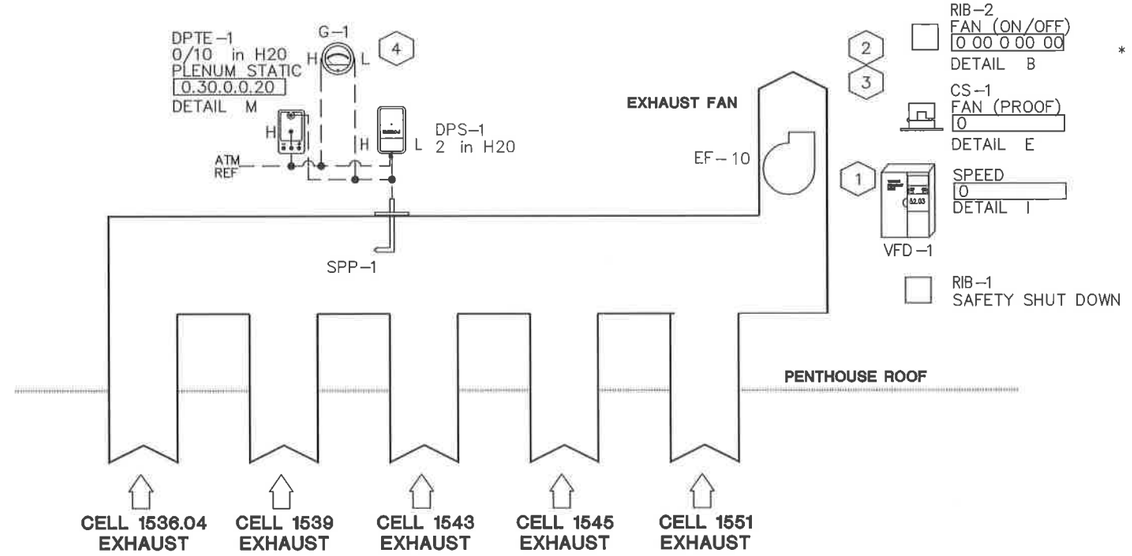
INSTALLATION NOTES:

1. VFD PROVIDED & INSTALLED BY OTHERS.
2. CURRENT SENSOR & RELAYS MOUNTED AT VFD.
3. DDC POINTS WIRED IN TO MEC–9 NEAR NEW EF–10 VFD.
4. PRESSURE TRANSMITTER & SWITCH TO BE MOUNTED IN TCP–9. GAUGE TO BE MOUNTED ON TCP–9 DOOR.

TEMPERATURE CONTROL PANEL 3

*FSA–2

LOW STATIC SHUTDOWN
3:0.0.3
DETAIL E



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1/004 EXHAUST FAN EF–10

LOCATION: PENTHOUSE ROOF
SERVES: TEST CELL ENGINE EXHAUST

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EXHAUST FAN 10

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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.

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REVISION HISTORY

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

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TEST CELL SEQUENCE OF OPERATIONS

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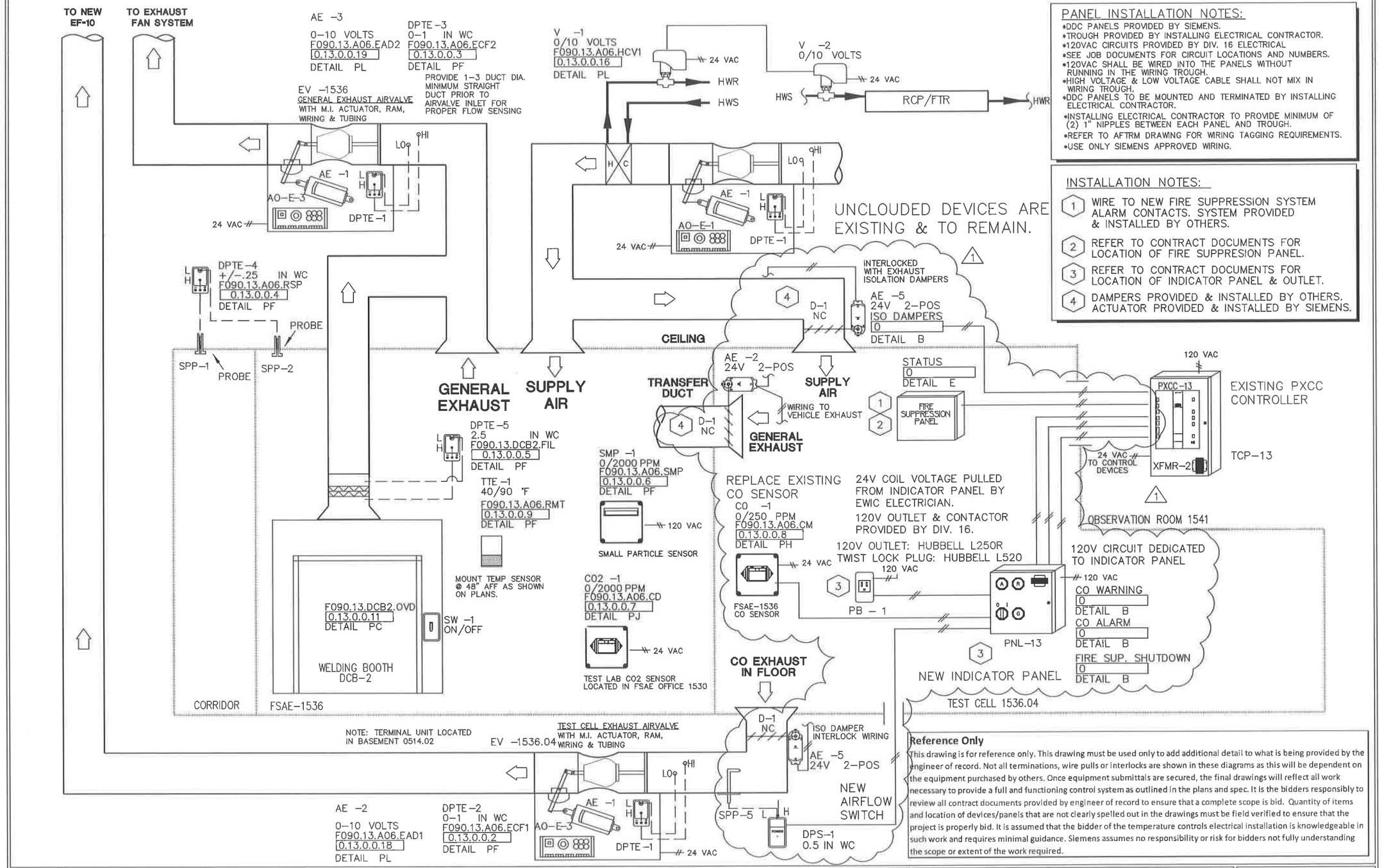

PANEL INSTALLATION NOTES:

- *DDC PANELS PROVIDED BY SIEMENS.
- *TROUGH PROVIDED BY INSTALLING ELECTRICAL CONTRACTOR.
- *120VAC CIRCUITS PROVIDED BY DIV. 16 ELECTRICAL
- *SEE JOB DOCUMENTS FOR CIRCUIT LOCATIONS AND NUMBERS.
- *120VAC SHALL BE WIRED INTO THE PANELS WITHOUT RUNNING IN THE WIRING TROUGH.
- *HIGH VOLTAGE & LOW VOLTAGE CABLE SHALL NOT MIX IN WIRING TROUGH.
- *DDC PANELS TO BE MOUNTED AND TERMINATED BY INSTALLING ELECTRICAL CONTRACTOR.
- *INSTALLING ELECTRICAL CONTRACTOR TO PROVIDE MINIMUM OF (2) 1" NIPPLES BETWEEN EACH PANEL AND TROUGH.
- *REFER TO AFTRM DRAWING FOR WIRING TAGGING REQUIREMENTS.
- *USE ONLY SIEMENS APPROVED WIRING.

INSTALLATION NOTES:

1. WIRE TO NEW FIRE SUPPRESSION SYSTEM ALARM CONTACTS. SYSTEM PROVIDED & INSTALLED BY OTHERS.
2. REFER TO CONTRACT DOCUMENTS FOR LOCATION OF FIRE SUPPRESION PANEL.
3. REFER TO CONTRACT DOCUMENTS FOR LOCATION OF INDICATOR PANEL & OUTLET.
4. DAMPERS PROVIDED & INSTALLED BY OTHERS. ACTUATOR PROVIDED & INSTALLED BY SIEMENS.

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2	9/30/2014	KAB	CHANGES/ADDITIONS PER UPGRADES PROJECT

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ROOM 1536

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INSTALLATION NOTES:

1. WIRE TO NEW FIRE SUPPRESSION SYSTEM ALARM CONTACTS. SYSTEM PROVIDED & INSTALLED BY OTHERS.
2. REFER TO CONTRACT DOCUMENTS FOR LOCATION OF FIRE SUPPRESION PANEL.
3. REFER TO CONTRACT DOCUMENTS FOR LOCATION OF INDICATOR PANEL & OUTLET.
4. DAMPERS PROVIDED & INSTALLED BY OTHERS. ACTUATOR PROVIDED & INSTALLED BY SIEMENS.

TO EXHAUST FAN SYSTEM

TO NEW EF-10

AE -5
24V 2-POS

D-2
NC

D-3
NC

AE -6
24V 2-POS

EV -1539
580/4000 CFM

EV -1539B
320/1000 CFM

DPTE-2
0-1 IN WC
F090.14.A08.ECF1
0.14.0.0.2
DETAIL PF

AE -2
0-10 VOLTS
F090.14.A08.EAD1
0.14.0.0.17
DETAIL PJ
24 VAC

DPTE-4
+/-.25 IN WC
F090.14.A08.RSP1
0.14.0.0.4
DETAIL PF

AE -3
0-10 VOLTS
F090.14.A08.EAD2
0.14.0.0.18
DETAIL PJ
24 VAC

DPTE-3
0-1 IN WC
F090.14.A08.ECF2
0.14.0.0.3
DETAIL PF

DPTE-1
0-1 IN WC
F090.14.A08.SCF1
0.14.0.0.1
DETAIL PF

AE -1
0-10 VOLTS
F090.14.A08.SAD1
0.14.0.0.16
DETAIL PJ
24 VAC

V -1
0/10 VOLTS
F090.14.A08.HCV1
0.14.0.0.15
DETAIL PJ
24 VAC
HWR
HWS

SUPPLY AIR FROM AHU

D-1
NC

INTERLOCKED WITH EXHAUST ISOLATION DAMPER

AE -4
24V 2-POS
ISO DAMPERS
0
DETAIL B

SV -1539
1400/5000 CFM

SPP-3

NEW AIRFLOW SWITCH

DPS-1
0.5 IN WC

CEILING

CEILING

SPP-1
PROBE

SPP-2
PROBE

GENERAL EXHAUST

CO EXHAUST

SUPPLY AIR

UNCLOUDED DEVICES ARE EXISTING & TO REMAIN.

CORRIDOR

CO WARNING
0
DETAIL B

CO ALARM
0
DETAIL B

AIRFLOW SWITCH INTERLOCK

120 VAC

FIRE SUP. SHUTDOWN
0
DETAIL B

120V CIRCUIT DEDICATED TO INDICATOR PANEL

120 VAC

PB - 1

24V COIL VOLTAGE PULLED FROM INDICATOR PANEL BY EWIC ELECTRICIAN.

120V OUTLET & CONTACTOR PROVIDED BY DIV. 16.

120V OUTLET: HUBBELL L250R
TWIST LOCK PLUG:
HUBBELL L520

PNL-13
NEW INDICATOR PANEL

REPLACE EXISTING SENSOR

CO -1
0/500 PPM
F090.14.A08.CM1
0.14.0.0.5
DETAIL PS
24 VAC

TEST LAB CO SENSOR

MOUNT CO SENSOR @ 3 TO 5 FEET AFF.

TTE-1
55/95 °F
F090.14.A08.RMT1
0.14.0.0.6
DETAIL PH
F090.14.A08.RMS1
0.14.0.0.7
DETAIL PH

PXCC-14

(EXISTING)
120 VAC

FIRE SUPPRESSION PANEL

STATUS
0
DETAIL E

24 VAC
TO CONTROL DEVICES

TCP-14

OBSERVATION ROOM 1541

TEST CELL 1539

1/006 TEST CELL CONTROL DIAGRAM

LOCATION: FIRST FLOOR TEST CELLS (4 TOTAL)
ROOM 1539 SHOWN - TYPICAL FOR 1543, 1545, & 1551

PANEL INSTALLATION NOTES:

- *DDC PANELS PROVIDED BY SIEMENS.
- *TROUGH PROVIDED BY INSTALLING ELECTRICAL CONTRACTOR.
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- *SEE JOB DOCUMENTS FOR CIRCUIT LOCATIONS AND NUMBERS.
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TEST CELL 1539

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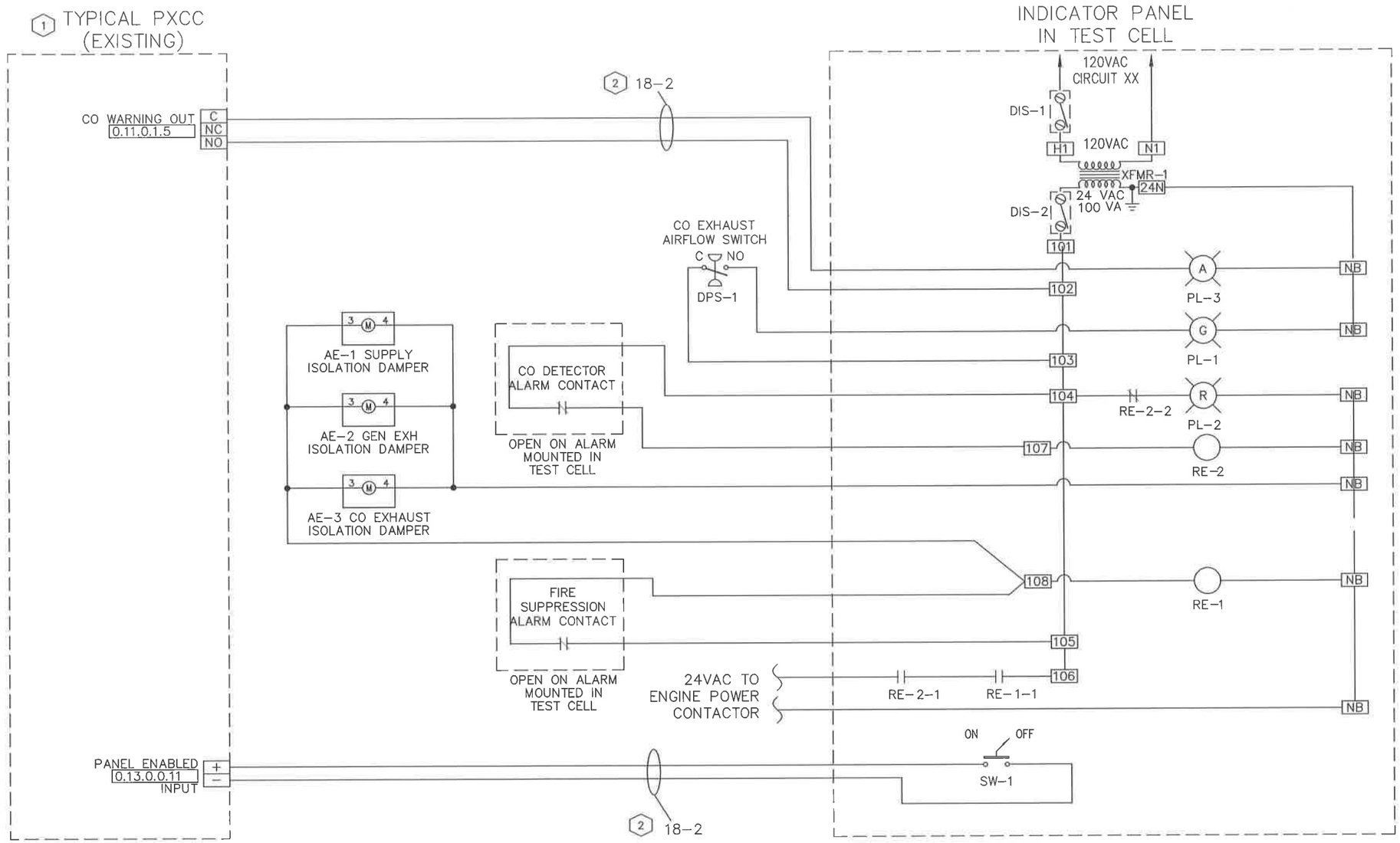

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INSTALLATION NOTES:

1. ONLY NEW POINTS ARE SHOWN – ADD TO EXISTING CONTROLLER. TYPICAL FOR 5 CONTROLLERS.
2. ALL WIRING TO MEET REQUIREMENTS OF STANDARD WIRING SPECIFICATIONS DRAWINGS.

REVISION HISTORY

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TEST CELL WIRING

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COMPRESSED AIR SYSTEM:

ADD DEWPOINT 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.

REVISION HISTORY

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

SIEMENS

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Building Technologies Division

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WSU EDC UPGRADES
Detroit, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
KAB	KAB		09/25/14	09/25/14

COMPRESSED AIR SYSTEM

44OP-999999
0

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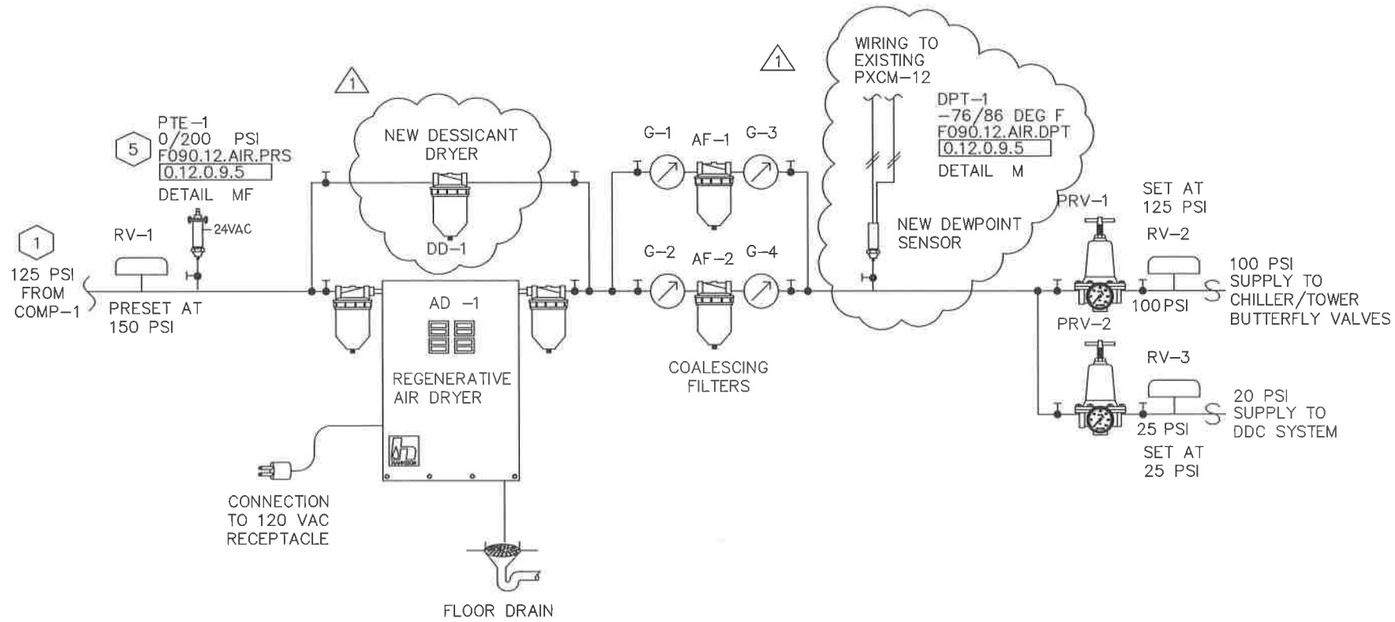

1/007 DDC PNEUMATIC AIR SUPPLY

LOCATION: PENTHOUSE #1 4505
SERVES: DDC SYSTEM PNEUMATIC DEVICES

Reference Only

This drawing is for reference only. This drawing must be used only to add additional detail to what is being provided by the engineer of record. Not all terminations, wire pulls or interlocks are shown in these diagrams as this will be dependent on the equipment purchased by others. Once equipment submittals are secured, the final drawings will reflect all work necessary to provide a full and functioning control system as outlined in the plans and spec. It is the bidders responsibly to review all contract documents provided by engineer of record to ensure that a complete scope is bid. Quantity of items and location of devices/panels that are not clearly spelled out in the drawings must be field verified to ensure that the project is properly bid. It is assumed that the bidder of the temperature controls electrical installation is knowledgeable in such work and requires minimal guidance. Siemens assumes no responsibility or risk for bidders not fully understanding the scope or extent of the work required.

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44OP-999999
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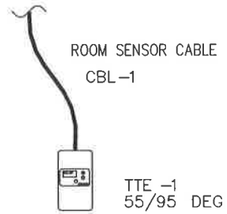
DISCONNECT EXISTING ROOM SENSOR
AT VAV SV1541 AND LEAVE IN PLACE.

OBSERVATION ROOM 1541



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

OBSERVATION ROOM 1547

Reference Only

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ROOM SENSOR RELOCATION

440P-999999
0

008

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